Fifth National Climate Assessment

Public Comment Period & National Academies Review Annotation

The U.S. Global Change Research Program (USGCRP) released the draft Fifth National Climate Assessment (NCA5) for public comment from November 10, 2022 - January 31, 2023, concurrent with review by a special committee convened by the National Academies of Sciences, Engineering, and Medicine (NASEM, November 10, 2022 - March 20, 2023).

The NASEM peer review panel evaluated the draft NCA5 and published a review report that captured consensus responses to questions posed within a carefully designed Statement of Task. The final NASEM review report can be accessed here and an acknowledgment generated by USGCRP leadership can be found here. The NASEM peer review report included overarching comments and recommendations (Part 2), a narrative review of each chapter (Part 3), and chapter-specific line-by-line comments (Appendix A). After carefully considering each comment in Appendix A of the NASEM peer review report, the NCA5 writing teams revised their draft chapter and/or noted the rationale for actions taken in their response to each comment, as appropriate. The NCA5 authors' responses to the NASEM review panel's line-by-line comments can be accessed here.

A Federal Register Notice announced the availability of the draft Fifth National Climate Assessment for public comment. Input from the public was collected via an online comment system. Names and affiliations of participants in the draft NCA5 Public Comment Period were withheld from the authors, Review Editors, Federal Steering Committee, and staff throughout review and revisions. Anonymity helped preserve integrity of the drafting process. During registration, all reviewers consented to have their names associated with relevant comments once the report was published. Chapter writing teams considered each comment, Chapter writing teams considered each comment and, as appropriate, revised their draft and/or noted the rationale for actions taken in their response to each comment. The authors' responses to the public comments received can be accessed here.

Independent Review Editors were chosen by the NCA5 Federal Steering Committee from a pool of external experts solicited through an open call for nominations, announced via Federal Register Notice (1 June 2022 - 1 July 2022). Each chapter was assigned a Review Editor to evaluate author responses to both the NASEM review and public comments, and the revised chapter drafts themselves, to confirm that the chapter writing teams had given due consideration to all review comments prior to submission for final agency review and clearance.

The full report underwent several additional rounds of review after authors' responses were generated. Therefore, subsequent edits may have been made that are not part of the attributed set of comments included on the following pages.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	MacCracken	Text Region	00. Front Matter		1	1	2	2	For clarity beyond this assessment, I'd suggest this say "Federal Steering Committee for the Fifth National Assessment" as otherwise it would seem to imply much more scope.	The text has been revised to adopt this suggestion. Thank you for helpig to clarify
Michael	MacCracken	Text Region	00. Front Matter		7	7	15	15	A comma (or equivalent) is needed to differentiate the names of the two chapters--so to indicate with which topic "Social Systems" is attached.	The text will be copyedited for clarification and grammar
Jim	Titus	Text Region	00. Front Matter		7	7	16	19	This description gives the reader no warning that (at least some of) the regional chapters are very different than in past NCA's, which provided regional descriptions and where possible quantifications of particular impacts. Instead, these chapter seem to take for granted that the reader generally knows about the impacts, and discuss some of the things that people are doing to prepare. That different approach may be warranted, but it does require a warning to the reader expecting the regional impact summaries found in past reports.	As with previous assessments, authors of regional chapters are not mandated to follow an identical template, but instead are left to determine the most important topics to include. Authors were also provided guidance to not repeat the findings of NCA4 if those findings remained accurate, but to build upon previous assessments to advance the conversation on climate change in the country. Through multiple rounds of review and peer review, regional chapter authors are encouraged to ensure adequate coverage of both observed and projected impacts and both mitigation and adaptation and to include information relevant to each state within their region. Continued revisions based on these comments have improved the coverage of topics within the regional chapters without forcing them into standard templates, which allows for regionally-specific information to be covered in ways that are most relevant to the comunities within those regions. For this reason, the text describing the regional chapters in the Front Matter has not been revised.
Michael	MacCracken	Text Region	00. Front Matter		7	7	18	18	The Figure makes it seem as if the boundaries for each region are solid and definitive; I'm assuming that in practice the boundaries are a bit fuzzy and it would be useful for those near boundaries to refer to discussions of what is happening in adjacent regions. This point might be made here in the text.	We appreciate this comment and note that the regional chapters themselves are likely the best place in the report to discuss transboundary issues and topics. The purpose of this graphic is to provide the reader an understanding of the regional divisions used in this assessment, to provide readers an understanding of how the NCA is structured. No changes were made in response to this comment.
Michael	MacCracken	Text Region	00. Front Matter		7	7	19	19	Does one really manage "risk" or actually manage/prepare for "impacts" the risk of which may be increasing or decreasing?	The text has been revised to add the concept of impacts as well as risks
Doug	Robbins	Text Region	00. Front Matter		9	9	11	29	The confidence and likelihood scale adopted for NCA5 (Mastandrea, 2011) has an insufficient range to appropriately communicate the likelihood of key findings in the report. The assigned probabilities of ‚Äúvirtually certain, very high confidence,Äù and ‚Äúextremely unlikely,Äù, representing the 99th and 1st percentile, fail to capture higher and lower probabilities which would provide meaningful information to the reader. As an example, the lifetime probability for an individual of dying in a car wreck (1:107) would be given the same description (‚Äúextremely unlikely,Äù) as the probability of being eaten by a T-Rex. The difference in the likelihood of these events is materially significant for policy and individual behavior. The likelihood of anthropogenic influences causing rising CO2 and warming (Key Message 2.1) is far higher than 99%; the likelihood of any competing explanation is several orders of magnitude smaller than 1%. The authors need a scale allowing expression of those more extreme likelihoods, or guidance on when to assign unequivocal statements of fact. Policy-makers and the public need to be presented with definitive statements of certainty for the NCA5 to be relevant for policy development.	Where underlying chapters report findings where certainty is greater than 99% (in other words, 100%), those chapters have adopted the terms "unequivocal" or "it is a known fact", and dropped the calibrated language as the commenter suggests.
Michael	MacCracken	Text Region	00. Front Matter		9	9	12	13	The text implies there are degrees of certainty, which is just not appropriate. One can have degrees of confidence and of uncertainty, but degrees of certainty just seems to be inconsistent with what "certain" means. I'd suggest dropping "certainty" or replace with "uncertainty"--or as done below, have degrees of likelihood.	The text has been revised to clarify in response to this comment
Michael	MacCracken	Text Region	00. Front Matter		9	9	13	13	It might be appropriate to define "projections" here (or previously) and differentiate its meaning from "predictions"	Please see Appendix 3, which describes the different between projections and predictions. Text and table headers have been revised in this section for clarity, based on this and other comments.
Joseph	Zajac	Text Region	00. Front Matter		9	9	19	25	The words "margin of error" do not appear in the definitions and is disquised as "confidence" or "likelyhood." Use margin of error and do not hide it using "confidence" or "likelyhood."	The suggested replacement for confidence and likelihood terminology is inacurrate and misleading, and thus the front matter has not been revised as the commenter suggests. The text describing the calibrated likelihood and confidence terms has been revised to improve clarity.
Joseph	Zajac	Figure	00. Front Matter		10	10	1	2	Table 1 There must a column added for margin of error.	Please see the information and tables on confidence and likelihood. These calibrated language terms are used to describe uncertainty. The suggested term "margin of error" is inaccurate and misleading. Thus no edits have been made in response to this comment.
Joseph	Zajac	Figure	00. Front Matter		10	10	5	6	Table 2 Again, there must a column added for margin of error.	Please see the information and tables on confidence and likelihood. These calibrated language terms are used to describe uncertainty. The suggested term "margin of error" is inaccurate and misleading. Thus no edits have been made in response to this comment.
Joseph	Zajac	Figure	00. Front Matter		10	10	5	6	Table 2 Likely is incorrect. Should be 66% to 90%.	This comment is incorrect. The calibrated uncertainty term for "likely" is defined accurately in the table. Thus no change has been made.
Joseph	Zajac	Figure	00. Front Matter		10	10	5	6	Table 2 Unlikely is incorrect. Should be 10% to 33%.	This comment is incorrect. The calibrated uncertainty term for "unlikely" is defined accurately in the table. Thus no change has been made.
Michael	MacCracken	Text Region	00. Front Matter		10	10	5	5	Somewhere, it is essential to make clear that scientific analyses tend to focus on the best or central estimates (so they seek 2-sigma confidence, etc.) whereas much of society (financial and investment, infrastructure planning, national security, etc.) is charged with ensuring resilience to the "worst plausible outcome" (e.g., the run on the bank, the 100-year flood, the capability to simultaneously deal with conflicts in the Atlantic and Pacific basins, etc.), so wanting to be prepared for the risk of plausible outliers. So, while an "atmospheric river deluge" may have a likelihood of, say, only one year in 10, so be considered an unlikely event using metrics in Table 2, this is just the type of extreme event that society needs to be resilient to. What is clear from the analyses of observations of summertime land surface temperature anomalies that Hansen and colleagues have done is that the likelihood of a three-sigma, so very rare, events has increased since the mid-20th century by a factor of 100 or more--and this is from observations. So, how will this type of situation be explained with this terminology? Basically, a very rare, 1 in one thousand likelihood event (so "Exceptionally Unlikely") has now become only "Very Unlikely" and this is based on observations, so would seem to be at least "Very Likely". It seems to me there must be a good bit more discussion about how such metrics are being applied, especially in that what seems to be causing the major impacts are rare events.	Additional text has been added to the Overview chapter to help decribe this shifting probability curve the commenter describes, and to note how once rare events are now more common. No change has been made to the established likelihood or confidence terms, nor to the guidance provided to authors in how to use these terms.
Michael	MacCracken	Table	00. Front Matter		10				Having been through this issue of levels of confidence and liklihood in the first US assessment, I would suggest that there is really no basis for such precise boundaries between categories--a point made strongly in the review process by the AMerican Petroelum Institute, etc. The National Weather Service runs many multiple rus to justify its use of such precision for weather forecasts, but this is simply not possible or justified if doing projections out for years, decades, etc. In the first US National Assessment, we went to what we called a fuzzy pillow diagram. Might I suggest instead, as I have suggested for IPCC, that one change that, for example, have "Likely" as being "Greater than roughly 2 chances out of 3", "Very Likely" to "Greater than roughly 9 chances out of 10," "As Likely As Not" to "Roughly 1 chance out of 2", "Unlikely" by "Less than roughly 1 chance out of 3", etc. I would also urge getting rid of the "Virtually Certain" as really scientific mumbo-jumbo and just say "is" when the odds are greater than 99 out of 100--again also, there are just not degrees of being certain--it is an abuse of the word "certain". In any case, as past reviewers have said, there is no scientific basis for differentiating between, for example, 66% and 67% or 89% and 90%, etc. I think it demeans scientific communication to imply that such a differentiation can be made.	Where underlying chapters report findings where certainty is greater than 99% (in other words, 100%), those chapters have adopted the terms "unequivocal" or "it is a known fact", and dropped the calibrated language as the commenter suggests. The commenter's descriptions of probability are acurrate and reflected in the table; likewise there is already no differentiation between 66% and 67%, nor any attempt to present higher degrees of precision than can be supported by the science. The calibrated language in tables 1 and 2 are identical to those used by the IPCC and widely accepted by the scientific community.
Joseph	Zajac	Text Region	00. Front Matter		11	11	7	15	Should read: Climate modelers develop global climate projections for a range of hypothetical outcomes based upon incomplete and known flawed data.	This comment is inaccurate and is not supported by the wide body of scientific literature on this topic. Thus the suggested text has not been used.
Joseph	Zajac	Text Region	00. Front Matter		11	11	7	15	The text has no value since it really is worthless in decision making.	We disagree with this statement. The purpose of this section of the Front Matter is to describe what climate scenarios are and articulate how they are used in the report. There are no assessment findings in the Front Matter, and no material in the Front Matter is intended to inform readers as to the findings of scenarios. As a result, no edits were made in response to this comment.
Joseph	Zajac	Text Region	00. Front Matter		12	12	1	2	There must a column added for margin of error. Why do you refuse to use marign of error?	Please see the information and tables on confidence and likelihood. These calibrated language terms are used to describe uncertainty. The suggested term "margin of error" is inaccurate and misleading. Thus no edits have been made in response to this comment.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Joseph	Zajac	Figure	00. Front Matter		12	12	1	2	Table 3 There must a column added for margin of error. Why do you refuse to use margin of error?	Please see the information and tables on confidence and likelihood. These calibrated language terms are used to describe uncertainty. The suggested term "margin of error" is inaccurate and misleading. Thus no edits have been made in response to this comment.
Charles	Hunt	Figure	00. Front Matter		13	13	1	25	The box is correct as written but could be revised to make it easier to understand. For example: Box 1. Global Warming Levels Measure How Much the Planet Has Warmed Global warming is measured using a procedure that is designed to help filter out the normal variability of weather that can make it difficult to understand trends in global warming. First, temperatures are taken around the globe each day and these are averaged to calculate the average global temperature for that year. Second, these yearly averages are combined to calculate a decades long moving average global temperature to filter out year to year variations. Third, these average temperatures are compared to the average preindustrial (1850 - 1900) global temperature (would be useful to include this here). The level of global warming is expressed as the difference between the current moving average and the preindustrial average. This procedure is important because earth is a complex system. Internal variability in the climate system means that even as the world rapidly warms, some years will be hotter and some years will be cooler than the multi-decade moving average. A single year in which the globe is 1.5¬∞C (2.7¬∞F) hotter than it was in 1850‚Äì1900 does not mean that the level of global warming has reached 1.5¬∞C. Using a multi-decade moving average means that the level of global warming calculated will lag behind the warming trend. This built in understatement, combined with year to year variability means that climate impacts projected to occur at a given global warming level may be experienced even before that level is reached. It is also important to understand that temperatures in different parts of the world will be warmer or cooler than the global average. A global warming level of 2¬∞C (3.6¬∞F) does not mean that every temperature measured will be 2¬∞C (3.6¬∞F) warmer. Some places on Earth will be cooler than that and some warmer. For example, actual measures show that many parts of the United States are warmer than the global warming level and a few are cooler.. Climate models predict similar results in the future (Figure 1.16). Global warming levels are not thresholds; they do not represent ‚Äúsafe‚Äù levels of warming, and exceeding a particular global warming level does not consign us to runaway impacts. Continued action to	Thank you for this comment. The text box has been revised for accuracy and clarity.
Joseph	Zajac	Text Region	00. Front Matter		13	13	2	4	False statement - there was no US nor global network of monitoring stations to come up with preindustrial temperatures (1850‚Äì1900 average), no certified equipment calibration and certification	Please see Appendix 3 for more information on climate datasets. Historical analyses are based on NOAA's nClimGrid and GHCN-Daily Datasets (Vose et al. 2014) and additinal information on historical climate records can also be found in the Indicators Appendix 4.
Michael	MacCracken	Text Region	00. Front Matter		13	13	2	4	Doing what IPCC and COP do, namely indicating the level of global warming by taking a multi-decade average of the annual average temperature anomalies at locations around the world, is a really watered down version of the seriousness of the issue and I think is going to be very hard to justify given that the 1-year average is becoming increasingly likely to exceed 1.5 C by 2030 even though the average warming per IPCC's metric will likely be something like 1.2 C. With respect to impacts, many are determined by short-term values of climate anomalies and not by an average of the last 30 years. At the very least, IPCC should be doing a linear fit to the past 20-30 years or so. In addition, virtually no one experiences the IPCC's value of warming--land warms more than the ocean, the mid and high latitudes warm more than the low latitudes, dry (and drying) areas warm more than moist areas, nighttime warming is generally more than daytime warming. The IPCC metric made sense for cautious scientists wanting to get good signal to noise ratio for first detection purposes, but it really makes very little sense as a basis for making policy as it is so far removed from giving an indication of the impacts associated with a given level and the commitments to further impacts such as ice sheet loss and significant sea level rise. And if world made stupendous efforts to cut emissions so that the IPCC metric for warming stayed below, say, 1.5 C, or more plausibly 2 C or above, half of the individual year global anomalies would be able that level, which I don't think will be easy for scientists to explain to policymakers and policymakers to the public to justifty all the effort put in to get off of fossil fuels. I think it would be useful somewhere starting to clarify all of this for the public, making clear that changes over the US will likely be a good bit greater than the very conservative reference value being used in the negotiations.	Additional text has been added to the Global Warming Level box to help clarify the role on internal or annual variability, as well as noting that some regions will warm more or less than global averages. Please also see Chapter 2 and 3 for further explanation of these impacts and the methods used to describe global warming levels. In addition, a figure has been added to the Overview chapter to help put the rapidly accelerating warming over recent years in historical context. Additional information on climate indicators can be found in Appendix 4.
Joseph	Zajac	Text Region	00. Front Matter		13	13	8	9	False statement - the world is not rapidly warming	The Overview chapter has added a new figure to help demonstrate Earth's rapid warming in context with the historical record. This comment is not supported by the wide body of scietnific literature on this subject and thus no change has been made to the Front Matter text.
Michael	MacCracken	Text Region	00. Front Matter		13	13	9	11	Try this explanation out on coral or the forests exposed to wildfire--it makes no sense. Many, if not most, types of impacts, will depend on the present short-term value, not the value averaged over the past couple of decades and on the regional to local value and not the global average. What this statement is seeming to justify policymakers being very delayed in addressing the issue and trying to be setting themselves up for claiming success in meeting a metric and so everyone should be satisfied with their work. Using such a past-focused metric really is an insult to those who are being affected now by much more significant climate change than the metric indicates, all because a few decades ago the scientific community (and I am part of it) based its studies on the most innocuous metric with respect to indicating impacts in order to get good signal to noise. And trying to explain this based on natural variability is just not correct--at least do a linear fit to past data to make clear that the world is on a path upward rather than using an average going so far back into the past.	Additional text has been added to the Global Warming Level box to help clarify the role on internal or annual variability, as well as noting that some regions will warm more or less than global averages. Please also see Chapter 2 and 3 for further explanation of these impacts and the methods used to describe global warming levels. In addition, a figure has been added to the Overview chapter to help put the rapidly accelerating warming over recent years in historical context. Additional information on climate indicators can be found in Appendix 4.
Michael	MacCracken	Text Region	00. Front Matter		13	13	13	14	"could be" is simply not a reasonable phrasing here. The physics make clear that the changes will be (not evenas doubtful as virtually ceertain) greater over the US land areas than over the oceans and that changes in mid and high latitudes will be greater due to not just albedo feedback but because over the ocean evaporation limits warming (the consequence is, however, that precipitation, where it occurs, which may well shift, will become more intense. So, in some places oe gets a good bit more warming and in some oe gets more intense precipitation, etc.	The text has been revised to clarify in response to this comment
Michael	MacCracken	Text Region	00. Front Matter		13	13	14	15	This is a very significant understatement--across the US the temperatures will be a good bit above the global average. Yes, there will be some variability due to atmospheric circulatio changes, but the typical experience is going to be greater warming than the global average, and especially the current warming is going to be greater than the IPCC metric of warming that covers the past two decades or so.	The text has been revised to clarify in response to this comment. Please also see the section and figure in the Overview chapter (1) and chapter 2, which descirbes the greater warming experienced in the United States as compared to global averages.
Michael	MacCracken	Text Region	00. Front Matter		13	13	21	22	Strictly speaking, this is not true. The weather we will be experiencing depends perhaps on the current level of global warming, not the IPCC metric of global warming, which covers the past couple of decades. Were IPCC fitting a linear curve to the past two decades or so, the statement could be said to be true, but as stated, it is not the case.	This text has been reviewed for accuracy and revised for clarity based on this and other comments
Michael	MacCracken	Text Region	00. Front Matter		13	13	22	23	Actually, this is not really true either due to the lag effect of how the IPCC metric is determined, which is how this report seems to be defining global warming. So, if emissions went way down, we would keep getting warming until quite near when we would get to Net-Zero emissions [atmospheric concentration would stabilize when the level of emissions equals the (declining) ability of the natural world to take up the emissions, and the uptake is, many would argue, dependent on the rate of emissions, so emissions would have to get pretty low to be equal to the uptake rate]. And warming will continue, so even as emissions are going down, warming will continue and the multi-decade average of the anomalies that the IPCC metric defines as global warming will be catching up to be closr to the present. I do admit this is for the long-lived species contribution; getting short-lived species emissions down can pretty quickly get reflected in their contribution to warming, etc. But, to be correct here, our past emissions commit us to further increases in the metric the IPCC uses for defining global warming (a metric that is apparently adopted in this assessment).	This text has been reviewed for accuracy and revised for clarity based on this and other comments. Please see chapters 2 and 3 for more detailed description of how impacts will change under different emissions pathways.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Charles	Hunt	Text Region	00. Front Matter		13	13	26	31	There have been significant changes since 1950. The US population has increased by 225%. The GDP has increased 75 times in nominal dollars. Normalizing by only the IPD does not adequately address the role that that national and local trends have on the incidence of billion dollar disasters. I have looked for more robust methods to normalize the data and was surprised that I could not find a reliable method in general use (they may be out there but I couldn‚Äôt find them). Because of changes in settlement, development, detection and reporting, the nature of weather, and the and therefore the difficulty of establishing trends in incidence and damages consider developing a more robust method to normalize and analyze for trends. If the trends are highly localized, apply the method to the changes in just those areas. (For example: some parts of Florida have undergone far more development in the time period than neighboring states). This block of text should be expanded to more fully address how these analysis are conducted (and then NCA Leadership needs to ensure that all sections apply these standard approaches).	The text has been revised to note the specific table and date accessed. The full reference for the table has also been added to the reference list for the Front Matter. Additional information on how billion dollar events are calculated has been added to the Overview chapter and other chapter figure captions where appropriate. Please also see the Economics chapter for information on GDP and in particular, the metadata surveys supporting the economic calculations for a more thorough description of methods used.
Charles	Hunt	Text Region	00. Front Matter		13	13	29	30	The link provided takes the reader to the right site but not to information specific to the GDPIPD. It would be more useful to provide a link to the general information and to the data. For example: ‚Äú For more information, please visit https://bea.gov/national/index.htm and for the dataset refer to https://apps.bea.gov/iTable/?reqid=19&step=3&isuri=1&1921=survey&1903=13#eyJhcHBpZCI6MTksInN0ZXBzIjpbMSwyLDMsM10sImRhdGEiOltbIk5JUEFfVGFibGVfTG1zdCIsIjEzIl0sWyJDYXRlZ29yaWVzIiwiU3VydmV5IlOsWyJGaXJzdF9ZZWFyIiwiMTk1MCIdLFsiTGFzdF9ZZWFyIiwiMjAyMiJdLFsiU2NhbGUiLCIwIl0sWyJTZXlpZXMiLCJBII1dfQ== (and the link should be appropriately formatted to make it easy to understand - the title of the data set is Table 1.1.9. Implicit Price Deflators for Gross Domestic Product.	The text has been revised to note the specific table and date accessed. The full reference for the table has also been added to the reference list for the Front Matter.
david	lipsky	Whole Chapter	00. Front Matter						The document needs a glossary of terms, and in some cases the terms should be further defined and hyperlinked to the glossary. This is especially important for readers thinking about reviewing only certain chapters. For example, although the term RCP and SSP are mentioned near the end of this intro chapter it is unclear what the 8.5 references in RCP8.5 or SSP2-7.0 etc. This chapter mentions that a glossary will be provided, but for those not fully emersed in NCA report reviews, some of the key terms should have been provided.	A glossary of terms is currently under development for NCA5, and will be published concurrently with the report itself. We appreciate the suggestion that terms in the glossary should have hyperlinking or other indicators to help readers know there is an additional resource connected to that term, and plans to include that functionality has long been part of the planned development of the NCA website. We are gratified to know that the functionality described here will be useful for NCA users.
Joseph	Zajac	Whole Chapter	00. Front Matter						The words "margin of error" do not appear in the entire document and is disquised as "confidence" or "likelyhood."	Please see the information and tables on confidence and likelihood. These calibrated language terms are used to describe uncertainty. The suggested term "margin of error" is inaccurate and misleading. Thus no edits have been made in response to this comment.
Elizabeth	Wilkening	Whole Chapter	00. Front Matter						In Section 5 Transformative Change, Climate Change Education is very important. This education needs to take place within our schools and communities. Not just for school children, but the whole population. Especially the media.	The commenter may be referring to section 5 of Chapter 1 and not the Front Matter. The authors agree that climate education, literacy, and workforce training are important elements of addressing climate change (see Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within) and that public education systems that support scientific literacy and social cohesion enable public engagement solutions (see KM26.5). See also examples of Vulnerability and Assessment plan and an Adaptation Plan that incorporate climate education in Chapter 21. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations, evaluate specific policies, prescribe nor advocate against policies. Discussion of policy options is beyond the defined scope of the National Climate Assessment (see About NCA5 at https://www.globalchange.gov/nca5).
Charles	Hunt	Whole Chapter	00. Front Matter						Thanks - this has been a wonderful learning experience. I only wish I could have done more. I know how challenging this report must be to bring to completion. I would be happy to help with any revisions on a volunteer basis.	We appreciate this comment and agree that the authors for NCA5 have done an impressive job synthesizing and assessing the state of the science.
Rachel	Licker		01. Overview		0	0			The examples used throughout the Overview skew heavily toward wildfire and drought. While these are compelling examples, there are other impacts that could be highlighted. For example, in Section 2.3 (Compound events), Hurricanes Laura and Ida both caused widespread devastation, but were followed by heat waves that were made water and power outages more difficult to cope with.	Thank you for this comment. Additional examples have been added to the chapter, including sea level rise and flooding, to provide a more balanced overview of the range of climate impacts our country faces.
Jesse	Freeman	Text Region	01. Overview		1	1	1	1	Comment	This comment does not appear to raise a question or suggest a revision.
Ross	McKitrick	Text Region	01. Overview		1	1	28	31	It is misleading to quote reductions in costs of wind and solar without acknowledging the intermittency issue. Costs of capacity installation are largely irrelevant for system planning if the power source is unreliable. When Germany faced the sudden shutdown of the Nordstream pipeline they didn't start putting up windmills and solar panels, they fired up coal plants and built an LNG import terminal in 8 months. Because they need cost-effective and reliable power. Who is the intended audience of this report? Anyone in a position of authority over energy system planning will not be impressed by your glib claims about the falling costs of renewables, instead it will serve sas yet another signal that this report is advocacy for the green cause, not objective and reliable information to aid decision-making.	The concept of intermittency is discussed in the Ch 32 references cited at the end of this statement. Chapter 32 notes the difference between variable renewables and dispatchable or "firm" renewables and discusses energy storage technologies as well as improved transmission, which are essential components within future scenarios that include high uptake of wind and solar technologies. For example, Chapter 32 notes that under scenarios of high expansion of wind and solar, "expansion of energy storage allows heavier reliance on wind and solar." The authors also discuss that many net zero scenarios have a slower decline of gas-fired electricity, which facilitates penetration of variable renewables. Chapter 32 includes costs beyond capital installation costs such as capacity factors, which are relevant to variable or intermittent solar and wind resources. Please see Figures 32.8b, which includes the levelized cost of electricity (LCOE), or the "estimated revenue required to build and operate a generator over a specific cost recovery period." Also referenced at the end of this statement is Chapter 5, which documents falling costs of wind and solar and notes that "greater transformation will be needed to meet US goals of 100% clean electricity in 2035 and a net-zero economy by 2050." Discussion of the need to sharply reduce emissions to avoid the worst impacts of climate change is discussed below in the Overview section 5.2. Because these topics are covered in much more detail in the references provided at the end of this statement, and this level of detail would not be appropriate to include in this brief example in the Overview, the authors have chosen not to revise this statement in response to the comment. Additional figures added to the Overview chapter do address some of these issues, namely mitigation opportunities, increasing capacity, and renewable energy job opportunities.
Jesse	Freeman	Whole Page	01. Overview		1				Comment	This comment does not appear to raise a question or suggest a revision.
Ross	McKitrick	Whole Page	01. Overview		1				This section is written as if there are no costs to emission reductions, which makes it irrelevant for rational decision-makers. It sounds like an extreme environmentalist pamphlet, not a serious scientific report. It makes sweeping generalizations that go beyond the available literature. Economic research does not imply that every increment of warming everywhere is harmful, instead it shows that there are many regions that potentially benefit from small warming increments. Nor are all emission reduction activities beneficial: the vast majority fail any reasonable cost-benefit test, which is why they haven't been implemented despite decades of advocacy. This section presupposes that climate change is "fuelling" increases in extreme weather yet the IPCC AR6 fails to report such a connection for most types of extreme weather. As an opening summary that will attract much attention this section needs to set a tone of balance, not sound like an activist screed--that is unless you want the entire report to be dismissed as an activist screed. The last sentence is an example of the problem. A balanced assessment would note that "faster and further" greenhouse gas emission cuts might reduce climate risks in the distant future, but at the cost of potentially significant economic harm today. In addition, as shown by the European calamity now underway, ill-advised attempts to shut down conventional energy sources can leave a country's economic and strategic security in peril. Many policy makers opening this report will be thinking more about the actual disaster facing Europe than the abstract risks of warming in the US. With this opening page, by using only worst-case hyperbolic language about climate change and talking as if there are no costs to GHG reductions you are signalling that the report is focused on advocy rather than information.	Text in the Overview has been revised to clarify that overall, net impacts of climate change are harmful. The assessment finds that within most sectors that have been studied, more Americans are harmed than benefit from anthropogenic climate change. Please also see chapters 2 and 19. The Overview chapter, and other sections of the report have also been revised to clarify attribution of the role climate change plays in changes in extreme weather events. Please see chapers 2 and 3. The commenter's statement about economic harms today is not consistent with the science, as there are many actions to reduce greenhouse gas emissions that would result in near term economic gain, or that are zero or low cost. Please see chapter 32. Limitations, challenges, and tradeoffs of mitigation and adaptation actions are discussed in section 5.5 of the Overview chapter, chapters 31 and 32, as well as the regional chapters.
Jesse	Freeman	Whole Page	01. Overview		2				sssssss	This comment does not appear to raise a question or suggest a revision.
Jesse	Freeman	Text Region	01. Overview		3	3	32	4	sssss	This comment does not appear to raise a question or suggest a revision.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Charles	Hunt	Text Region	01. Overview		4	4	1	9	While it is understandable to adopt an optimistic tone, this one paragraph seems to suggest that everything that needs to be done is being done and that there is no need for additional action at the National, State, or local level. Consider a more balanced tone that stresses the need for coordinated action. For example: How We Are Addressing Climate Change The effects of human-caused climate change on the United States are already far-reaching and worsening. Communities at the Local, State, and National levels are now better equipped with a deeper understanding of the risks they face and what actions can be taken to adapt to, and mitigate the causes and harmful consequences of climate change. Actions that can be taken that avoid or delay additional warming will reduce future harmful impacts. Decisive, deeper cuts in greenhouse gas emissions are required to reduce the worst harms from climate change. These reductions are achievable through a rapid transition in how we produce and use energy and manage lands, building on cost-effective approaches available today. Even with mitigation, adaptation to the consequences of climate change will be required. Climate change will have wide ranging impacts on all levels of government, business, citizens, and the American economy. While some of the adaptations will present opportunities, many of the actions needed will require difficult and challenging decisions.	Section 1.1 of the chapter notes the importance of action to reduce risks of catastrophic impacts. Text has been revised throughout the chapter, notably in section 1, to make clear that while progress has been made, there is still a long way to go. References to section 5 of the Overview have been added to direct readers to content about what is needed to reach national committments, as well as the availability of cost-effective solutions. Text has also been added to note that even when net-zero is reached and warming slows or stops, the impacts of climate change will continue. See also Chapter 2, which notes the need for continued adaptation even after reaching net-zero. See Section 5 for discussion of opportunities and also challenges and tradeoffs in mitigation and adaptation decisions.
Michael	MacCracken	Text Region	01. Overview		4	4	2	9	This implicitly, at least, implies that if the US gets its emissions down, this will have a noticable effect. Actually, it is global emissions that have to be reduced. Indeed, while the rate of worsenig of impacts may bWithout doing climate intervention to exert a significant cooling influence in the near term, If we really want to reduce the level of impacts, then the world needs to ramp up carbon removal to putIl the CO2 concentration back down. As a second point, even with possible approaches beig available, it is quite an assertion to say that a rapid transition is possible given how slow the world has been in dealing with this issue. Indeed, global emissions are still increasing and fossil fuels still provide roughly 80% of global energy. The prospects for a fast transition that will be enough to stop the worsening of impacts are somewhere between very unlikely and exceptionally unlikely given the observed response of the world over the three decades since the Framework Convention was agreed to in 1992. While I am working on approaches that could help in a more rapid conversion either the world nor the US has gotten to a response level equivalent to fighting World War II, the level which is needed to make the transition near to as fast as technological capabilities could justify and are needed to really make much difference by the mid-21st century.	The chapter has been reviewed to ensure authors are referring to US emissions, targets, actions where intended, and global emissions, temperature, targets, etc where that is intended. Additional text has been added and a figure has been added to better note carbon removal, sinks, and storage as an important element of achieving net-zero emissions. The speed of the transition is also clarified in the revised text to provide context for how fast this transition would need to happen in relation to previous rates.
Andrew	Carleton	Text Region	01. Overview		4	4	6	7	CO2 and CH4 or just CO2.	No changes has been made to the text because this sentence discusses greenhouse gases, which include CO2 and CH4, but also other greenhouse gases. Please see KM3.1 for a more detailed description of climate drivers. Methane and N2O have been added to the figure on unprecedented changes in atmospheric greenhouse gases since 800kya.
Juanita	Constible	Text Region	01. Overview		4	4	10	23	Please consider changing the subhead title from EVERY DEGREE COUNTS to EVERY TENTH OF A DEGREE COUNTS to drive home the incredibly important point about increments of warming.	The authors have elected not to make this change to maintain readability. The first sentence of this section makes clear that "every additional increment of warming..." is critical.
Michael	MacCracken	Text Region	01. Overview		4	4	11	12	A very nice platitude, but it would be good to add that a key US step needs to not only be getting its emissions rapidly to below zero (so to be making up for its past emissions) and also helping the rest of the world take similar actions. I just don't think the present phrasing conveys the seriousness of the situation, reflecting too much the optimistic statement of what is possible by the IPCC which very much seem to be ignoring economic, ideological, equity and other rather presently intractable issues. If we really want quick action, the only approach that could achieve actual near-term cooling is climate intervention (and study of, much less consideration, is coming alog very slowly, being held up by those somehow convinced that the uncertainties and unintended consequences of climate intervention will be far worse than the future impacts in the absence of climate intervention). Emissions cutbacks, especially of short-lived species, can slow the pace of warming but not counterbalance the warming we are experiencig, and CDR will take many decades to scale up. I would suggest dropping this sentence and instead make clear that moderating the pace of change will require very aggressive international efforts, and the US needs to b a leader in taking action if we expect there to be worldwide action.	The authors agree that avoiding the worst impacts requires sharply reducing emissions. Please see sections 1.5 and 5.2 of the Overview chapter where we discuss net-zero scenarios and how limiting the worst harms from climate change requires reaching net-zero CO2 emissions globally by 2050 and net-zero emissions of all human-caused greenhouse gases within the following few decades. Please also see KM32.3, which explores the additional mitigation options needed to reach net zero and includes Box 32.2 on CDR (Carbon Dioxide Removal). KM32.1 discusses issues raised about the factors that determine the pace and efficacy of mitigation opportunities. Because these topics are covered in more detail in other sections, and because this portion of the Overview chapter is describing the relationships between temperature and damages in the United States, the authors have not revised the sentence in response to this comment.
Charles	Hunt	Text Region	01. Overview		4	4	13	16	Each degree of global warming will cause more damage and greater economic losses than the last. Each degree also increases the risk of catastrophic or unforeseen consequences. And, each degree of global warming will, based on history and modeling, result in more warming and more impacts in United States.	This comment does not appear to raise a question or suggest a revision, though some of the commenters points are included in the Overview text.
Michael	MacCracken	Text Region	01. Overview		4	4	15	16	It should also be noted that the likelihood of extremes that take a location or region beyond the level it was designed to be resilient is increasing much faster than is the exceedance of intolerable conditions due to the slower and steadier rise in the time-averaged change. So, while the change in the average seems small and might tend to be downplayed, even small changes in the mean can lead to large increases in the occurrence of what have in the past been considered extreme conditions (i.e., the return time between what have been considered design extremes, such as what in the past were used to determine the 100-year flood, are now occurring much more often).	Additional text has been added to section 2 of the Overview chapter to better convey the shift in probabilities of extreme events (and thus both the shift in the mean and the higher chance of once rare events occurring). Additional text has also been added to describe the stress on infratructure and institutions that were not originally designed to cope with the impacts of climate change.
Rachel	Licker	Text Region	01. Overview		4	4	19	19	Suggest replacing "heat-related illness and death and other health impacts" with "negative health impacts." Yes, heat-related illness and death are important, but it seems a bit off to elevate those over, say, health problems related to exposure to wildfire smoke or persistent mental health challenges in hurricane-prone areas.	The authors agree with this comment and have revised the text to be more inclusive of the broader range of human health impacts associated with climate change.
Diane	Martinez	Text Region	01. Overview		4	4	22	23	One of the problems with having climate assessment reports by country is that it creates and/or reinforces the myth of separateness throughout the world. Furthermore, wording such as "safer every American will be..." also reinforces that climate change is something that has borders. The fact is that less future warming will result in less harmful impacts for people globally. Although I realize this is a national report for our government, shouldn't this committee also be stressing to all readers that climate change and the effects of climate change are borderless?	Thank you for your comment. The mandate for this report covers climate change impacts in the United States, so the authors believe the existing text is appropriate. Please see chapter 17 for impacts that occur in other countries that have an effect on the United States. Please also see Chapter 19 (Sector interactions, multiple stressors, and complex systems) and the Focus Feature on Risks to Supply Chain for limited information on how impacts can ripple beyond our borders.
Michael	MacCracken	Text Region	01. Overview		4	4	22	23	Yes, but it would be appropriate to add that we are not anywhere near the point of starting to shrink the likelihood of extreme events.	Thank you for this comment. The need for deep cuts in emissions to avoid the most harmful impacts of climate change is covered below in sections 1.5 and 5.2 of the Overview chapter. The text has been revised to include a cross-reference to these sections.
Michael	MacCracken	Text Region	01. Overview		4	4	25	28	Yes, but until we (meaning the world) get to virtually zero CO2 emissions, the atmospheric CO2 concentration will continue to rise and so impacts will continue to grow. So, starting on this path is a start to getting where we need to get, but completing the hike along this path is when things might stop getting worse.	The need for deep cuts in emissions to avoid the most harmful impacts of climate change is covered below in sections 1.5 and 5.2 of the Overview chapter. Please also see Figure 1.1 for emissions pathways. Because these topics are covered in more detail below, where the chapter discusses the cuts in emissions needed to avoid the worst climate impacts, and this section of the Overview discusses advances in mitigation already taken, the authors have chosen not to edit the text here in response to this comment.
Michael	MacCracken	Text Region	01. Overview		4	4	28	31	Progress, but renewables are still only up to something like 25% of our electricity--we have a long ways to go.	The authors agree that we have a ways to go. Please see the Overview section below (5.2) on how avoiding the worst impacts requires sharply reducing emissions. Please also see KMs 32.2 and 32.3 for more details on emissions reduction options, including shares of renewables and level of end-use electrification.
Michael	MacCracken	Text Region	01. Overview		4	4	35	36	So, that averages out to about 1% per year, which hardly seems as optimistic a situation as the overall text is portraying--much greater action is needed if there is to be a significant effect in the lifetime of most people living today.	The authors agreen that a sharp decline in emissions is needed to avoid the worst impacts of climate change. The need for deep cuts in emissions to avoid the most harmful impacts of climate change is covered below in sections 1.5 and 5.2 of the Overview chapter. Please also see KMs 32.2 and 32.3 for more details on emissions reduction options.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Charles	Hunt	Text Region	01. Overview		5	5	1	16	This continues an essentially optimistic tone which is unwarranted. While making the first chapter sound unduly pessimistic would be wrong, a positive but serious tone is better suited to this section and the chapter as a whole (I promise to try and stop saying this over and over and just suggest changes in any additional Chapter 1 comments). For example : 1.3. Adaptation is moving forward across the country More Americans {alternate United States Citizens} are facing increasingly severe climate risks and consequences. In response, individuals, organizations, companies, communities, and governments are making difficult decisions and taking action to adapting in response to changing situations and to reduce future climate impacts. New tools, more data, advancements in social and behavioral sciences, and better consideration of practical experiences are enabling a broad range of actions. (see Box 1.1) {12.3; Ch. 31, Introduction}. For example, state climate assessments and online climate services portals are providing communities with location- and sector-specific information on climate hazards to support adaptation planning and response across the country, including: {31.4; Table 31.1} Managed retreat, moving threatened infrastructure and cities, from high-risk coastal and flood prone areas in ways that consider equity {9.3, 22.1} Innovative agricultural practices and crop selection to manage increasing drought risk {11.1, 22.4, 25.5} Vegetation management to reduce wildfire risk {5.3} Nature-based solutions to reduce shoreline erosion {8.4, 9.3, 21.1} Upgrades to stormwater infrastructure that account for heavier rainfall to reduce future damages{24.4} Assessment of climate risks to roads and public transit to support proactive planning, budgeting, and response{13.1} Urban heat planning to reduce health risks from heat extremes {12.3, 21.1} However, though positive first steps are being taken by those most immediately affected, as the above examples demonstrate, it would be wrong to conclude that current actions are sufficient to address the issue climate change will affect the United States through the end of the century. They should instead be	Section 1.1 of the chapter notes the importance of action to reduce risks of catastrophic impacts. Text has been revised throughout the chapter, notably in section 1, to make clear that while progress has been made, there is still a long way to go. References to section 5 of the Overview have been added to direct readers to content about what is needed to bridge the gap between current actions and what is needed to avoid the worst climate impacts.
Juanita	Constible	Text Region	01. Overview		5	5	1	6	This header and paragraph seem inconsistent with the Adaptation chapter, where the main points center on barriers to adaptation and the lack of transformative change. While there has been progress, framing this progress as groups taking advantage of adaptation opportunities doesn't seem quite right. In reality, adaptation often takes place despite barriers and challenges (e.g., as described on page 31-6, lines 4-6), rather than as a result of exciting opportunities as this sentence suggests. Consider being more specific about the incremental nature of most adaptation actions to provide some context for the solid examples in the rest of this section.	The authors acknowledge that adaptation activities often face challenges (as described in Ch. 31), however these are still opportunities. The authors modified this paragraph to highlight that these opportunites are reducing risk.
Michael	MacCracken	Text Region	01. Overview		5	5	2	16	Paleoclimatic analyses suggest that sea level sensitivity to global average temperature is of order 15-20 METERS per degree C rise in temperature, and the world is headed to something like 2.5-3 C warming---just because the rise won't fully manifest for several centuries, the IPCC's high confidence in less than a meter by 2100 was based on leaving out additions to sea level being caused by movement of ice streams off Greenland and Antarctica because scientists don't have high confidence in their estimates of this term (which ultimately will be the largest contribution to sea level rise). The notion that there can just be some sort of slow managed retreat from the coast as sea level rises seems greatly over-rated. Warming as significant as will be occurring is going to lead to transformation of the landscape, with existing ones stressed by pests and then wildfire and new ones struggling to arise as climate change continues. This section seems far too optimistic for the overwhelming changes that lie ahead.	The chapter has been reviewed and written with the intent to provide a clear, scientific tone without being policy prescriptive. Additional text has been added to note the potential extreme sea levels that can't be ruled out. Additional information on the methods used to develop the sea level rise scenarios has been added to the Front Matter and to Appendix 3. Please also see the references therein to learn more about the impact of low probability events on sea level rise estimates (e.g., melting Antarctica).
Charles	Hunt	Text Region	01. Overview		5	5	18	18	Suggest strengthening to: Examples of focused, early adaptation and mitigation actions to respond to climate change are underway and can be found in every region of the United States.	This text has been revised to "Mitigation and adaptation actions to address and respond to climate change are underway in every region of the country."
Michael	MacCracken	Text Region	01. Overview		5	5	20	20	Great to distribute air conditioners, for example, but while it does not take much energy to cool dry air, it takes much more (~20X) energy to cool moist air, which is what prevails in NY City--so are they planning to greatly increase their supplies of renewable energy to meet this requirement? Great to see such efforts going on, but hard to see how such efforts will be able to keep up with the acceleratig rates of warming (much less heat index) and sea level rise without a greatly intensifed US and global effort to get to zero emissions, and sort of implying here that adaptation and resilience enhancement can alleviate impacts without much stronger mitigtion actions seems quite misleading given the increasing seriousness of the situation and rather limited international action to even stop the increase in emissions.	The authors appreciate this comment and recognize the commenter's concern about air conditioning and conflict between their mitigation and adaptation potential (please see KM31.1). The authors have revised the table to provide an improved example of adaptation in the Northeast. The need for deep cuts in emissions to avoid the most harmful impacts of climate change is covered below in sections 1.5 and 5.2 of the Overview chapter. Please also see KMs 32.2 and 32.3 for more details on emissions reduction options.
Diane	Martinez	Table	01. Overview		5		21		Table 1.1: In reference to air conditioners being distributed to combat extreme heat, what about the electricity and coal needed to run those air conditioners? Can distributing air conditions really be considered mitigation if running them contributes to greenhouse gas emissions?	The authors appreciate this comment and recognize the commenter's concern about air conditioning and conflict between their mitigation and adaptation potential (please see KM31.1). The authors have revised the table to provide an improved example of adaptation in the Northeast.
Rachel	Jacobson	Text Region	01. Overview		6	6	2	3	The people and communities we should center in this sentence are those who experience the consequences of climate change first and worst: who are both highly exposed to climate hazards because of the places they live and have fewer resources, capacity, safety nets, or political power to respond because of widespread discrimination. Using the term "risk" here does not necessarily serve us if we truly want to center those people and communities. Risk = probability X consequence. In many cases, consequence is determined by monetary value and therefore cuts out those whose property does not have high monetary value. Also, it is important to call out WHY people affected by environmental and social injustice are more highly exposed to climate hazards (ie - historic and current discrimination.)	We have added a reference to Overview section 2.4, which covers disproportionate climate change impacts on underserved communities and those that are already overburdened by environmental risks and harms. The authors also note that the definition of risk used in the report encompasses non-monetary values. This definition of risk is available in the report glossary. The Overview chapter has been reviewed with this comment in mind and revised to clarify risks versus impacts.
Rachel	Jacobson	Text Region	01. Overview		6	6	5	7	This sentence focuses on current and future impact of climate action. It needs to also address righting historic wrongs that have created the conditions for increased exposure and vulnerability of specific people and communities, including: Black people, Indigenous Peoples, people of color, and people from low wealth backgrounds.	The authors agree that addressing historic systems and institutions driving disparate impacts of climate change is an important topic. The text has been edited to reference the sections of the Overview chapter below that discuss historic discrimination, inequities, and opportunities for environmental justice in more detail. Please also see KM20.1
Jim	Titus	Text Region	01. Overview		6	7	9	6	Change "would" to "will". Whether the statements are meant to be future tense or implied future conditional, "will" is correct usage.	This header has been revised to clarify meaning and to avoid policy precriptive language.
Michael	MacCracken	Text Region	01. Overview		6	7	9	3	I'd suggest that "Commitments" is not really the word to be using here. Doing this will at best only slightly slow the increasing pace of climate change. What is needed to really have an effect is to get to net-zero emissions and then start pulling out large amounts of CO2, etc. Note that the IPCC definition of Net-Zero refers only to direct human activitiies--that human-induced climate change is diminishing natural carbon sinks means that even if nations get to net-zero, the atmospheric CO2 concentration will coninue to rise (e.g., due to emissions from thawing permafrost, forest loss, etc.) and so climate change will continue. I'd suggest this report eeds to make clear the US needs to get to zero emissions, not just meet its present commitment which is only a starting step along the path to where we need to be, which is pulling back virtually all of our past emissions.	In response to this comment and others, a new figure has been added to the Overview chapter to describe mitigation options for reaching net zero emissions by 2050. In addition, the text in this section has been revised to clarify additional impacts that may occur even after the world reaches net zero.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Gabrielle	Dreyfus	Text Region	01. Overview		6	8	10	8	COMMENT: Section 1.5 exclusively discusses CO2 with no mention of the non-CO2 greenhouse gases that are responsible for about 45% of present-day radiative forcing from GHG (excluding aerosol forcing). By omitting non-CO2 GHG and only discussing net-zero in the context of CO2 with no mention of non-CO2 forcing, this section gives the false impression that net-zero CO2 emissions by 2050 alone would achieve targets: ∀c¬Ã¬úTo achieve current national and international commitments to limit global warming to well below 3.6∀Ç¬∞∞F (2∀Ç¬∞∞C), and preferably to 2.7∀Ç¬∞∞F (1.5Ç¬∞∞C), compared to the preindustrial era (1850∀c¬Ã¬ì 1900), global CO2 emissions would have to reach net zero around 2050. (2.3, 32.1).∀c¬Ã¬ù This is inconsistent with the main conclusions of IPCC Special Report on 1.5 (2018) and IPCC AR6 WGIII which both find that achieving international commitments to limit global warming to well below 2C requires three strategies: 1) net zero CO2 by mid-century; 2) rapid, deep, and sustained cuts to methane, HFCs, N2O, black carbon; 3) carbon dioxide removal. Please add a paragraph describing the necessity of pairing strategies to achieve net-zero CO2 by 2050 with strategies targeting deep and sustained emissions reductions of non-CO2 GHG, in particular methane, HFCs, N2O, and black carbon. Decarbonization strategies alone are insufficient to achieve national and international commitments and will likely increase warming in the near term unless paired with strategies targeting non-CO2 GHG and black carbon. CITE: See Table S1 for a summary of the radiative forcing by GHG from IPCC WGI reports and for analysis showing how decarbonization strategies alone are insufficient to keep warming below 2C in Dreyfus G. B., Xu Y., Shindell D. T., Zaelke D., & Ramanathan V. (2022) Mitigating climate disruption in time: A self-consistent approach for avoiding both near-term and long-term global warming, Proceedings of the National Academy of Sciences 119(22): e2123536119 https://www.pnas.org/doi/full/10.1073/pnas.2123536119. See also Intergovernmental Panel on Climate Change (2022) Summary for Policymakers, in CLIMATE CHANGE 2022: MITIGATION OF CLIMATE CHANGE, Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Shukla P. R., et al. (eds.), SPM-22	We appreciate the comment and have revised this section to clarify that CO2 emissions are not the sole (or close to the sole) contirbutor to warming, and therefore reductions in other GHGs will be necessary to achieve national and international warming goals and committments.
Andrew	Carleton	Text Region	01. Overview		6	6	12	12	Indicates primarily CO2 but should probably mention CH4, O3 and N2O.	For brevity, we are avoiding including lists of multiple GHGs, but we have made sure to clarify in this section that other GHGs are significant contributors to overall warming.
Charles	Hunt	Text Region	01. Overview		6	6	13	13	Suggest: ‚Äú¶ reach net-zero, with some climate changes including changes in sea level, changes to precipitation patterns, national and international supply chains, and health continuing beyond the time we reach net-zero,Ä¶Äù Rationale - ensure that the reader is aware that the continuing changes are not simply incidental or unimportant.	This text has been added: Although additional warming is not “locked in” after net emissions fall to zero, some climate impacts will continue beyond the time we reach net-zero emissions, such as sea level rise, changes to ice sheets, ocean acidification, and associated disruptions to human health, social systems, and ecosystems,
Rachel	Licker	Text Region	01. Overview		7	7	1	2	Revise sentence to "Net zero means that emissions either decline to zero or that any ongoing emissions are offset..." The two instances of "must" in the TOD read awkwardly.	This sentence has been revised to remove "must."
Ross	McKitrick	Text Region	01. Overview		7	7	4	6	Scientific writing would include an appropriate qualifier at the start of the sentence, rather than making such a categorical declaration. For example the start of the sentence should read: "Based on standard estimates of climate sensitivity, drivers of global warming and future emission trends, achieving current national and international commitments... would require global emissions to reach net zero by around 2050."	Because this is an assessment written for a non-technical audience, rather than a typical journal article, the text is designed to to be accessible and free of jargon, but with enough citations and documentation, including references and traceable accounts, to fully support all statements. The statement the commenter notes in the Overview summary is cited to chapters 2 and 32, which expand on this topic, and also provide traceable accounts and references to document the methods used to arrive at this finding. Please see Front Matter for a description of how uncertainty is treated throughout the report and the purpose of Traceable Accounts associated with every Key Message.
Michael	MacCracken	Text Region	01. Overview		7	7	4	6	If the report is going to mention these targets, it should give an indication of what such warming levels have meant in the past--so sea level being higher by 15 to 20 meters or more, heat indices being so high that quite a number of areas will be unlivable and so force emigration of hundreds of millions of environental refugees into the mid-latitudes (like it or not), completely different landscapes with widespread loss of biodiversity. It is just not clear to me how a science-based report can go along with the global targets established by politicians without pointing out how serious the changes would be. Yes, perhaps the world might avoid a few even much more serious tipping points, but to imply that the 1.5 and 2 C warmigs (which the world is not yet close to being able to meet except using the IPCC's time-averaged global metric that even if met will result in half or so of the individual years exhibiting greater warming). Somehow, this report really needs to do a better job of explaining the seriousness and urgency of the issue instead of seeming to assure the public that building resilience and adaptation along with slow mitigtion will lead to an acceptable world to pass alog to the next generation.	Section 1.1 of the chapter notes the importance of action to reduce risks of catastrophic impacts. Text has been revised throughout the chapter, notably in section 1, to make clear that while progress has been made, there is still a long way to go. References to section 5 of the Overview have been added to direct readers to content about what is needed to bridge the gap between current actions and what is needed to avoid the worst climate impacts. Figure 1.6 on how current climate conditions are unprecedented for thousands of years has been revised to help put the current climate changes we are observing into a paleoclimate context. Please also see Section 3 of the Overview for an extensive discussion on the impacts of these changes in temperature, including impacts on migration and displacement.
Charles	Hunt	Figure	01. Overview		7	7	7	11	Suggest changing the title to ‚ÄúFigure 1.1 Emission Pathways Used For Climate Modeling. The figure as drawn does not directly demonstrate the link between the different pathways and warming. The Caption (lines 9 - 11) should also be changed. Suggest: ‚ÄúCAPTION: the five scenarios shown depict the CO2 emissions associated with the scenarios that are the basis for the regional and topic assessments in this report. See Front Matter for scenario definitions. Source: Adapted from Arias et al., 2021. Figure 1.15 on page 32 should be on the same or following page as figure 1.1. (please refer to a separate comment on the organization of this chapter)	The title of this figure has been revised. Additional text has been added to the caption to clarify what is being shown by the lines, as well as clarifying the time period and baseline period. Because this figure is designed to help readers understand definitions of commonly used terms (e.g., net zero), the authors have decided to maintain its position in the chapter in section 1, and not move figures from section 4.
Rachel	Licker	Text Region	01. Overview		7	7	9	11	In the caption for Figure 1.1, add a description of what the grey line in the graph is indicating (i.e., historical emissions).	Text has been added to note that the grey line shows historical global CO2 emissions from 2000 through 2015.
Diane	Martinez	Text Region	01. Overview		7	8	12	2	This is vitally important information for readers to grasp, and it might be best to start the chapter with this instead of embedding it in the middle of this section/chapter.	This text is in section 1 of chapter 1, which the authors agree is a suitably elevated place within the report and the chapter for this important information.
Ross	McKitrick	Text Region	01. Overview		7	7	12	14	The end of the sentence is an editorial gloss that shouldn't be there. You can say that the current rate of emission decline is not sufficient to meet current national and international commitments, but you should not add the promotional line that these commitments are "designed to avoid the worst harms from climate change."	This phrase has been removed.
Michael	MacCracken	Text Region	01. Overview		7	7	12	14	It would be useful here to give an indication of what the "worst harms" you are talking about are--such things as a commitment to sea level rise of several tens of meters over several centuries to a few millennia--so incredible coastal inudation and the need to relocate many of the nation's largest cities; unlivable heat indices in low latitudes (including, say, Texas); complete transformation of the nation's landscape; etc.. Going to net zero by 2050 is going to allow impacts to significantly worsen as compared to today--going with the high scenarios would be almost unimaginably worse.	This text has been revised to note that current declines are insufficient to meet national committments. Additional text has been added throughout the chapter to provide more information on some of the more severe impacts of climate change, including extreme sea level projections that can not be ruled out (section 4.3).
Rachel	Licker	Text Region	01. Overview		7	7	12	14	This sentence should be clearer as to the emissions reduction commitments and the goals they are aiming to achieve. As currently written, the sentence implies that our national commitments were designed to avoid the worst harms from climate change, but that is a debatable point given the cumulative emissions of the US. In other words, our national emissions reduction goal is 50-52% by 2030, which is in line with what is needed globally to avoid the worst harms, but it likely represents less than the US's "fair share," so is not necessarily the international commitment that would ideally be designed to avoid the worst harms.	This sentence has been revised.
Jim	Titus	Text Region	01. Overview		7		13		Use a word other than "worst". You already said that the more we emit, the worse the effects. Therefore, the impacts avoided with current decreases are worse than what we avoid by limiting warming to 2 degrees, so it does not make sense to say that we are not avoiding the worst impacts.	The phrase "designed to avoid the worst harms from climate change" has been removed.
Michael	MacCracken	Text Region	01. Overview		7	8	14	1	In that the pandemic did not even cause a persistent 6% decrease, it would seem appropriate to give a sense of what would be required to sustain a 6% per year decrease out to 2050. For this to happen, the US must commit to the energy transformation the way it committed during World War II and really make things happen. To limit impacts to not impossible levels, it should be made clear how significant the effort needs to be--a lot is doable, but it will require a lot more effort than now underway.	The authors agree that this will require a lot more effort than what is now underway. We already note that in the text "the current rate of decline is not sufficient" and refer to "faster and more widespread deployment" and "accerate the transition to a decarbonized US economy." We have added more comparative text, to emphasize that the rate of improvement so far has been less that 1% per year, compared to 6% per year reductions needed. Also note that Chapter 32 has a Figure showing recent annual capacity growth for wind and solar, and compares it to the much higher levels of annual capacity growth needed to acheive net zero scenarios.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	MacCracken	Figure	01. Overview		7				How is it not more important to be presenting the projected impacts here than the emissions scenarios, somehow seemig to suggest that the world will continue along just fine with the high and even mid-range scenarios?	Projected impacts are covered extensively in sections 2, 3, and 4. However, Section 1.1 of the chapter notes the importance of action to reduce risks of catastrophic impacts. Text has been revised throughout the chapter, notably in section 1, to make clear that while progress has been made, there is still a long way to go. References to section 5 of the Overview have been added to direct readers to content about what is needed to bridge the gap between current actions and what is needed to avoid the worst climate impacts. This figure is intended to introduce readers to commonly used terms (e.g., net-zero) early in the discussion to provide defintions, and so has not been revised to also show projected impacts.
Gabrielle	Dreyfus	Figure	01. Overview		7				COMMENT -- Figure 1.1: Similar to previous comment, this figure and discussion gives the false impression that CO2 mitigation strategies alone are sufficient to achieve temperature targets. Recommend adding a panel showing methane, F-gas, and N2O emissions trajectories for each scenario. Recommend against a figure in CO2-equivalent terms as this obscures the deep emissions reductions by 2030 required in non-CO2 GHG to achieve temperature targets. Arias et al. (2021) Figure TS.4 includes non-CO2 GHG (specifically methane) emissions. AR6 WGI Figure SPM.4 also includes methane and nitrous oxide emissions.	This figure (now FIgure 1.4) is intended to introduce readers to commonly used terms (e.g. net-zero) early in the discussion to provide context and defintions. The figure shows CO2 and not CO2 equivalent. Text has been added to the caption to note that CO2 is the largest long-term driver of warming.
Rachel	Licker	Figure	01. Overview	1	7				The grey line indicating historical emissions looks to end around 2016. If possible, it would be useful to extend this line as far out as possible and to layer it above the lines for the SSPs so that readers could see where we currently are relative to different SSPs.	The figure has been revised to update the "today" line to 2023 and add historical observation through 2023. Note that model projections begin in 2015, so the colored lines will continue to begin in 2015.
Charles	Hunt	Figure	01. Overview		8	8	3	8	Following page 8, line 8, add a credible estimate of the cost of meeting the 2050 goal (it should separate costs for net new infrastructure (e.g. additional electric generating capacity needed for growth, additional capacity needed to support electrification, etc.), replacement of existing infrastructure, costs related to carbon capture, etc. For Example ¸Áú¸Ä¶ net-zero emissions goal.{5.3, 6.3,32.2} Achieving net-zero emissions by 2050 is projected to cost about $275 Trillion globally and $51 Trillion in the United States. A significant portion of these estimates will be necessary to modernize infrastructure and expand capacity but at least a third ($17 Trillion) represents additional investment needed to replace / retrofit existing serviceable infrastructure. (This is roughly based on McKinsey¸Äôs net zero study but the cost estimates to use need to be developed or validated for this assessment) It is great to tell the reader that there are cost effective solutions available but taking into account the size of the US economy and the scale of the country, it is important that the reader have a clear sense of the investments needed. IF estimates for other net zero timelines (US / world) are included, the expected additional adaptation / disaster costs should be included to help the reader understand the tradeoffs required.	This comment is inconsistent with the author team's thorough assessment of the science. The Overview chapter notes the findings from the underlying chapter that economic benefits of mitigation actions including, for example, the statistical value of avoided deaths from air pollution through emissions reductions, far outweigh the costs of the transition to net zero.
Michael	MacCracken	Text Region	01. Overview		8	8	3	8	Well noted, and it might be added that the INVESTMENT in doing this would pay big dividends for the country, including jobs--but then also add, the effort must be considerably greater than is now the case.	Additional benefits of mitigation efforts are covered in section 1.5. as well as in section 5 of the Overview chapter. This section already states that the effort must be considerably greater to achieve our current commitments.
Gabrielle	Dreyfus	Text Region	01. Overview		8	8	9	31	COMMENT -- Box 1.1: Given the theme of risks to ecosystems and natural systems of abrupt change (e.g., key message 8.1), consider adding a bullet to Box 1.1 section on physical climate science on improvements in our understanding of risks from abrupt change (tipping points and feedbacks). CITE: See also recent synthesis by Armstrong McKay D. I., Staal A., Abrams J. F., Winkelmann R., Sakschewski B., Loriani S., Fetzer I., Cornell S. E., RockstrvÉ–ðm J., & Lenton T. M. (2022) Exceeding 1.5vÇ–ººC global warming could trigger multiple climate tipping points, Science 377(6611): eabn7950 https://www.science.org/doi/10.1126/science.abn7950.	Ecosystem impacts have been added to the second secton of this box. However, given space constraints, the authors have not added new text about abrupt change or tipping points.
Michael	MacCracken	Text Region	01. Overview		8	8	11	11	It is not just "risks", but impacts that will occur and be felt. It really needs to be made clear that lots more will happen, not just have a chance of occurring.	This text has been changed from "risks" to "impacts and risks."
Michael	MacCracken	Text Region	01. Overview		8	8	17	18	So, nice to give numbers, but for public there needs to be some indication of the significance of these numbers. First, these are global numbers, and over the US the likelihood the change would be of order twice this. So, perhaps give some comparison of city pairs--such as Chicago would have the climate of New Orleans, or New York of Atlanta, or whatever is the appropriate comparison--but it would be useful to give a sense of what the numbers mean.	Please see previous sections and especially the Overview section 4 for more information on regional impacts across the US. This list is a very high-level presentation of advances in NCA since 2018 across the entire report, thus it would not be appropriate, nor does the chapter have the space, to fully describe regional impacts. Much more information on these impacts are provided elsewhere inthe Overview (e.g., Section 3) and in the underlying chapters (e.g., Chapter 2)
Ross	McKitrick	Text Region	01. Overview		8	8	19	24	"Scientists can now rapidly quantify how much more frequent and/or severe a specific extreme event has become due to human-caused warming." This is too assertive and categorical. The event attribution literature is very new and the methods have not been subject to detailed appraisal or critique. Many of the papers are in the gray literature still. It's an inherently unfalsifiable method since it relies on model-simulated counterfactuals. Adocates for the method claim they can do these things, but readers have no way of testing the claim since the literature is backward-looking. It's very premature to say the models have been proven and the methods have been properly evaluated. It was only 2021 when elementary mathematical errors were revealed in the Allen and Tett 1999 fingerprinting method on which so much attribution work has been based.	This comment is inconsistent with the author team's thorough assessment of the science. The text noted in this comment has been revised to provide a sepecific example and to note that these are estimates.
Michael	MacCracken	Text Region	01. Overview		8	8	22	23	Nice comparison, but then it might be added, "and this is with global warming only about half as much as is projected, under best case policy actions that the world's natios are yet to fully commit to, at which time such heat waves would likely occur roughly every year" [or few years, whatever the case may be]. Providing greater context would really be helpful.	Please see Chapter 3 for more information on the extreme event attribution. This list is a very high-level presentation of advances in NCA since 2018 across the entire report, thus it would not be appropriate, nor does the chapter have the space, to fully describe risks and impacts in this Box. Much more information on these impacts are provided elsewhere inthe Overview (e.g., Section 3) and in the underlying chapters (e.g., Chapter 2).
Michael	MacCracken	Text Region	01. Overview		8	8	25	28	But the question is, do these soci-economic scenarios include the impacts of climate change on society. The National Academy of Sciences just held a workshop on how to do this and what was pretty clear was that existing socio-economic models don't do well at incorporating the impacts of the severe and extreme weather events now, much less for the future. Thus, there would seem to be significant underestimation if all that is being done is looking at the effects of average changes and not doing the extreme weather events that are really what will matter. So, the "deeper exploration" is still quite shallow.	Please see Appendix 3 and references therein for more information on the methods used to develop these scenarios. This list is a very high-level presentation of advances in NCA since 2018 across the entire report, thus it would not be appropriate, nor does the chapter have the space, to fully describe methods of scenarios.
Michael	MacCracken	Text Region	01. Overview		8	9	35	1	It would really be helpful in this overview not just to say that there is better understanding, BUT also say what that better uderstanding is. Above, there was an example of what better attribution allowed. Each of the points made here should be illustrated with an example of what actually has been learned instead of being limited to saying that there is better uderstanding and then pointing the reader to many locations in the text--please, tell the reader the most important or two findings. The reader wants results, not information that the research progream is succeeding at getting better understanding.	The authors have opted to keep the text as is for length considerations.
Rachel	Jacobson	Whole Page	01. Overview		8				Box 1.1 is an opportunity to highlight advances in integrating Western science with traditional knowledges. It would be great to see some additional text/examples to that effect.	Thank you for this great suggestion. Authors have added a bullet under the "response" section dedicated to the integration of Western science and Indigneous knowledge, with several references to the underlying chapters that get into more detailed examples.
Michael	MacCracken	Text Region	01. Overview		9	9	3	8	Some real examples please, which could readily be done by not much rewording of the key sentence.	The authors have opted to keep the text as is for length considerations.
Michael	MacCracken	Text Region	01. Overview		9	9	9	11	Please provide a key specific insight or two--the result, not that you have a result.	The authors have opted to keep the text as is for length considerations.
Michael	MacCracken	Text Region	01. Overview		9	9	14	25	Please add specific examples of results.	The authors have opted to keep the text as is for length considerations.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Diane	Martinez	Text Region	01. Overview		9	10	33	2	One issue to consider here is that the way this is written it reinforces the idea that humans are separate from Earth's natural systems and that we are victims of these systems when, in fact, humans are the ones who have caused Earth's warming and these effects of climate change that now threaten our ways of living. It is important for this committee to emphasize to readers their impact on Earth's systems, thus their responsibility, for what is now threatening their way of living. As stated in the front matter, this committee does not recommend certain adaptations, but as this is a report coming from scientists, it seems like it would be totally appropriate to provide not just what the current situation is but emphasize how it got to be like this. This is not about blame but rather emphasizing, through science, that humans are an element of Earth's systems. The main concern with this wording is that readers see themselves as victims of natural processes instead as integral to how Earth's systems function based on input and output. The way this is worded is that humans are in a battle or trying to hold off nature or natural processes and they do not see how their actions caused these processes to worsen in the first place. And once again, although this is a report for the American government and people, it could actually be a unique report in that it emphasizes the reality of climate change being a global issue and say something like "Americans, as well as people throughout the world, are experiencing the effects of human-caused climate events that strain public services and outdated infrastructure. If human behaviors, at the individual, community, corporate, and national levels, do not change to actions that significantly reduce greenhouse gas emissions, then climate risks will continue to increase..." This type of wording would then reinforce the first sentence in the next section and readers are not having to mentally switch from being victims to being the cause. It seems that the message of human-caused climate change should be consistent throughout the report. Later in the report, the wording "human-driven greenhouse gas emissions..." is used, and it is important to keep using language/terms that clearly state that what is being experienced now is human caused; thus, phrases like human-caused climate change or impacts from human-caused climate change will help keep that fact in readers' minds.	The authors feel that the chapter has clearly and sufficiently established the link between human-caused greenhouse gas emissions, global warming and other associated climate changes, and the resulting effects on human and natural systems. The author disagree that adding "human-caused" in front of every mention of "climate change" is necessary to communicate this message.
Ross	McKitrick	Text Region	01. Overview		9	10	33	2	This kind of language is so extreme it guarantees the report will be ignored. Who is your audience? Sure, activists and sympathetic journalists will eat it up and leftwing politicians will shout about it, but if your aim is just to talk to the people who are already in the climate alarmist camp there's hardly any point issuing a report. How does this sentence sound to you? "Multiple climate hazards and cascading climate impacts are disrupting essential societal systems in every part of the country." All I take away from a sentence like that is that the writing and review process for this report is one-sided and unserious.	NCA authors are instructed to evaluate all available sources of information that meet Information Quality Act and Evidence Act requirements. The NCA5 has complied with all required laws, including those mandating specific standards of data quality and evidenciary support.
Michael	MacCracken	Text Region	01. Overview		9	9	35	35	People do not experience "risks"--they experience impacts.	The proposed revision has been implemented.
Michael	MacCracken	Text Region	01. Overview		10	10	5	6	Phrasing needs revision to something like "marked amplification of the inadvertent role of human activities (primarily the reliance on fossil fuels for energy) causing changes in the global Earth system, including by causing increasing temperatures ..."	The proposed revision adds unnecessary complexity for this audience.
Rachel	Licker	Text Region	01. Overview		10	10	5	6	The first part of this sentence reads awkwardly. Suggest changing "...acceleration in the cause of climate change" to "...acceleration in the pace of human-caused greenhouse gas emissions," which would be more succinct and descriptive.	This sentence has been revised to improve readability.
Michael	MacCracken	Text Region	01. Overview		10	10	8	8	I'd suggest, changing "Human activities have increased" to "Human activitites, including especially ongoing emissions from combustion of coal, petroleum and natural gas, and clearing of the natural landscape, have increased ..."	Specific human activities that contribute to greenhouse gas emissions are addressed in section 4. The authors have determined that this level of detail is not needed to achieve the purpose of this section, which is to outline the accelerating climate-related changes attributable to human GHG emissions.
Rachel	Jacobson	Text Region	01. Overview		10	10	12	13	This sentence can be read as "IF the trends continue as projected, we will have no choice but to adapt." Recommend changing to: "These trends are projected to continue over the next decade even if greenhouse gas emissions fall substantially. Therefore, the country has no choice but to adapt to a changing climate."	This sentence has been removed.
Diane	Martinez	Text Region	01. Overview		10	10	12	13	This paragraph seems to state that we must adapt because of what has already been done, but it might be helpful to reiterate the earlier message that any changes made now can reduce the need to adapt and instead find equilibrium.	While mitigation actions can reduce the need for future adaptation, some effects of climate change have already occurred and will continue to require adaptation in the near-term. Text to support this has been added to Section 1.5.
Michael	MacCracken	Text Region	01. Overview		10	10	12	12	It is a bit confusing what "These trends" is referring to as it goes back two to three sentences. It might be helpful to say "With continuing emissions, climatic conditions are projected to further and further go beyond conditions that allowed societal development over the past several thousands of years even if ... "	This sentence has been removed.
Charles	Hunt	Text Region	01. Overview		10	10	12	13	Suggest changing the text to: ‚ÄúThese trends are projected to continue through at least 2100 even if greenhouse gas emissions fall substantially, leaving the country no choice but to adapt to a changing climate. (Ch. 2),Âú Based on Figure 1.15. Limiting the horizon to just 10 years suggests that the impacts are contained and are likely to stop after 2032. This should be clarified.	This section has been revised and text has been added to the previous section to clarify the impacts expected even after reaching net zero.
Jim	Titus	Figure	01. Overview		10		14		Figure 1.2 caption. A sentence or two is needed to explain the anomaly of southeast cooling and minimal warmiong.	This figure has been updated and replaced with a temperature trend over time. Please see Chapter 2 for more information on geographic variations in observed warming in the US.
Charles	Hunt	Figure	01. Overview		10	11	14	7	The baseline used for global warming is 1850 - 1900 why are different timescales used here? Page 11 line 2, 1901 - 1960 is not the first half of the last century. Either limit the ending year to 1950 or change the caption. Page 11 line 3 Remove ‚Äúand precipitation‚Äù since Figure 1.2 does not include precipitation.	This figure, and the caption, have been updated and replaced with a temperature trend over time. The caption has been revised to clearly note the baseline.
Rachel	Licker	Text Region	01. Overview		10	11	16	1	Delete sentence starting with "Placeholder for..."	This figure, and the caption, have been updated and replaced with a temperature trend over time.
Ross	McKitrick	Figure	01. Overview		10	11		7	Why do you compare a recent 30 year period to a prior 60 year period? Why not compare same-length intervals? And why describe 1901 -1960 as the first "half" of the century?	This figure, and the caption, have been updated and replaced with a temperature trend over time. The caption has been revised to clearly note the baseline. Changes in temperature over time are often averaged over a time period of 30 years, such as the NOAA climate normals, or longer to better capture climate change rather than internal variability.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Richard	McNider	Whole Page	01. Overview		10				Surface temperature is not an appropriate metric for detecting GHG warming. The essence of GHG climate change is the slow accumulation of heat in the deep troposphere due to less radiation escaping to space. Here the warming is enhanced by the greater water vapor holding capacity of the troposphere. This water vapor feed back more than doubles the direct CO2 effect. See Christy, J.R. and McNider, R.T., 1994. Satellite greenhouse signal. Nature, 367(6461), pp.325-325 and Christy, J.R. and McNider, R.T., 2017. Satellite bulk tropospheric temperatures as a metric for climate sensitivity. Asia-Pacific Journal of Atmospheric Sciences, 53(4), pp.511-518. The warming in surface temperatures, especially at night, in the shallow boundary layers (100-200m) cannot contribute to the long water vapor pathlengths needed for the water vapor feedback seen in models. Nighttime temperatures are also extremely impacted by local land use changes around an observing site (see Runnalls, K.E. and Oke, T.R., 2006. A technique to detect microclimatic inhomogeneities in historical records of screen-level air temperature. Journal of Climate, 19(6), pp.959-978 also McNider, R.T., Steeneveld, G.J., Holtslag, A.A.M., Pielke Sr, R.A., Mackaro, S., Pour,ÂêBiazar, A., Walters, J., Nair, U. and Christy, J., 2012. Response and sensitivity of the nocturnal boundary layer over land to added longwave radiative forcing. Journal of Geophysical Research: Atmospheres, 117(D14). Warming at night and especially in the Arctic, even if initiated by added downward long wave CO2 energy is really about the redistribution of heat in the stable boundary layer not the accumulation of heat (see McNider, R.T., Steeneveld, G.J., Holtslag, A.A.M., Pielke Sr, R.A., Mackaro, S., Pour,ÂêBiazar, A., Walters, J., Nair, U. and Christy, J., 2012. Response and sensitivity of the nocturnal boundary layer over land to added longwave radiative forcing. Journal of Geophysical Research: Atmospheres, 117(D14). Daytime temperatures (Tmax) may be a better metric than Tmin, since the layer depth representing the observation is greater than for Tmin. However, both daytime maximum temperatures and nighttime temperatures are extremely dependent on surface moisture (see Dai, A., K. E. Trenberth, and T. R. Karl (1999) Effects of clouds, soil moisture, precipitation and water vapor on diurnal temperature range, J. Climate, 12, 2451-2473) Thus, variations in moisture not related to the accumulation of heat in the	This comment is inconsistent with the author team's thorough assessment of the science. The chapter has been reviewed for accuracy.
Thomas	Knutson	Text Region	01. Overview		11	11	5	7	Change "quantify" to "estimate" or "estimate quantitatively" (quantify implies that the estimate and its uncertainty levels are well-captured in general, which may be the case for some extreme events but seems too optimistic for extreme events in general).	The text has been revised with new examples and the word "estimated" has been added to clarify.
Diane	Martinez	Figure	01. Overview		11	11	8	9	This is a helpful graphic to put things into perspective. Might the idea that all of these things indicate that the warming that is taking place is not natural? The reason for this comment is that some readers, most especially legislators, still maintain that there has been warming in the past, that what we are experiencing is just the natural rhythm of the earth. It seems like it would be advantageous to not give readers wiggle room to make false claims by once again emphasizing that this warming is human caused.	The caption to this figure has been revised to note that human-caused greenhouse gas emissions are driving global warming, which is in turn driving other large and rapid changes in the climate system.
Thomas	Knutson	Figure	01. Overview		11		8	11	These are all stated as facts, but I think confidence qualifiers, likelihood statements, and/or more careful wording are needed.	For NCA5, confidence and likelihood statements are intended for Key Message statements only. There are many reasons for this, but in this specific instance, we want to remind readers that the Overview is summarizing the themes in the underlying report, not directly assessing literature that would result in confidence and likelihood language being appropriately applied. In order to keep to that consistency, we are not including confidence or likelihood language in this section of text in the Overview.
Michael	MacCracken	Text Region	01. Overview		11	11	8	8	"Thousands of years" is a significant underestimate--what we are experiencing has never been experienced during the time of human civilization. Saying "in the past 800,000 years" is only because that is as far back as data goes--the period is much more likely to be in the several millions of years. Regarding "the past 2000 years" sayig "at least" does not really give a sense of how long a period this applies--I'd suggest saying something like "at least the last 10,000 years following the warming ending the last glacial period." In the third supporting point, I'd suggest changing changing "The current drought" to "The human-induced climatiic drying" as using the word "drought" sort of implies that the situatio might rebound when this is not the case. What is happenig is a progressive aridification, not just a random fluctuation of the amout of precipitation. And again on wildfires, saying" 2000 years" seems an undersatement, perhaps say "in the thousands of years of societal development"	This figure has been revised and the text and caption have been reviewed to ensure it accurately reflects the findings within the underlying chapters.
Michael	MacCracken	Text Region	01. Overview		11	12	12	11	Well said.	Thank you for your comment.
Diane	Martinez	Text Region	01. Overview		11	12	13	5	Once again, the way this paragraph is worded makes it sound like humans are victims. It might be helpful to instead say something like "Results from the increase in human-caused greenhouse gas emissions as noted in Figure 1.3 include an increase in heat-related illnesses and deaths, extreme heat and wildfire smoke, deterioration or elimination of cultures, traditions, and livelihoods tied to land, water, and ecosystems."	The authors feel that the chapter has clearly and sufficiently established the link between human-caused greenhouse gas emissions, global warming and other associated climate changes, and the resulting effects on human and natural systems. The authors disagree that adding "human-caused" in front of every mention of "climate change" is necessary to adequately communicate this message, and feel that it would decrease readability.
Jim	Titus	Text Region	01. Overview		11		13		"For many Americans, their primary" bad grammar	This text has been revised.
Thomas	Knutson	Text Region	01. Overview		11		15		It would be better to using wording like: are likely becoming more frequent and/or severe", especially since tropical cyclones are included in your list of extremes and their frequency (e.g., U.S. landfalling major hurricanes) has not increased significantly since the late 1800s. Although TC frequency in the Atlantic has at least temporarily been increasing since 1980, this is believed to be due to aerosol decreases back towards pre-industrial levels and/or natural variability (e.g., Murakami, et al., PNAS, 2020).	The text has been revised and the suggestion implemented.
Rachel	Licker	Text Region	01. Overview		11	11	15	15	Some of these impacts are becoming more frequent (e.g., heat waves), but some are not or don't have clear evidence yet (e.g., hurricanes), so I'd suggest saying "becoming more frequent and/or more severe."	The text has been revised and the suggestion implemented.
Ned	Ende	Figure	01. Overview		11				Figure effectively and succinctly conveys the current situation. Suggest that this figure is included when summarizing this document or in communications to the public.	Thank you for your comment.
Richard	McNider	Whole Page	01. Overview		11				The page section cites that ‚ÄúMany extremes, including heatwaves, heavy precipitation, drought, flooding, wildfire, and tropical cyclones/hurricanes, are becoming more frequent and severe due to climate change, with a cascade of effects in every part of the country.‚Äù This statement is patently not true. If you use the whole climate record the maximum and number of extreme temperatures summer temperatures were much greater in the 1930‚Äôs and 1950‚Äôs (just use NOAA NCEI data and you can see for yourself). Tropical Cyclones/hurricanes have not increased (Klotzbach, P.J., Bowen, S.G., Pielke, R. and Bell, M., 2018. Continental US hurricane landfall frequency and associated damage: Observations and future risks. Bulletin of the American Meteorological Society, 99(7), pp.1359-1376., Pielke, R., 2021. Economic ‚Äònormalisation‚Äôof disaster losses 1998‚Äì2020: A literature review and assessment. Environmental Hazards, 20(2), pp.93-111.) Fires have not increased (see Swetnam et al. 2016 Phil Trans B, Lomborg, B., 2020. Welfare in the 21st century: Increasing development, reducing inequality, the impact of climate change, and the cost of climate policies. Technological Forecasting and Social Change, 156, p.119981. Floods and Droughts have not increased. Just go to NOAA data and plot Monthly Fraction of US with Very Wet (flood-like) or Very Dry (drought) ConditionsJan 1895 ‚Äì Dec 2020 NOAA/NCDC (20 driest months before 1988) Your overstatements are tiresome. You must be only using data since 1970 or 1980.	This comment is inconsistent with the author team's thorough assessment of the science.
Gabrielle	Dreyfus	Figure	01. Overview		11				COMMENT -- Figure 1.3: Add √¢¬Ä¬úat least" to √¢¬Ä¬úhigher than at any time in AT LEAST the past 800,000 years" as this statement is based on gas records reconstructed from ice cores that currently only extend back to 800,000 years. This would be consistent with IPCC AR6 WGI SPM A.2.1 √¢¬Ä¬úhigher than at any time in at least 800,000 years."	This change has been implemented.
Rachel	Licker	Figure	01. Overview	3	11				In red and orange panels, add a thousands separator to "2000" to be consistent with the other panels	This figure has been updated and the text copyedited for consistency to NCA guidance.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Licker	Figure	01. Overview	3	11				The third and fourth conditions listed here are primarily relevant to the western US given that that are for drought and wildfire. However, this section is about climate impacts more broadly, and the figure could be improved by the addition of panels on other climate impacts (heavy precipitation events, less snow vs. rain, heat extremes, etc.)	This figure has been revised and the text and caption have been reviewed to ensure they accurately reflect the findings within the underlying chapters. The underlying chapters do not include paleoclimate comparisons for current levels of snow or precipitation, so these could not be added to the figure.
Rachel	Licker	Text Region	01. Overview		12	12	1	2	The risks of extreme heat and wildfire smoke extend far beyond outdoor worker and go far beyond the loss of participation in sports and recreation. Suggest broadening this sentence so that it includes public health impacts more generally. For example, wildfire smoke and heat exposure are both associated with heightened risks for pregnant women and babies, both are linked to decreased academic achievement, etc.	This section highlights observed impacts from extremes that are changing in frequency, likelihood, and/or severity due to climate change. The sentence on extreme heat already mentions increasing heat-related illnesses and deaths.
Rachel	Jacobson	Text Region	01. Overview		12	12	6	17	I know we are all working hard to educate the public on the difference between weather and climate. I think the phrase "billion-dollar weather and climate disasters" used here does not help that effort. These are climate change-induced weather events which result in disasters - let's find a way to succinctly and accurately describe them that is not confusing or misleading to the public.	The figure title has been revised to simplify this language for communication purposes. However, because the underlying data source characterizes their methods and monitoring "weather and climate" events, we have maintained this wording in the figure caption for accuracy.
Juanita	Constible	Text Region	01. Overview		12	12	6	11	Please consider indicating that the costs reflected by these billion-dollar events are in fact significant underestimates, since they mostly reflect damage to property and crops rather than health-related costs.	The text in this paragraph has been revised to include a statement that these estimates of loss are conservative and include a short list of the types of loss which are unable to be included in the methodology.
Thomas	Knutson	Text Region	01. Overview		12	12	7	10	The increase in inflation-adjusted billion dollar disasters is presumbably affected by growth in the value of buildings, etc. that are at risk, due to development, population increase, etc. This should be mentioned here for context.	The text in the paragraph above this figure has been revised to reflect that increases in assets at risk (through population growth, rising property values, and development in hazard-prone areas) are also driving increases in billion-dollar events, alongside climate impacts
Diane	Martinez	Text Region	01. Overview		12		8		Maybe emphasize climate change is global by stating: United States, and countries throughout the world, have seen...	The text in this section has been revised to note cascading effects of climate change on a global scale.
Jeff	Peterson	Text Region	01. Overview		12	12	11	11	The Overview does a good job of summarizing a wide range of risks but does not make clear the critical role of coastal storms and hurricanes as the principal cause of major disaster impacts. NOAA reports that: ‚Äúln short, tropical cyclones are the most costly of the weather and climate disasters.‚Äù¶Accounting for just under a fifth (17.5%) of the total number of events, tropical cyclones have caused more than half (52.0%) of the total damages attributed to billion-dollar weather and climate disasters since 1980.‚Äù NOAA source: https://www.ncei.noaa.gov/access/monitoring/dyk/billions-calculations Page 12; line 11; should add: ‚Äúcoastal storms and tropical hurricanes result in just over half the total cost of all billion-dollar weather and climate events, while accounting for just under 20 percent of all such high-cost events.‚Äù	The figure on billion-dollar disasters has been updated to reflect the full dataset from 2018 through 2022, and new text has been added to the caption to highlight the impact of different types of extreme weather and climate events. Added text inludes information on recent hurricanes, particularly the damages associated with Hurricane Ian.
Charles	Hunt	Figure	01. Overview		12	12	12	3	After reviewing the source report a number of changes to Figure 1.4 would improve readability and sharpen the message. Change the title from ‚ÄúDamages by State from Billion-Dollar Disasters in the United States (2018‚Äì2022)‚Äù to ‚Äú2022 Billion-Dollar Weather and Climate Disaster Cost (CPI-Adjusted)‚Äù Use the caption already developed at https://www.ncei.noaa.gov/access/billions/mapping Also, include the complete key, and the focus is on 2022 - limit the data rage This is touchy but virtually ALL of the disaster impact in 2022 was in FL - itisagood example of how extreme events linked to climate change can hammer one part of the country and leave others only lightly touched but either expand the time scale to provide a more representative sample and / or explicitly address this in the caption or the body of the report. If you use the last 5 or 10 years, keep the scale consistent with the source	Thank you for the comment. The figure shows a time range from the last NCA (2018) through 2022. The figure has been updated with the complete dataset through the end of the year 2022. The figure title has also been revised for clarity, and additional text and examples have been added to the caption to better reflect the different event types, regional impacts, and costs.
Ross	McKitrick	Figure	01. Overview		12	12		17	This kind of diagram and text should never has passed review up to this point. Your disaster data are not adjusted for the massive increase in the stock of buildings and equipment since the 1980s. Even if you have adjusted for price inflation, it is obviously the case that a weather event can do more damage now than 40 years ago because there are a lot more homes, buildings, and stockpiles of physical wealth in the path. If your intent is to advertise loudly that the report is baised towards alarmist advocacy, then by all means leave this section as is.	The text in the paragraph above this figure has been revised to reflect that increases in assets at risk (through population growth, rising property values, and development in hazard-prone areas) are also driving increases in billion-dollar events, alongside climate impacts. Additional revisions have been made to the caption for accuracy and clarity.
Rachel	Licker	Figure	01. Overview	4	12				The text in this section is conveying the increase in billion-dollar disasters in the US, so the emphasis in the figure on state-level damage costs over time feels somewhat misaligned. A time series showing the number of disasters per year and the total cost per year would be more informative here, and such data are readily available from NOAA.	Please see Appendix 4, Indicators, for a time series version of this dataset.
Jim	Titus	Text Region	01. Overview		13		4		The statement in the heading is almost certainly wrong, and not supported by the report. It also defies common sense. Seriously: Do you really think that the harm would be less if there was no trade, no foreign aid, etc? The only point really made here seems to be that the impact on one sector or region can affect another--that is different than saying the impacts would be less if we lacked these interconnections.	Thank you for the comment. This header has been revised.
Rachel	Jacobson	Text Region	01. Overview		13		5		See above. I think the phrase "climate event" (and definitely the phrase "weather or climate event" is confusing and misleading.	This has been changed to "extreme events."
Michael	MacCracken	Text Region	01. Overview		13	13	7	7	Suggest changing "continues to warm" to "warming becomes more and more intense." Present phrasing seems too innocuous.	This sentence was removed in the course of other edits.
Michael	MacCracken	Text Region	01. Overview		13	13	11	12	"individuals and communities" is too limiting. There are whole sections of the world experiencing such impacts--the Horn of Africa, Central America, and more--so need to say "of indivicuals, communities, vulnerable nations, and even impacted regions of the world." And on line 14, say "communities and nations"	The text has been revised to make note of cascading effects of climate change globally, but the authors note that the NCA mandate covers climate change impacts on the United States; as such, the underlying report doesn't cover global impacts except where they affect US interests.
Michael	MacCracken	Text Region	01. Overview		13	13	21	21	"229" just seems like a small number--there were all sorts of additional health impacts.	While there were many health impacts, this particular impact is included in the underlying report text. The Overview chapter can only summarize material from the underlying report.
Michael	MacCracken	Text Region	01. Overview		13	13	28	29	A couple of points: I think it would be worth specifically mentioning those with poor housing for which air-conditionig is just ot an economical option. And it may also be worth mentioning those in low-lying coastal areas where inundation from increasingly severe storms can be devastating. [Note, though I do see mention of these in subsequent sentences, so perhaps not necessary]	Both of these points are made in subsequent sections; the authors would like to keep the text as is.
Jim	Titus	Text Region	01. Overview		13		35		"...redlining... forced communities of color into the least-valuable, often low-lying areas that are now more vulnerable to flooding, extreme heat, and air pollution from" is totally incorrect. It is not immediately which, if any, of the 11 chapters cited for the assertion is the source of this error, or the Chapter 1 author is the source. But redlining refers to the red-colored zones in maps created by the Home Owners Loan Corporation. Areas that already had high minority populations (or were in floodprone areas) were generally colored red, with the implication that real estate appreciation was less likely and therefore loan criteria had to be more stringent. That is, the redlining reflected segregation, rather than causing it.	A federal definition of redlining has been added with the first usage of the term. The commenter's characterization of redlining is not in line with the literature cited in NCA5.
Reid	Sherman	Text Region	01. Overview		13	13	35	35	Term redlining is used 4 times in 2 paragraphs without definition; definition given on line 13 p. 20 (which forced communities of color into the least valuable neighborhoods). Make sure definition comes with the first usage.	A federal definition of redlining has been added with the first usage of the term.
Steve	Roth	Text Region	01. Overview		13	13	35	37	The part about native Americans may be correct, but the part about "people of color" is somewhere between nonsense and a Liberal talking point. Free blacks chose to live in New Orleans, don't blame redlining. Free blacks chose to set up other communities near bodies of water. Don't blame redlining.	The commenter's characterization of redlining is not in line with the literature cited in NCA5.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Licker	Text Region	01. Overview		14	14	6	7	Residents of formerly redlined areas don't just "feel the effects of extreme heat more acutely," it's actually hotter in their neighborhoods. Suggest clarifying that when it comes to these areas, there are issues of both heightened exposure (i.e., it's literally hotter) and heightened vulnerability (e.g., because low-income residents are less likely to have adequate cooling at home or to have underlying conditions that make them more susceptible to heat-related illness). To some degree, this is explained in the following sentence, so perhaps it's just a matter of slightly reorganizing this paragraph.	The text in this section has been reorganized to improve flow and to address this comment.
Michael	MacCracken	Text Region	01. Overview		14	14	11	24	While no question that there are discrimnatory impacts, I think it needs to also be made clear that everyone is going to be impacted. First, it is often those who are poor who do all the work that benefits the better off--so how they are affected determines how others are affected. Second, with more intense and more frequent extreme events, locations once thought safe are not safe--so the houses of the rich, etc. are being affected by wildfires, coastal storms, etc. While there may well need to be some remedial actions taken to assist the least well off--I think it a mistake to divide the country this way. EVERYONE is going to be increasingly impacted, some perhaps more directly than others, BUT it is in the interest of all to be dealing with this situation. It is really essential it seems to me not to be implying that the well off get off free of actual impacts rather than just having to pay money to the less well off for suffering on their behalf. To do anything significant on this issue, EVERYONE needs to act, so I'd suggest being very careful of over featuring this point--climate change will be a disaster for all (e.g., note that the Norwegian pension fund for example, is basically saying that climate change is making it so their investments will not be enough to keep paying the planned pensions that so many of the better off depend on). If climate change affects just a couple of the major grain growing regions, prices will rise not only for food (which is more difficult for the poor to deal with), but it will pull resources from the rest of the commercial economy and there will be a global economic collapse, ad that will affect everyone. Just because a few billionaires can escape to fortresses in New Zealand is no reason to imply that only the poor will be impacted.	The authors disagree that the current text implies that only particular communities will be affected.
Reid	Sherman	Text Region	01. Overview		14	14	22	22	Physical environmental factors are missing among the factors (Check 15.2; fig 15.5; Ch 20- Intro)	This sentence has been removed.
Charles	Hunt	Figure	01. Overview		15	16	1	1	Using a table to provide examples is a good way to make the point but it needs work - make the columns meaningful the first could be an event from recent history (last three years) leading to death / destruction / economic loss, the second could be a current example of how climate change is impacting the economy (e.g. Increasing damages from Hurricanes, stresses the property insurance industry lending to dramatic increases in premiums), the third could be observed health impacts. Make the linkages clear, some of the current examples sound like disconnected collections of ideas and do not establish causal links (I am not saying the links aren,Äôt there but you HAVE TO make it clear to the reader). Always include the consequence to the reader for example ‚ÄúRising heat increases power demand and hurricanes and storms stress power grids. KM 23.4,Äù could be ‚ÄúRising temperatures and the increase in dangerous heat waves increases power demand for cooling, stressing power grids, resulting in power failures, increased deaths due to heat and increased utility rates. KM 23.4,Äù	This table and the caption have been updated to better reflect the content and to clearly note the time period (2023-2030). The examples are not intended to show historical obersvations nor long-term projections. Final figures will undergo copyediting and graphic design layout to improve readability. The methods used in developing this table have been clarified to note that these are three examples of greatest concern, chosen based on the judgement of the regional chapter teams, and are by their nature as examples not comprehensive. Please also note that tables in this report must meet 508 compliance for readability by screenreaders, which can limit the size or complexity of tables. The authors intend this figure to serve as a hub, in which readers can click on the provided links to find more detailed information (e.g., causal links, additional consequences, equity concerns) in the underlying chapters.
Michael	MacCracken	Text Region	01. Overview		15	15	7	7	Is this table of impacts being felt now or for some time in the future. I think making this clear (as I presume these are examples of preset conditions that will worsen I the future) will help make clear that all are being impacted.	The figure title and caption have been revised to clarify the time period.
Juanita	Constible	Table	01. Overview		15				This table would be much easier to read and understand without the icons, and if each column included examples from just one category of impacts. Although you might only be able to fit 4 or 5 impact categories in the tables, it is important to reinforce that health impacts and housing impacts, in particular, are being felt in every region.	This table and the caption have been updated to better reflect the content. Final figures will undergo copyediting and graphic design layout to improve readability. The methods used in developing this table have been clarified to note that these are three examples of greatest concern, chosen based on the judgement of the regional chapter teams, and are by their nature as examples not comprehensive. Please also note that tables in this report must meet 508 compliance for readability by screenreaders, which can limit the size or complexity of tables.
Michael	MacCracken	Text Region	01. Overview		17	17	1	1	The focus of this section, and done quite well, are "impacts"--not "risks". I think the heading needs adjustment.	The heading has been adjusted to address this comment.
Gabrielle	Dreyfus	Text Region	01. Overview		17	17	1	9	COMMENT: Good framing to connect impacts to what people value both economically but also culturally and socially,including heritage.	Thank you for the comment.
Jim	Titus	Text Region	01. Overview		17		2		The first sentence is not demonstrated by the text that follows, and probably could never be proven. This report does not evaluate what Americans value most, at least in the common sense of what that statement means. .	This sentence has been removed.
Michael	MacCracken	Text Region	01. Overview		17	17	2	9	Going to first person here (something the guidelines for review comments say to avoid) makes these important findings seem like a personal plea rather than a factual statement from the government. I'd suggest that it might be good to go to third person, so talk about activities that Americans love to do, etc.	Thanks for pointing this out; this particular instance of the first person was eliminated. In general, we decided to eliminate the first wherever possible and especially where its use is imprecise. We retained the first person in a few cases where we felt its use makes the message more effective.
Marcy	Rockman	Text Region	01. Overview		17	17	2	9	Request/recommend that terms of culture and/or heritage be included in this paragraph in some way. One possible rewording could be "...places we love, our livelihoods, connections to culture and history, and pastimes..."	Great point, thank you. We added culture and heritage to this section.
Rachel	Licker	Text Region	01. Overview		17	17	14	14	In addition to making water resources unreliable, these rapid shifts from wet to dry make water resources difficult to predict and manage. These challenges are distinct from reliability and should be mentioned here as well.	The text has been edited to reflect this suggestion.
Rachel	Licker	Text Region	01. Overview		17	17	17	20	The sentence starting "Urban and..." is quite long and complex. Suggest breaking it into two for clarity.	Thank you for the comment. The sentence has been broken up and the language in this paragraph revised to clarify the different points.
Reid	Sherman	Text Region	01. Overview		17	17	23	23	Use of adaptive capacity for communities of color and low-income communities is not defined.	The text has been revised here to clarify and better define adaptive capacity.
Michael	MacCracken	Text Region	01. Overview		17	17	24	24	"$291.1 billion" is scientifically excess precision. Say, roughly $300 billion. Of course, this is of order 30 years and the average population is 300 million, say, so it is roughly $30 per person per year, which does not really seem that much. The problem is that it is some people being penalized a lot and a lot of people not so much. And does this amount really count all the extra money for air conditioning and otherwise keeping safe; or the amount for having to build the infrastructure to keep the water flowing during a drought? I'd suggest it might be better to find some other way to indicate the importance than this dollar figure.	This value has been updated to reflect the underlying chapter finding, and to standardize dollar estimates across the report to 2022 inflation adjusted dollars. Please see Chapter 4 for more information on this statistic and the methods for calculating.
Andrew	Carleton	Text Region	01. Overview		17	17	28	30	Mention flash droughts here as they are not considered until Chapter 2, page 16, lines 18-20.	The authors have determined that flash droughts don't warrant inclusion in the Overview.
Sean	Fleming	Text Region	01. Overview		17	17	33	33	Ch 1 page 17 line 33, suggest changing to ‚Äústreamflow and increases wildfire risk‚Äù	The text has been revised to include this commenter's suggested wording.
Michael	MacCracken	Text Region	01. Overview		17	17	36	37	I think this is greatly overstated. Salt water intrusion into coastal aquifers is not easily dealt with except by desaliation plants, and a good fraction of the population lives in coastal regions (see page 1-21, lines 24-26). And tell me what the options are in the California Central Valley and other agricultural areas. And adjusting reservoir management practices I understand require Congressional approval--talk about a battle location. Yes, for small to modest impacts, there are practices, but not for a good number of situations. This is just too optimistic.	The authors have reviewed the text and find it is accurate and reflects the underlying chapter findings. The sentence notes there are "many proven options" but does not provide a comprehensive list of all of the locations where these options may or may not be available.
Michael	MacCracken	Text Region	01. Overview		18	18	1	3	The problem is that some areas experiencing floods, like the northern Great Plains, just do not have the hydrogeography that make flood control management easy--the land is quite flat and does not have deep channels as the regions has not had to develop with deep snowfall (due to snow from moist Gulf of Mexico air) and then rapid melting.	This comment does not appear to raise a question or suggest a revision.
Jim	Titus	Text Region	01. Overview		18		13		We need a likelihood statement here. "Are expected" is really weak and one wonders: by whom?	All headers and subheaders have been reviewed and revised to convey complete statements and to ensure they reflect the content of the underlying section text. Calibrated languge (such as likelihood) appears in the underlying chapter Key Messages, but is not included in headers.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	MacCracken	Text Region	01. Overview		18	19	14	12	This analysis completely fails to mention that many agricultural products are now an international commodity, so what matters a lot is what is happending around the world in their competitive markets, both on the supply and demand side. With each region experiencing different and not readily predictable consequences on a seasonal scale. figuring out what, when and how much to plant and then sell has greatly complicated the lives of farmers in addition to the relatively local aspects mentioned here.	Please see Focus on Supply Chains, which has a case study on disruptions to food supply internationally. Please also see Chapter 17 (International) and Chapter 18 (Complex Systems) for additional information on interacting, complex impacts.
Gabrielle	Dreyfus	Text Region	01. Overview		19	19	1	5	COMMENT VC¬Ã¬ì Ground level ozone is both a major contributor to increasing temperatures and to decreasing crop productivity. Please add a sentence on role of ground-level ozone and its precursors (including methane) in contributing to stresses on crop productivity. CITE -- United Nations Environment Programme & Climate & Clean Air Coalition (2021) GLOBAL METHANE ASSESSMENT: BENEFITS AND COSTS OF MITIGATING METHANE EMISSIONS, 68 (VC¬Ã¬úMethane also plays a significant role in reducing crop yields and the quality of vegetation. Ozone exposure is estimated to result in yield losses in wheat, 7.1 per cent; soybean,12.4 per cent; maize, 6.1 per cent; and rice, 4.4 per cent for near present-day global totals (Mills et al. 2018; Shindell et al. 2016; Avnery et al. 2011a)VC¬Ã¬ù); and Shindell D., Faluvegi G., Kasibhatla P., & Van Dingenen R. (2019) Spatial Patterns of Crop Yield Change by Emitted Pollutant, EARTHVC¬Ã¬ôS FUTURE 7(2): 101VC¬Ã¬ì112, 101 (VC¬Ã¬úOur statistical modeling indicates that for the global mean, climate and composition changes have decreased wheat and maize yields substantially whereas rice yields have increased. WellVC¬Ã¬êmixed greenhouse gasses drive most of the impacts, though aerosolVC¬Ã¬êinduced cooling can be important, particularly for more polluted area including India and China. Maize yield losses are most strongly attributable to methane emissions (via both temperature and ozone).VC¬Ã¬ù); and Mbow C., et al. (2019) Chapter 5: Food Security, in Climate Change and Land, Special Report of the Intergovernmental Panel on Climate Change on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems, Shukla P. R., et al. (eds.), 451 (VC¬Ã¬úMethane increases surface ozone which augments warming-induced losses and some quantitative analyses now include climate, long-lived (CO2) and multiple short-lived pollutants (CH4, O3) simultaneously (Shindell et al. 2017; Shindell 2016). Reduction of tropospheric ozone and black carbon can avoid premature deaths from outdoor air pollution and increases annual crop yields (Shindell et al. 2012). These actions plus methane reduction can influence climate on shorter time scales than those of carbon dioxide reduction measures. Implementing them substantially reduces the risks of crossing the 2VÇ¬∞∞C threshold and contributes to achievement of the SDGs (Haines et al. 2017; Shindell et al. 2017) VC¬Ã¬ù; VC¬Ã¬íOzone causes damage to plants through damages to cellular	The effects of ground-level ozone on crop productivity are not covered in the underlying report and thus cannot be referenced in the Overview.
Charles	Hunt	Text Region	01. Overview		19	19	13	17	The first sentence is reasonable but would benefit from some supporting evidence. Exclude any responses that are not supported by evidence. Aquaculture (from other mentions in the report) is highly localized and seems to be as much a way to simple market opportunities - needs evidence. On line 17, Box 27.2 is mentioned but in reviewing 27.2 it is at best barely linked to aquaculture and does not support the statement made here.	The reference to Box 27.2 has been replaced with Box 27.3. An additional reference to aquaculture in another underlying chapter has been added.
Diane	Martinez	Text Region	01. Overview		20	20	3	5	The way this sentence is worded with climate change being the subject that is doing the action can create a false sense of responsibility for readers. Climate change becomes an entity, an entity that is threatening us and our way of living. It is important that climate change does not become an enemy because then readers will definitely not see their connection to it because they won't want to be associated with it. Instead, it might be more helpful to avoid the climate change vs. humans dichotomy, and word it something like: Homes, property, and infrastructure are increasingly at risk of damage from the effects of human-cased climate change, such as heavy rainfall, flooding, and wildfire, increasing the cost...	The sentence has been revised for clarity and accuracy.
Michael	MacCracken	Text Region	01. Overview		20	20	3	3	How about changing "risk" to "likelihood"	This section has been revised for clarity and accuracy in response to other comments; risk no longer appears in this sentence.
Jeff	Peterson	Text Region	01. Overview		20	20	5	5	Sections 3.3 and 3.4 address risks posed by extreme climate and weather event to homes and to infrastructure but do not clearly identify the significant threats that rising sea level poses to these assets. For example, sea level rise poses a threat to some two million homes in the United States. Rising sea level also poses risks to diverse major types of infrastructure assets located along the coast, including transportation (highways, rails, bridges, ports), water treatment facilities, energy facilities, and defense assets (see comment on page 12 for more information). Insert a new sentence: ‚ÀúRising sea level poses a risk of permanent inundation of land areas now occupied by over two million homes.‚Àù	The sentence: "In addition, coastal communities across the country—home to 123 million people or 40% of the total US population—are exposed to the impacts of sea level rise, with millions of people at risk of being displaced from their homes by the end of the century" has been added to section 3.3. The sentences: "In coastal areas, sea level rise poses a risk of permanent inundation to major infrastructure including roadways, railways, ports, tunnels, and bridges; water treatment facilities and, power plants; and hospitals, schools, and military bases. More frequent and intense storms also threaten natural and built infrastructure, as well as critical services like access to medical care as seen after Hurricanes Irma and Maria in the US Virgin Islands and Puerto Rico" have been added to section 3.4. "Sea level rise" has also been added to the section titles.
Jim	Titus	Text Region	01. Overview		20		13		"Redlining policies, which forced communities of color into the least valuable neighborhoods" is simply wrong. The redline maps were created by the Federal HOLC and they reflected pre-existing segregation and hazards in the 1930s which, in the judgement of the mappers, made property more risky. You could change this to "historic segregation policies" or something like that and be accurate. Redline is a nice buzzword, but it is being mis-used throughout this document.	This text has been removed from this section as it was redundant to section 2.4. An approved federal definition of redlining has been added to section 2.4 upon first usage.
Juanita	Constible	Text Region	01. Overview		20	20	15	22	Please consider adding more nuance to the sentence about public cooling centers. Recent research suggests that cooling centers are often underused because they are not sufficiently accessible by public transit or on foot. Underutilization can also occur if local populations are unaware of cooling centers, for example because of language barriers. Finally, the phrase CRITICAL HEALTH SERVICES implies that there are trained medical professionals on site at cooling centers. That is rarely the case, especially for cooling centers in libraries or commercial spaces such as malls. You could rephrase the sentence along these lines: Public cooling centers accessible to vulnerable/marginalized/overburdened/underserved populations can help protect the health of people without adequate shelter on hot days.	The text has been revised for clarity and accuracy.
Rachel	Licker	Text Region	01. Overview		20	20	26	27	Drought and major hurricanes have altered where people live, but so have wildfire, lesser hurricanes/tropical cyclones, and inland floods, so it seems skewed to just mention the first two impacts in this opening sentence. Suggest broadening to "Climate impacts have contributed to shifts in where people live both historically and in the present day."	The findings of the underlying chapters show that, historically, only major or long-lasting extreme events, namely droughts and major hurricanes, have had a lasting impact on past human migration in the United States. However, moving forward, increases in the severity and frequency of other extreme events are expected to increasingly affect migration and displacement in the future. The text has been reviewed for clarity and accuracy to ensure it captures the findings of the underlying chapters.
Rachel	Licker	Text Region	01. Overview		20	20	31	33	The first half of the sentence starting "More severe..." refers to future projections whereas the second half ("while climate-driven economic changes...") refers to ongoing trends. Suggest editing to either focus both clauses on the future or both on ongoing trends so that there is tense agreement between the clauses.	The text has been revised for clarity and accuracy.
Jim	Titus	Whole Page	01. Overview		20				Somewhere on this page, it might be worth noting that the displacement of Black people from floodplains and land close to sea level is especially disproportionate: In the last 30 years, Blacks are about 5 times as likely as the general population to have moved away from land below the 1 meter contour, and 2 to 3 times as likely to have moved out of a floodplain. This should probably be mentioned in the water and coastal chapters as well.	Section 2.4 has been revised and includes information on redlining and neighborhoods that have substantially higher risk of flooding.
Jeff	Peterson	Whole Page	01. Overview		20				Sections 3.3 and 3.4 address risks posed by extreme climate and weather event to homes and to infrastructure but do not clearly identify the significant threats that rising sea level poses to these assets. For example, sea level rise poses a threat to some two million homes in the United States. Rising sea level also poses risks to diverse major types of infrastructure assets located along the coast, including transportation (highways, rails, bridges, ports), water treatment facilities, energy facilities, and defense assets (see comment on page 12 for more information). Source for lost homes: https://www.zillow.com/research/climate-change-underwater-homes-12890/ Revise the titles of 3.3 and 3.4 to add at the end ‚Äúand rising sea level.‚Äù (Note that, although sea level rise is a threat to some supplies of drinking water, this risk is notably smaller than sea level rise risks to communities, ecosystems, and infrastructure assets.)	The sentence: "In addition, coastal communities across the country—home to 123 million people or 40% of the total US population—are exposed to the impacts of sea level rise, with millions of people at risk of being displaced from their homes by the end of the century" has been added to section 3.3. The sentence: "In coastal areas, sea level rise poses a risk of permanent inundation to major infrastructure including roadways, railways, ports, tunnels, and bridges; water treatment facilities and, power plants; and hospitals, schools, and military bases. More frequent and intense storms also threaten natural and built infrastructure, as well as critical services like access to medical care as seen after Hurricanes Irma and Maria in the US Virgin Islands and Puerto Rico" has been added. "Sea level rise" has also been addded to the section titles.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Diane	Martinez	Text Region	01. Overview		21	21	17	19	This sentence is similar to the one above, and caution should be taken in making climate change the subject of a sentence, the thing doing the action. While active voice is preferred over passive voice in most instances because actors and responsibility are clearly distinguished with that type of rhetorical structure, using climate change as the subject may have the reverse effect the committee may want readers to have because they read this as "climate change" is responsible, not me. Instead, it might be more conducive to revise so that climate change is not the subject doing the action. It could be something like "Current or rising levels of human-cased greenhouse gas emissions increases the potential and frequency of disruptions..."	The authors disagree that using "human-caused greenhouse gas emissons" instead of "climate change" is necessary to communicate that humans are responsible for climate change. This point has been established multiple times earlier in the chapter, which emphasizes both human contributions to observed impacts and ability to reduce future impacts through collective choices. The authors further disagree that the term "climate change" should not be the subject of a sentence and that doing so implies that it's a separate entity from humans. What climate change is and who is responsible for it has been clearly defined.
Jeff	Peterson	Text Region	01. Overview		21	21	21	23	The existing sentence should be revised as follows: ‚Äúln coastal areas, rising sea levels pose a risk of permanent inundation to major infrastructure including transportation assets (e.g., highways, railways, bridges, ports), water treatment facilities, power plants, hospitals, and defense assets."	The sentence has been revised to "Many infrastructure systems across the country are at the end of their intended useful life and are not designed to cope with additional stress due to climate change."
Thomas	Knutson	Text Region	01. Overview		21		26		Suggest replacing "more frequent hurricane damages" with "additional hurricane damages associated with sea level rise" or just delete the phrase, since Atlantic hurricanes themselves are not necessarily projected to become more frequent due to greenhouse gas-induced climate change (Knutson et al. 2020).	The sentence has been revised to: "At the same time, climate change is expected to increase demands on critical infrastructure. Future increases in average temperatures and more intense heatwaves will heighten electricity and water demand, while wetter storms and intensified hurricanes strain wastewater and stormwater pumps."
Diane	Martinez	Text Region	01. Overview		22		4		How about... Weather patterns disrupted by the increase of greenhouse gas emissions from human activity will place increasing demands on critical infrastructure. Once again, it is important to not make climate change a separate entity from human activity.	The authors disagree that repeating "human-caused" in front of every mention of climate change is necessary to communicate this message, which is reinforced a number of times throughout the chapter.
Rachel	Licker	Text Region	01. Overview		22	22	10	11	The first sentence of this paragraph implies that infrastructure and related systems alone would maximize resilience, which ignores the importance of a wide range of adaptation measures that would also help to maximize resilience (e.g., forward-looking pre-disaster mitigation funding, strengthening of social systems and local economies, etc.). Suggest changing "can maximize" to "would help build."	The text has been revised for clarity and accuracy.
Juanita	Constible	Text Region	01. Overview		23	23	3	7	Please consider including a bullet about heat-related illnesses, injuries, and deaths. Although heat is partially captured by the extreme event bullet, heat-related health outcomes regularly occur outside of multi-day heat waves. Furthermore, even though heat is already the deadliest form of extreme weather in the US, it tends not to get the same attention as hurricanes or wildfires.	This is a list of health hazards, not outcomes. Therefore it would not be appropriate to add injuries or illness to this list. We provide the references to the underlying text, mainly in Chapter 15, that describes in more detail the health outcomes of heat-related illnesses, injuries, and deaths.
Jim	Titus	Text Region	01. Overview		23		18		"Reducing greenhouse gas emissions would result... " Why "would"? That makes it sound very hypothetical. Isn't this already happening? If not, why not say "will"? Why so tentative?	This text is an assessment of the outcome of policies/actions that reduce greenhouse gas emissions, not a statement of what definitively will happen. Therefore the use of "would" is appropriate.
Jim	Titus	Text Region	01. Overview		24		12		Unlike some of the headings, this heading seems too understated. Transformational change applies to some, but others are partly or totally lost.	All headers and subheaders have been carefully reviewed and revised to ensure they convey complete statements and reflect the content of the underlying section text.
Diane	Martinez	Text Region	01. Overview		24		13		How about... Human-caused climate change harms the health... Maybe the answer is to use the phrase human-caused climate change and not just climate change. Keeping the human in the phrase reminds readers about who is ultimately responsible for where we are and where we are going.	The authors disagree that repeating "human-caused" in front of every mention of climate change is necessary to communicate this message, which is reinforced a number of times throughout the chapter.
Michael	MacCracken	Text Region	01. Overview		24	24	17	17	Use of the word "may" is inappropriate given the likelihood/confidence metric of terms that the assessment adopted.	The text has been revised to remove the word "may."
Gabriel	Oppler	Text Region	01. Overview		25	25	6	10	The terminology used in current literature in place of 'ecosystem connectors' and similar terms is 'ecological corridors', or simply ‚Äòcorridors,Äô. An ecological corridor is defined as a clearly defined geographical space that is governed and managed over the long term to maintain or restore effective ecological connectivity. The following terms are often used similarly: ‚Äòlinkages,Äô, ‚Äòsafe passages,Äô, ‚Äòecological connectivity areas,Äô, ‚Äòecological connectivity zones,Äô, and ‚Äòpermeability areas,Äô (Hilty et al. 2020. Guidelines for conserving connectivity through ecological networks and corridors https://portals.iucn.org/library/node/49061).	This comment does not appear to provide a suggestion or recommended change.
Rachel	Licker	Text Region	01. Overview		25	25	13	13	The Dixie Fire burned almost one million acres of land, not one billion.	This error has been corrected.
Jim	Titus	Text Region	01. Overview		25		25		This 11 to 14% uncertainty range seems implausibly narrow. Maybe that is all you have, if so, try to write something to make it clear that the range is actually wider. In addition, the statement is a bit misleading if we are taking 15% off a growing baseline. Are you sure that climate change will not cause the economy to actually shrink?	This text has been revised to generalize international impacts on the US economy and to focus on domestic economic impacts.
Rachel	Licker	Text Region	01. Overview		27	27	20	22	Two things here: Extreme heat in the Southwest also threatens agricultural worker health, wine production, and dairy production, so it seems like it should be mentioned here alongside wildfire and drought. Also, "cattle production" reads awkwardly. Is this dairy production? Or beef production?	The text has been revised to include the hazard of extreme heat. The existing text already includes impacts to agricultural worker health. The authors checked the underlying literature supporting this statement and found that the Midwest and Southwest chapter use the term cattle production (as do several other chapters) and that this term is used to encompass both beef and dairy production. To be consistent with the underlying chapters, this text has not been revised.
Rachel	Licker	Text Region	01. Overview		27	27	31	32	The phrase "many small businesses will struggle" implies certainty about the future. Suggest changing "will" to "may," or qualifying the sentence to make clear that without financial and other types of assistance, many small businesses will struggle.	Because the underlying chapter text supporting this statement notes that small business are likely to face these challenges, the text has been revised to "are expected to."
Rachel	Licker	Text Region	01. Overview		28	28	19	20	Unless there is certainty that losses in fossil fuel related jobs will be offset by increases in mitigation-related jobs, suggest changing “will” to "may" or “will be offset, at least in part."	Based on the underlying chapter text that supports this statement, the sentence has been changed to "are projected to"
Diane	Martinez	Text Region	01. Overview		29		14		It would be a good idea to definitely add human-caused climate change if the word threatens if going to be used.	The authors disagree that repeating "human-caused" in front of every mention of climate change is necessary to communicate this message.
Marcy	Rockman	Text Region	01. Overview		29	29	14	20	Really appreciate this section! Recommend edit to line 17 "particularly impacts from on natural ecosystems" - this is not fully supported. Damage to cultural heritage also occurs in developed and urban areas, even deployment of renewable energy, loss of connection to affiliated communities, and others. Refs on impacts of climate on heritage include Rockman et al. 2016, https://www.nps.gov/subjects/climatechange/culturalresourcesstrategy.htm, and Sesana et al. 2021, https://doi.org/10.1002/wcc.710. Potential impacts to archaeological resources due to inland migration from coasts is described in Anderson et al. 2017, https://doi.org/10.1371/journal.pone.0188142.	Thank you for this comment and for the resources. The text has been revised for clarity and accuracy.
Reid	Sherman	Text Region	01. Overview		29	29	21	21	Leading a cultural heritage discussion with recreation is not sensitive to the nuances of many cultural resources. Cultural heritage is non renewable and the consequences of loss are severe and treated too lightly here. Switching paragraphs 2(recreation) and 3 (NBS) will help. Recommend citing material from Ch 16 p 9 line 24 for Culture and p. 17 line 1 Relocation.	The first paragraph in this section on culture and heritage describes elements of cultural heritage that includes includes buildings, monuments, livelihoods, and practices, and notes climate damages to archaeological, cultural, and historical sites further reduce opportunities to transfer important knowledge and identity to future generations. The format of these sections is to describe the impacts first and then the mitigation and adaptation actions that can protect against those risks and impacts. As such the Nature Based Solutions paragraph has been kept at the end of the section. The cross-references the commenter suggested have been added to the chapter.
Marcy	Rockman	Text Region	01. Overview		30	30	16	17	Recommend rephrasing of sentence beginning "Incorporating local values..." to explicitly state that cultural heritage is/can be a source of solutions as well; this is described, but it would help with equity and parity with nature-based solutions to add specific phrasing, such as "Cultural heritage can also be a source of culture-based solutions, as incorporating local values, Indigenous...".	Thank you for this comment. The text has been revised to emphasize cultural heritage as a climate solution.
Juanita	Constible	Text Region	01. Overview		31	31	2	6	The message of urgency in this section should extend to adaptation. As Section 5.3 points out, the kind of transformational adaptation we need will take time. But many of even the most incremental protections are years away, given the speed at which planning, funding, and implementation typically happens.	The authors agree that their is an urgent need for adaptation, especially because of the lead times associated with implimenting large-scale changes. As you noted, this is addressed in Section 5 (How We Move Forward). The authors have chosen to maintain the narrative arc of Sections 4 & 5 and feel that adaptation is best addressed in Section 5.
Diane	Martinez	Text Region	01. Overview		31	31	3	5	Maybe alternative wording could be: the choices people make today impact the extent that society experiences damage, loss, and changes to quality of life.	This text has been revised for clarity and to ensure it captures the content of the subsectin text.
Michael	MacCracken	Text Region	01. Overview		31	31	3	3	Not just greater risks, but greater impacts/consequences.	The authors agree with this comment and have revised the text accordingly.
Michael	MacCracken	Text Region	01. Overview		31	31	5	5	Should avoid use of word "we". Also lines 6, 14	The authors have removed "we" in a number of instances throughout the chapter, but have opted to keep it in a few cases to improve communications value.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	MacCracken	Text Region	01. Overview		31	31	6	6	Again, future generations will experience impacts, not just risks.	This edit has been implemented.
Diane	Martinez	Text Region	01. Overview		31	31	8	10	This needs should be highlighted, maybe pushed to the top of the chapter. It is buried right now, and it is critical for readers to see.	The authors feel that human causation of climate change has been made sufficiently in the first section of the chapter and that it is appropriate to provide more detail in a later section.
Rachel	Licker	Text Region	01. Overview		31	31	8	10	The construction of the first sentence of this paragraph is incorrect because "primarily by..." and "as well as from..." are not serving the same function in the sentence. Suggest changing "from" to "through," which I think would make it correct.	The sentence has been revised for grammar and clarity.
Michael	MacCracken	Text Region	01. Overview		31	31	9	9	"more than 47%" would better say "about 50%"--so about 280 to about 420 ppm.	This suggestion has been implemented.
Michael	MacCracken	Text Region	01. Overview		31	31	11	12	Well, yes, they have taken up the CO2, but this has not been without impacts, includig ocean acidification, impacts on the marine biological cycle, altering ecosystem competition, etc. It should not be implied that the uptake is without consequences. And, indeed, the climate change that has resulted are starting to greatly limit the ability of the natural system to take up so much--so the oceans are becoming stratified by warming and landscapes are being stressed by warming, permafrost is thawing, etc. Whether the airborne fraction will stay as low as about 50% is becoming increasingly doubtful.	The authors discussed and determined that the sentence does not imply that this uptake has been without consequences. Ocean acidification is mentioned several times throughout this chapter, namely as an impact that will continue even if/when net-zero emissions are reached. Please also see Chapter 10 for more information on ocean acidification
Rachel	Licker	Text Region	01. Overview		31	31	12	12	It's important to correct here that ocean and land carbon sinks have not "removed" more than half the CO2 emitted by human activities, they've either "removed more than half the CO2 emitted by human activities from the atmosphere" or they've "absorbed more than half the CO2 emitted by human activities."	The sentence has been revised for clarity and accuracy.
Diane	Martinez	Text Region	01. Overview		31	31	14	16	This point should be highlighted in some way, maybe even pushed to the top of the chapter. It is important for readers to see. It is somewhat buried right now.	The authors have determined that the top-level point about human choices driving greenhouse gas emissions has been made adequately in section 1 of the chapter and that it is appropriate to elaborate on it in later sections.
Michael	MacCracken	Text Region	01. Overview		31	31	26	28	Scientists do not try to predict for a "future year" or "a specific outcome". The projections are really for a range of years (or actually decades) and for a range in the possible outcomes. So, when it is said something will happen in 2100, they don't mean that specific year. Some clarification is needed here.	The authors have changed "year" to "time" to avoid the appearance of specificity and linked to relevant Key Messages in the physical science chapters.
Michael	MacCracken	Text Region	01. Overview		31	31	29	31	Some rephrasing is needed. Once the CO2 level is up to a particular level, the concentration will continue and the warming will continue, so even if emissions went to zero, the warming would continue. What needs to be said is that "projected emissions" will not change much--then keep the first part of the next sentence. Over a decade there actually is some lag i the warming as it takes time for changes in ice cover, ecosystems, and upper ocean to warm. What is the case is that the CO2 concentration will be about the same independent of the scenario over ten years.	This comment is not in line with recent scientific advancements, including the results of the Zero Emissions Committment project, in which reductions in ocean heat uptake are largely balanced by biosphere carbon uptake. The median estimate of committed warming is close to zero, and thus the claim that "warming will continue" if emissions go to zero does not align with the science. While the text has been revised for clarity, the commenter's suggestion has not been implemented.
Michael	MacCracken	Text Region	01. Overview		31	31	32	33	Nice to say "emissions fall to zero" but this won't happen in anything like a decade, which was the focus of the previous sentence--getting to zero will take quite a number of decades and this needs to be made clear to differentiate the main message of this sentence from the preceding ones. That this is necessary as the next paragraph seems to take us from one-decade into the future to two to three decades in the future (and we're unlikely to get to zero emissions by then either).	The authors disagree that this sentences implies that emissions will fall to zero in the next decade. It is a statement about how the earth system will respond to net-zero emissions and does not include a timeframe.
Michael	MacCracken	Text Region	01. Overview		32	32	2	2	I'd suggest changing "are apparent" to "start to become apparent"	The text has been revised for clarity and accuracy.
Michael	MacCracken	Text Region	01. Overview		32	32	4	7	Some context needs to be given on significance of such changes--these are huge amounts--and will be even laerger over the US.	The authors note that "Figure 1.16. What would 3.6°F (2°C) of global warming feel like in the United States?" illustrates how this temperature increase would affect different locations across the US. The text notes that warming impacts experienced in the US are greater than the global averages.
Rachel	Licker	Text Region	01. Overview		32	32	6	6	Change "very lowest" to "very low" to be consistent with how scenarios are named overall and used specifically in this paragraph.	The text has been revised for accuracy and consistency with defined scenario terminology.
Michael	MacCracken	Text Region	01. Overview		32	33	13	3	Very nice graph, but it would help to give context of the numbers if there was also some indication of what the difference is in annual average temperature across the US, so what is the difference between America's major cities so the reader can have some context regarding what these numbers mean.	The authors note that "Figure 1.16. What would 3.6°F (2°C) of global warming feel like in the United States?" illustrates how this temperature increase would affect different locations across the U.S. Please also see Figure 12.3, which notes differences in urban climate zones and typologies.
Thomas	Knutson	Text Region	01. Overview		33		6		The words "have caused" implies this is a fact. In contrast,the IPCC AR6 said the following on this topic: "The likely range of total human-caused global surface temperature increase from 1850-1900 to 2010-2019 is 0.8–∞C to 1.3–∞C, with a best estimate of 1.07–∞C. It is likely that well-mixed GHGs contributed a warming of 1.0–∞C to 2.0–∞C..." and "Global surface temperature was 1.09 [0.95 to 1.20] –∞C higher in 2011-2020 than 1850-1900." What IPCC AR6 said is not equivalent to the text used in draft line 6, so I recommend the draft line 6 text be reworded to be equivalent to AR6. You could use the three sentences quoted above from the AR6 SPM.	These values have been checked for accuracy and the sentence edited for clarity. These findings are in line with those of the IPCC AR6.
Steph	Courtney	Text Region	01. Overview		33	35	11	8	I think the section of text and figures discussing increased warming in the US, compared to global average, is important. However, it would be very helpful and much more precise to disclose whether those stats include Alaska (I'm assuming they do) and to also include the comparison between average global warming and CONUS warming, even if the whole-US stats are still used most for the graphics and whatnot.	The authors note that the caption for this figure states that temperature data is annually averaged over all 50 states and Puerto Rico. A new figure has been added to the Overview and text has been revised to clearly demonstrate the rise in temperature in the US as compared to the global rise in temperature, to provide context for faster warming in the US. The text notes that faster warming in the US reflects a broader global pattern in which land areas are warming faster than the ocean and higher latitudes are warming faster than lower latitudes.
Charles	Hunt	Figure	01. Overview		34	34	1	6	Caption: As the world warms, the United States warms more. The map shows projected annual surface temperature changes in the US from the present day (1990 - 2020) under the international targeted 3.6~∞F (2~∞C) of global warming above preindustrial levels (see Figure 2.8). Regional examples demonstrate differences in how temperature impacts are experienced by people across the country. Source: USGCRP 2023 In addition, please consider adding an additional figure with two maps showing the projections for 2050 and 2100 for SSP2-4.5 (or whatever is judged to be the median likelihood GHG emission scenario through 2100) since the 2C target seems to be improbable). The readers need to have a clear understanding of where the world and the United States is headed.	Climate scenarios present multiple plausible futures and do not have likelihoods assigned to them in this report. Chapter 2 includes a figure showing projections at different global warming levels, which is an alternative approach to evaluating and communicating potential climate futures. This figure in Chapter 2 shows how different global warming levels would affect the United States (US Average Temperatures at 1.5°, 2°, 3°, and 4°C of Global Warming). The Overview figure presents additional details about regional changes. In addition, Figure 1.15 in the Overview shows what different scenarios mean for U.S. temperature warming and when a given temperature threshold is crossed.
Michael	MacCracken	Text Region	01. Overview		34	34	3	6	It would seem important to make clear the assumptions for the calculations here, which I presume include: this calculation assumes no change in the atmospheric circulation (e.g., no change in the overall planetary wave pattern; these calculations do not account for changes in precipitation and evaporation, which may well change the extent of evaporative cooling; these changes do not account for changes in vegetation cover of the region; these calculations do not account for how warming may be concentrated in particular episodes like heat waves; what else?). I'd also note that it might be more informative to be doing this calculation for the heat/discomfort index, which is really matters most for people in terms of being outdoors, energy demand, etc.	Please see the metadata survey for details on how this figure was created. The map was developed using CMIP6 global climate models (see also the figure in Chapter 2 (2.8) that shows different average annual temperatures reached under different global warming levels). The values in the text presented for each of the regions comes from downscaled data using LOCA2 and STAR-EDSM (see Appendix 3 for model and scenario information). These values were determined using 16 global climate models, which incorporate varying assumptions about general atmostpheric circulation (see references in Appendix 3). Describing the modeling parameters for these 16 global climate models is beyond the scope of NCA. Precipitation values can be seen in Figure 2.7. Please also see the Land Use chapter for maps of vegetation cover and the Water chapter for maps on how evapotranspiration and soil moisture are expected to change.
Michael	MacCracken	Text Region	01. Overview		34	34	8	9	It might well be worth mentioning here that generally housing and infrastructure are built for conditions experienced in the past, so the types of changes might well go beyond the range of values for which infrastructure, etc. has been designed. And also that there are in some cases that are sort of thresholds, such as the heat index that can be withstood, etc.	Text has been revised throughout the chapter, notably in section 3.3, to note climate deviations outside the range of historically observed conditions.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Charles	Hunt	Figure	01. Overview		35	35	1	8	For three of the first four graphs (US Ave Temp, Number of days .95F, Extreme precipitation events) add the year that the warming level is expected in the United States for SSP2-4.5 (or most likely scenario). For Average annual rainfall consider dividing the US into three (north, southeast, southwest) or four (north east, northwest, south east, south west) using 37 degrees north latitude and 98 degrees west longitude as the dividers. The southern US has two dramatically different climate regions that should not be lumped together (this graph should also show likely years under SSP2-4.5 or most likely scenario) The reader needs a clear sense of not simply the possible consequences but when those consequences are likely. For the last two graphs, make it clear that these depend on global warming levels applied to high latitudes (mainly Greenland and Antartica). The scale should reflect bottom third high latitude warming estimates under SSP2-4.5 (or most likely scenario), middle third, and top third each applied to ice loss and impact on sea level and, if significant, the effect on sea volume due to warming of the oceans. Since holding global warming to 2C is unlikely and the impact at high latitudes is greater in any event, estimates should be provided (even if they have larger than desired uncertainties - considering what is at stake, the sources of the uncertainty should be identified along with research priorities to improve the estimates). This information is critical to coastline adaptation (in the US and around the world) and should extend beyond 2100 to help allow decision makers to avoid additional adaptation requirements within the economic lifetime of decisions (e.g. moving a town 1 mile inland only to find that it should have moved 4 miles inland to avoid an additional need to move in the early 2100,Âôs, not designing port facilities and transportation to accommodate sea level rise greater than 1 meter, etc. - good decisions and engineering can save $ trillions in the United States alone)	Climate scenarios present multiple plausible futures and do not have likelihoods assigned to them in this report. Thus it would be inaccurate to convey SSP2-4.5 as the most likely scenario. Extensive detail about disparate precipitation patterns across the US can be seen in Figure 2.7. Because that detail needed to be simplified to fit into this multi-panel bar graph for the Overview chapter, the authors decided not to apply additional complexity to the precipitation graph. To see when different consequences are likely, the authors recommend viewing the figure earlier in this section (now numbered Figure 1.21) to show the "crossing times" of when temperature thresholds are reached under each scenario. Additional information on global warming levels and crossing thresholds can be found in Chapter 2. The authors do not find the suggestions for the bottom two figures to be scientifically accurate and point the reader to Chapter 9 and the Sweet et al. (2022) technical report for additional details on how these values were calculated. Please also see Chapter 9 for sea level rise values that extend beyond 2100 (to 2150).
Michael	MacCracken	Figure	01. Overview		35				Regarding presenting the sea level rise estimates, if the information is drawn from the IPCC, not that theire primary estimate (sea level rise below 1 m by 2100) ignores the contribution added by moving ice streams draining the Greenland and Antarctic ice sheets, which is likley to soon become the largest influence on sea level. The chart should really, in my view, be giving a range of time in which 1 m is likely to be reached, same fo 1.5, 2, and higher levels, making clear that sea level rise will be continuing for many centuries and more. This particular chart thus seems inadequate given that paleo evidence suggests a sea level sensitivity of 15-20 m/degree rise in global average temperature.	The source for this is Sweet et al. (2022), which is based on the AR6. The AR6 and by extension Sweet et al. (2022) does include contributions from Greenland and Antarctica. No additional edit has been made to the figure, but the author is correct that there is a wide range of possibilities beyond the 2100 time frame considered here.
Steph	Courtney	Figure	01. Overview		35				I like this figure, but some additional context would make it more understandable. Y axes should be labeled future or potential "global average temperature", and x axis label could give more context, rather than the context being separated with the color-coded legends. i.e., x axis could read "US average temperature (F)". It is a problem that 2.1F serves as a "zero" point, including the current temp saying that, but baseline (true zero on x axis) is not defined anywhere. Zero should be labeled as historical average, 2.1 should be labeled as modern average, and then additional potential warming should be the one type of data that varies over time (all these examples are for the first graphic in the panel, but most could obviously apply to the others too). "Change from today" label is fine since it unites the graphs. Interpretive title ("The US warms more...") per graph is great. (visual climate communication is my specialty, fyi)	The caption for this figure has been updated for clarity and to help orient the reader to what is being shown in the multiple graphs. Please also see text boxes in Front Matter and Overview chapter defining global warming levels. Text has been added to clarify that the "zero" on the x-axis is based on a preindustrial baseline (1850-1900). Thank you for your comment.
Michael	MacCracken	Text Region	01. Overview		36	36	2	3	This is quite optmistic unless what one means by "worst consequences" is the end of global civilization as we know it. Global landscapes will be quite different and movement of enviromental refugees are very likely to be experienced even if global temperatures can be kept to a 2 C increase.	Text has been revised here and throughout the chapter to ensure accuracy. The text notes that some climate impacts will continue even when net-zero is reached.
Rachel	Licker	Text Region	01. Overview		36	36	2	3	It's important to clarify in this sentence the scale at which the decarbonization must hpappen. It isn't sufficient, for example, for the US to decarbonize on its own--we must do so alongside other nations doing the same. Adding "global" in front of "economy" would sufficiently communicate this.	Text has been reviewed and revised to ensure it is clear when the authors are referring to US emissions, actions, damages, etc. and when referring to global emissions, etc. The NCA is mandated to address impacts to the US and does not make policy recommendations, nor prescribe what other countries should do.
Michael	MacCracken	Text Region	01. Overview		36	36	9	10	There is no way to protect future generations from harm and impacts. Mitigation alone will not reverse warming except over many centuries. If we want to limit harm and impacts to less than we are experiencing the only way to actually move toward restoring the mid-20th century climate over coming decades is climate intevention, and it would actually be appropriate to be presenting that as a policy option that is not yet being seriously considered even though, while not at all perfect, appears very likely to be a potential protection against the very severe consequences of not intervening.	We appreciate the commenter raising the status of presenting climate intervention as a policy option; however, consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations, evaluate specific policies, prescribe nor advocate against policies. Discussion of policy options is beyond the defined scope of the National Climate Assessment (see About NCA5 at https://www.globalchange.gov/nca5). The authors disagree that the the only way forward is climate intervention. Understanding the challenges in reducing all GHG emissions to zero, we have expanded discussion of options like Carbon Dioxide Removal, which can balance any residual emissions and reduce concentrations. While not reflected in the overview chapter, other chapters (Ch 32) have addressed some aspects of solar radiation modificiation, which is the main climate intervention being discussed in the literature.
Andrew	Carleton	Text Region	01. Overview		36	36	17	17	CH4 is mentioned for the first time here, I think. It should be mentioned much sooner in this overview chapter, such as on page 4.	Methane (and N2O) have been added to section 1 and Figure 1.6 so that they are mentioned earlier in the chapter.
Gabrielle	Dreyfus	Text Region	01. Overview		36	36	17	18	v¢¬Ã¬ûReducing emissions of short-lived climate pollutants like methane improves air quality and saves lives while also reducing near-term warming. {14.5}v¢¬Ã¬ù COMMENT v¢¬Ã¬ì Excellent bullet. Consider one small nuance in phrasing: v¢¬Ã¬ùv¢¬Ã¬¶ while also slowing warming in the near term.v¢¬Ã¬ù This gets at the important ability of strategies targeting SLCPs to affect the rate of warming and avoids the impression that emissions of SLCPs only affects near-term warming (continued emissions of SLCPs also creates a thermal legacy in the ocean and through impacts on feedbacks in the climate system). CITE v¢¬Ã¬ì Zickfeld K., Solomon S., & Gilford D. M. (2017) Centuries of thermal sea-level rise due to anthropogenic emissions of short-lived greenhouse gases, PNAS 114(4): 657v¢¬Ã¬ì62 https://www.pnas.org/content/114/4/657.	This edit has been implemented.
Michael	MacCracken	Text Region	01. Overview		36	36	18	18	Reducing short-lived species emissions will reduce the rate of warming, but unless very , very large will not reduce actual warming, so this sentence needs correction.	This text has been revised to note the slowing rate of warming. Authors have checked this against the underlying chapter for accuracy.
Gabrielle	Dreyfus	Text Region	01. Overview		38	38	9	11	Section 5.2 v¢¬Ã¬ûLimiting the worst harms from climate change requires reaching net-zero CO2 emissions globally by 2050 and net-zero emissions of all human-caused greenhouse gases within the following few decades.v¢¬Ã¬ù COMMENT v¢¬Ã¬ì Recommend clarifying this statement to be consistent with the findings of IPCC AR6 WGIII by adding the phrase in ALL CAPS: v¢¬Ã¬ûLimiting the worst harms from climate change requires reaching net-zero CO2 emissions globally AND MAKING DEEP CUTS TO METHANE AND OTHER SUPER CLIMATE POLLUTANTS by 2050v¢¬Ã¬¶v¢¬Ã¬ù CITE: Intergovernmental Panel on Climate Change (2022) Summary for Policymakers, in CLIMATE CHANGE 2022: MITIGATION OF CLIMATE CHANGE, Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Shukla P. R., et al. (eds.), SPM-22 (v¢¬Ã¬úC1.2 In modelled pathways that limit warming to 2vÇ¬ººC (>67%) assuming immediate action, global net CO2 emissions are reduced compared to modelled 2019 emissions by 27% [11v¢¬Ã¬ì46%] in 2030 and by 52% [36-70%] in 2040; and global CH4 emissions are reduced by 24% [9v¢¬Ã¬ì53%] in 2030 and by 37% [20v¢¬Ã¬ì60%] in 2040. In pathways that limit warming to 1.5vÇ¬ººC (>50%) with no or limited overshoot global net CO2 emissions are reduced compared to modelled 2019 emissions by 48% [36v¢¬Ã¬ì69%] in 2030 and by 80% [61-109%] in 2040; and global CH4 emissions are reduced by 34% [21v¢¬Ã¬ì57%] in 2030 and 44% [31-63%] in 2040. There are similar reductions of non-CO2 emissions by 2050 in both types of pathways: CH4 is reduced by 45% [25v¢¬Ã¬ì70%]; N2O is reduced by 20% [-5 v¢¬Ã¬ì 55%]; and F-Gases are reduced by 85% [20v¢¬Ã¬ì90%].v¢¬Ã¬ù). Intergovernmental Panel on Climate Change (2022) Summary for Policymakers, in CLIMATE CHANGE 2022: MITIGATION OF CLIMATE CHANGE, Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Shukla P. R., et al. (eds.), SPM-30v¢¬Ã¬ìSPM-31 (v¢¬Ã¬úDeep GHG emissions reductions by 2030 and 2040, particularly reductions of methane emissions, lower peak warming, reduce the likelihood of overshooting warming limits and lead to less reliance on net negative CO2 emissions that reverse warming in the latter half of the centuryv¢¬Ã¬¶ Future non-CO2 warming depends on reductions in non-CO2 GHG, aerosol and their precursor, and ozone	This text has been revised to: "Limiting global temperature change to well below 2°C requires reaching net-zero CO2 emissions globally by 2050 and net-zero emissions of all human-caused greenhouse gases within the following few decades."

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Reid	Sherman	Text Region	01. Overview		38	38	26	26	Are reuse and recycling as feasible as new production of materials?	The text on this line is "Improving land management to increase carbon storage or decrease emissions." The comment does not seem relevant to this and the authors can't identify which text it is referring to.
Michael	MacCracken	Text Region	01. Overview		40	40	21	25	I think the phrasing from "because" on line 21 to the end of the first sentence will distract from wanting to move forward on the issue, and would instead then go to the phrase of "who bears the highest burden of pollution from oil and gas facilities", leaving out the rest of the second sentence. Not that the points are not valid to varying degrees in various parts of the country but to keep the focus on moving forward rather than generating a lot of discussion on relative factors and responsibilities regarding the past when the need is to together move forward rapidly to build resilience and address the very serious risks and impacts, which is what this Section of the Overview is about.	The author's disagree with the comment. Understanding past injustices in central to being able to address the distribution of risks, and address them in an effective and inclusive way. Transformative change requires understanding of historical contexts in order to identify what needs to change and the methods through which that can be achieved.
Katie	Boyd	Whole Page	01. Overview		40				Climate education is a very important part of enacting climate solutions - education is a critical component and foundation to support a broad societal response (e.g. Bowman & Morrison, 2021; Kwauk, 2020; Otto et al., 2020; UNESCO, 2020). For example, Research studies highlight that educating secondary students on climate change topics can result in a significant reduction of individual CO2 emissions (Cordero et al., 2020). Furthermore, educating youth has been shown to increase parent awareness and parents‚Äô level of climate concerns (Lawson et al., 2019). I would encourage you to add more references and information about recommending climate education throughout the United States throughout this document. Here is one place where it is particularly relevant. I think you should add a recommendation for the need for climate education and the teaching of the Next Generation Science Standards in schools throughout the U.S. References: Bowman, T. & Morrison, D. (Eds.). (2021). Empowering climate action in the United States. Part of Resetting Our Future Series. Changemaker Books. Cordero, E. C., Centeno, D., & Todd, A. M. (2020). The role of climate change education on individual lifetime carbon emissions. PloS one, 15(2), e0206266. Kwauk, C. (2020). Roadblocks to Quality Education in a Time of Climate Change. Brief. Center for Universal Education at The Brookings Institution. Lawson, D. F., Stevenson, K. T., Peterson, M. N., Carrier, S. J., L Strnad, R., & Seekamp, E. (2019). Children can foster climate change concern among their parents. Nature Climate Change, 9(6), 458-462. Otto, I. M., Donges, J. F., Cremades, R., Bhowmik, A., Hewitt, R. J., Lucht, W., ... & Schellnhuber, H. J. (2020). Social tipping dynamics for stabilizing Earth‚Äôs climate by 2050. Proceedings of the National Academy of Sciences, 117(5), 2354-2365. United Nations Educational, Scientific and Cultural Organization (UNESCO). (2020). Education for Sustainable Development: A Roadmap.	The Overview chapter occupies a unique space in NCA5. As it is providing a high-level overview of the key themes of the whole report, the Overview does not provide individual references to literature. Rather, it references the underlying chapter is it summarizing. However, education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nationwide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Jane	Heinze-Fry	Whole Page	01. Overview		40				Transformative change can be catalyzed through public education about climate change. Today,Äôs students will need to address climate change throughout their lifetimes. They need knowledge of how the climate system works and they need to be empowered with knowledge of what they can do about it. This urgent need is not currently being met. The National Climate Assessment needs to highlight public education as a major tool to address climate change.	We appreciate the commenter raising the status of climate-related education in schools; however, consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations, evaluate specific policies, prescribe nor advocate against policies. Discussion of policy options is beyond the defined scope of the National Climate Assessment (see About NCA5 at https://www.globalchange.gov/nca5).
Rachel	Licker	Text Region	01. Overview		41	41	2	2	Wellbeing does not need to be hyphenated here (it is being used as a noun rather than as an adjective)	The report will be copyedited and all text aligned with the NCA style guide.
Reid	Sherman	Whole Page	01. Overview		41				This section would benefit from content on the financial benefit of transformative adapation- innovation, job creation, etc from Adaptation Chapter.	The authors updated the text to reference benefits of adaptation. This includes a new box with a definition of adapation that references beneficial opportunities and updated language in Section 1.5 referencing economic benefits.
Anthony	Oertel	Whole Chapter	01. Overview						1. Will citizens identify as Americans or as survivors when climate change causes the construction of long-term relocation camps? 2. Does the government have plans to manage the lives of millions of unemployed people? 3. How will bureaucrats organize large groups of permanently displaced and unemployed citizens? 4. Will social media provide an outlet for idle and bored refugees? "Organizing Refugee Camps: 'Respected Space' and 'Listening Posts',Äù is the basis of my letter. As the climate worsens, more Americans will become internally displaced. Democratic capitalists will be organized into camps. A democratic capitalist assumes four roles: voter, taxpayer, worker, and consumer. The roles of a democratic capitalist balance each other. A voter balances his desire for government services against an affordable tax burden. Workers consume an amount equal to or less than their wages. A refugee or internally displaced person, on the other hand, balances stability against freedom with the use of democracy as a safety valve (listening post). A refugee balances boredom and idleness against personal fulfillment (pursuit of happiness) with the use of respected space. Philosophy answers the question, ‚ÄúWho am I?‚Äù After the American Revolution, the answer was, ‚ÄúI am an American.‚Äù Refugee philosophy provides the answer, ‚ÄúI am a survivor / climate realist.‚Äù	We thank the reviewer for the comment. The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Discussion of policy options is beyond its defined scope.
Jesse	Freeman	Whole Chapter	01. Overview						Comment	This comment does not appear to raise a question or suggest a revision.
Jesse	Freeman	Whole Chapter	01. Overview						sss	This comment does not appear to raise a question or suggest a revision.
Peter	Meng	Whole Chapter	01. Overview						In the Overview Section, there is no mention of seismic activity as a result of climate change. Climate change-induced glacier melting and ocean thermal expansion may also contribute to another earthquake-related hazard. Rising sea levels are raising the water table in many parts of the world, which can lead to increased liquefaction during earthquakes.	We appreciate this suggestion, but space is limited. The author team has deliberated and prioritized the information and illustrations to include. Based on these agreed priorities, the chapter has not been revised. The Overview chapter is designed to cover the content in the underlying chapters only, and because this topic is not covered in the report itself, this has not been incorporated into the chapter.
Sheila	Fleischhacker	Whole Chapter	01. Overview						Appreciate inclusion of nutrition	Thank you for the comment. This comment does not appear to raise a question or suggest a revision.
Glenn	Branch	Whole Chapter	01. Overview						Although references to education and outreach are scattered unsystematically throughout the draft report, it would substantially benefit from the addition of a unit -- ideally a chapter, but possibly a chapter section, an appendix, a focus box, or something else -- especially devoted to discussing the current state and future needs of education and outreach efforts on climate change. The addition of such a unit would accordingly require revisions in the summary given in this chapter.	The decision to add chapters, appendices, or Focus Boxes is made by the Federal Steering Committee based on comments received on the draft NCA5 prospectus (2020). At this stage of development, the Federal Steering Committee is not considering the addition of additional chapters, especially because such chapters would not have undergone the same rigor of agency, technical, and peer review as the existing chapters. This comment has been conveyed to the developers of the sixth National Climate Assessment and the US Global Change Research Program for consideration in future assessments. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Charles	Hunt	Whole Chapter	01. Overview						Please restructure the chapter to improve flow, readability, and for those who only read the overview, provide a better understanding of the issues. NCA5 Chapter 1 alternate flow Where We Have Been What is the starting point for assessment What is the time period used for a baseline Why was this time period chosen Do we know what the climate was like at that time What was the level of CO2 during this period and how do we know what it was? Was this an especially cold or otherwise unique period in history? Are there any significant gaps in our knowledge of that time period? What was the climate like during this period Global average Temperature What was the climate like in key regions around the world that are important to the US diplomatically or economically What was the climate like in the 10 regions of the United States covered by this report (brief thumbnail descriptions / key reference points like seasonal average temperatures, growing season) Where are we now? What is the climate like today,Äù Global average Temperature Move Box 1 from page 0-13 here (my comments are still applicable) What is the climate like in key regions around the world that are important to the US diplomatically or economically What is the climate like in the 10 regions of the United States covered by this report (brief thumbnail descriptions / key reference points like seasonal average temperatures, growing season - highlight the	The Overview chapter has undergone extensive revisions to clarify text and improve narrative flow. Some of the commenter's suggestions have been taken (e.g., moving Box 1) but not all. The changes to the Overview chapter reflect the combination of both the public and peer review comments, and the consideration of the author team.
Jeremy	THORNER	Whole Chapter	01. Overview						I am shocked that nowhere in this "Overview" chapter is there any mention of the need and role for formal education of school children (appropriate to each grade level, of course) about global warming and climate change. Mandatory components of science courses should include this material. Moreover, it is clear that the most effective means by which to improve and enhance the treatment of climate change and related subjects is to make certain that the treatment of climate change in State science standards is as accurate, complete and up-to-date as possible and to make certain that our teachers are knowledgeable about and, hence, prepared to teach in accordance with those rigorous State science standards that deal with global warming and climate change. Our children are the ones who must be armed with the information they need to confront and grapple with these threats to planet Earth and all the livings things that dwell upon it.	The authors, Federal Steering Committee, and the US Global Change Research Program agree that educators and students are an important audience of NCA. NCA5 has been developed with these important audiences and their needs in mind. Development of the NCA is designed to result in a report that is authoritative, timely, relevant, and policy neutral; valued by authors and users; accessible to the widest possible audience; and fully compliant with the GCRA and other applicable laws and policies (see About NCA5 at https://www.globalchange.gov/nca5). To make the findings of the NCA useful and usable to educators and students, we have worked to make the NCA accessible to a broad range of audiences, both in the development of the content and the delivery of the final report materials on the website (see Appendix A1.3). Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside the development of NCA5.
Michael	MacCracken	Whole Chapter	01. Overview						My sense in reading the chapter is that Section 3 is quite descriptive of the situation now and portrays a much more serious situation that the sort of over-optimism of particularly Section 1 of the chapter and that continues in Section 2 by not really facing up to the seriousness of the situation being faced.	Additional text and figures have been added to Section 1 to better clarify the urgency of action needed to meet national and international committments, and to reach net zero emissions by 2050. More information on the gap between where we are and where we need to be to avoid the worst impacts of climate change is covered in Section 5 of the Overview.
Michael	MacCracken	Whole Chapter	01. Overview						There are quite a few places where the word "risks" is used when what it is referring to are actual "impacts" which is what people experience. So, what climate change is doing is cuasing an increasing likelihood of actual impacts, and this seems to me what should be made clear, and I don't think saying "risks" adequately makes this points.	The authors have reviewed the chapter and replaced "risks" with "impacts" where appropriate, or have added impacts in addition to risks.
Michael	MacCracken	Whole Chapter	01. Overview						There are places where the chapter switches over from third person to first person, making it seems as if the presentation is a personal view rather than the scientific consensus. It would be good to screen for the word "we" throughout the chapter (and the document?). I admit to doing it in my comments despite the guidance about comments not doing this--it can be difficult to avoid, but does need to be done in the report as it is reporting on the national scientific consensus.	The authors have removed first person language in many cases where it was easily replaced without losing meaning. The authors have opted to retain it in limited cases where statements are referring to collective choices.
Michael	MacCracken	Whole Chapter	01. Overview						The Overview, at least, reports on changes in global average temperature without really giving adequate context of what these mean. So, it talks about, say 4 C warming--well, that is of order 2/3 the way to warmth of time of dinosaurs as well as 2/3 of the difference from maximum ice age conditions to the present--these are huge changes. There is also not adequate explanation of what the Paris Agreement goals are and why, and how significant these levels are. Readers of this report are interested impacts ad significance and should not be assumed to be familiar with overall temperature history of the Earth and the goals of negotiations and the likelihood and unlikelihood of reaching them.	Information on global warming levels is presented in the Front Matter of the report and in Chapter 2. Figure 1.4 also provides context for how unprecedented the climate changes we're observing now are in relation to paleoclimate. Text has been added to the caption to further clarify the role of climate change in these unprecedented impacts. Technical information on the Paris Agreement can be found in the 2017 NCA4 Volume I (climate science special report) and also Chapter 32 of NCA5; because these assessments are policy neutral, we do not provide commentary on international negotiations. The Paris Agreement is discussed in Ch 32 to provide the context for the mitigation goals, particulalry net-zero emissions goals, that are discussed in depth in Ch 32. The Overivew, Chapter 2, and Chaper 32 make clear that the likelihood of reaching international targets is a choice that is in our hands and that we know how to drastically reduce emissions in the United States.
Don	Haas	Whole Chapter	01. Overview						The broader report is lacking substantive references to the role of climate change education, and this omission is problematic. The overview chapter is one place to address education. The chapter has five sections: 1. How We Are Addressing Climate Change 2. How We Experience Climate Change 3. The Risks We Are Facing 4. Where We Are Headed 5. How We Move Forward Education has roles in addressing the topics of each of the five sections and deserves more attention within each section. Further, a section (if not a chapter) on the role of climate and energy education is warranted. The most obvious places for more substantive attention to education within the existing sections sections 1 and 5. There are considerable though insufficient efforts to address climate change through education in both formal and informal settings and across the age span - from K to gray. Fundamental to how we are addressing climate change and to how we move forward is through education. All other efforts have that as a component and this should be made much more explicit in sections 1 and 5. Sections 5.4. Mitigation and adaptation actions result in systemic, cascading benefits and 5.5. Transformative change is an opportunity for a more just Nation (pages 40 and 41) would especially benefit from substantive references to the role of education. The cascading benefits begin their cascade with education. Likewise, a just transition begins with educational efforts. Much work in climate education is federally funded, and the US Global Change Research Program has in-house expertise in this area through Frank Niepold who is a well-connected leader in climate and energy education. Some examples of resources from NOAA are found here: https://www.noaa.gov/educational-resources The National Science Teaching Association has extensive and growing resources here:	Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nationwide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Craig	Hanna	Whole Chapter	01. Overview						To whom it may concern: The Climate Change Joint Task Force of the American Academy of Actuaries, appreciates this opportunity to provide the following comments regarding the draft of the Fifth National Climate Assessment (NCA5). The draft NCA5 covers an extensive range of climate issues and is a significant document for those interested in learning more about climate as well as for policymakers interested in information that will help them focus on potential actions. The task force has limited its comments to portions of a few chapters---Chapter 2 Climate Trends (and Appendix 4 Indicators), Chapter 15 Human Health, and Chapter 31 Adaptation.	This comment does not appear to raise a question or suggest a revision.
Andrew	Carleton	Whole Chapter	01. Overview						For the most part, this Overview chapter is highly comprehensive and balanced in its survey of the entire climate assessment. Particular strengths are the inclusion of surface water, clarifying the similarities to the ICCP categories, and giving the interactions with human social and economic systems. My main comment, given specifically in the text region edits, is to include mention of greenhouse gases additional to CO2, including CH4, N2O, and O3, early on.	Thank you for the comment. We have now included mention of the primary greenhouse gases (CO2, CH4, N20, and short-lived climate pollutants) in Section 1.1 and in Figure 1.6.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Richard	McNider	Whole Chapter	01. Overview						This whole report and especially this chapter is a fantasy overstatement of impacts, extremes and confidence. The tone is not one of trying to convince but one of don,Äôt even think about questioning us. Early in the climate change debate there were voices that would caution on uncertain statements. Unfortunately, these voices have been purged from the panels that write the IPCC and the National Assessment. The authors seem to forget that for most Americans climate change does not rank in their top issues of concern. A 2022 CNN Poll says - Despite this year,Äôs major climate change legislation, that issue ranked last among the seven issues CNN asked about in the September/October poll, with only 38% of registered voters calling it extremely important to their vote. The present document would never pass hold up in a court of law. Here real data would be used to show the model failures and the cherry picking of observations. One of the key issues is that in most of the document you are not using the entire climate record and starting with, e.g., the 1980,Äôs for tropical storms or heat waves. The 1930,Äôs and 1950,Äôs far surpass the recent incidents of high temperatures and drought. Throughout the report, the tone is that climate change theory and models are robust and beyond refute. In fact, while trends in climate models might show agreement in global numbers, the global agreement is in part due to two errors an over-prediction in the tropics and an under prediction at high northern latitudes (see Swanson 2013 GRL). Most models overstate tropical warming by factors of two or more and underestimate Arctic Warming by often greater amounts. Warming of the deep atmosphere through accumulated heat is the very foundation of GHG climate change. Yet, observations continue to show that the deep atmosphere is not warming at an alarming rate. Even hard-core climate change activists agree that model warming of the deep atmosphere is overstated. For example in Santer, B., Fyfe, J., Pallotta, G. et al. Causes of differences in model and satellite tropospheric warming rates. Nature Geosci 10, 478,Äì485 (2017). https://doi.org/10.1038/ngeo2973 - States ‚ÄúOver most of the early twenty-first century, however, model tropospheric warming is substantially larger than observed; warming rate differences are generally outside the range of trends arising from internal variability. The probability that multi-decadal	The chapter has been revised extensively based on public and peer review comments to improve clarity and ensure accuracy. Please find more information on how uncertainty is captured throughout the report in the Front Matter and within each chapter's Traceable Accounts sections. Captions for figures in this chapter and throughout the report have been revised to ensure that the time period and baseline period being used is clearly defined. Additional information and references on the topic of tropospheric warming can be found in Chapters 2 and 3, and also in the 2017 Climate Science Special Report. Because the statements of the commenter are not supported by the vast weight of scientific literature, observational records, model projections, nor the understanding of the expert authors, these statements have not been added to the Overview chapter.
Reid	Sherman	Whole Chapter	01. Overview						The overview would benefit from more information about transportation, and covering climate effects on large cities beyond heat.	Thanks for this comment. We added transportation text to the infrastructure section. We also added text about cities and hurricanes/wildfire to the homes and property section. We also built out the adaptation options for urban/suburban environments.
Rachel	Licker	Figure	01. Overview		16				The "i" in "Midwest" should be lowercase. Additionally, the varying metrics by which regional changes are described is very confusing because a) you can't compare across regions; b) the text regarding each change is describing metrics that often differ from the colors in the map. Suggest breaking out the regional descriptions into a table, even if the map would have to be sacrificed to do so because the data in the map could more easily be conveyed in consise text than the regional impacts described in figure text.	The text in this figure has been copyedited to address grammar and spelling. The reader is correct that the regional examples are different from one another and also different from what is being shown in the map. The caption clarifies that these are examples and the metadata survey describes the different methods used to develop these metrics. Different examples were chosen for each region because they were of import to the people in that region, and so the authors have decided not to standardize all the examples to be identical. A complementary NCA5 atlas is under development, which would allow a reader to see how the same metric (say, days over 95F) would compare across all the regions.
Gene	Takle	Whole Page	02. Climate Trends		21	2	21	2	Suggest adding: "CMIP models have a significant warm and dry bias in the central US that may be as much as 3°C high in temperature and 45% low in precipitation in summer (Lin et al	Chapter 3 discusses model biases.
Jeff	Peterson	Whole Page	02. Climate Trends			2			The text paragraph explaining the higher rate of sea level rise along the US coast than globally should be clarified to add the data from the graphic to the text to highlight the data and make it easier to cite: Add the following sentence at line 6: ‚ÄúAlthough the global average rate of sea level rise in 2022 [note need to clarify date] was 3.4mm/year, the average along the coast of the contiguous US was significantly higher at 4.7mm/year.‚Äù	This point has now been addressed in the text.
Kieran	Yeatman-Biggs	Text Region	02. Climate Trends			3	3	2	2 There is a grammatical error in line two. The sentence should read "Human activities are changing the climate" instead of "Human activities are changing climate."	Noted. The TSU will be performing a thorough copyedit.
Andrew	Carleton	Text Region	02. Climate Trends			3	3	7	10 Here or elsewhere early in this chapter should probably mention low-level O3 pollution in urban areas.	While ozone (O3) is a greenhouse gas, it is not a primary contributor to climate change. For example, the U.S. EPA's inventory of greenhouse gasses from 1990 to 2020 shows that it is not one of the top four categories of greenhouse gasses generated by the US, which collectively account for nearly 100% of emmissions in Carbon Dioxide equavalent units (EPA, 2021, https://www.epa.gov/climate-indicators/climate-change-indicators-us-greenhouse-gas-emissions). Therefore, authors opted to keep the focus in this section on the gases that are the primary contributors to cimate change.
Kieran	Yeatman-Biggs	Text Region	02. Climate Trends			3	3	11	11 There is a missing comma in the setence "As a result, the planet is on average about." It should read "As a result, the planet is, on average, about."	Noted. The TSU will be performing a thorough copyedit.
Thomas	Knutson	Text Region	02. Climate Trends			3		13	I suggest changing "long-term" to "century-scale" to differentiate from ice age to interglacial changes over thousands of years, etc.	Noted.
Ross	McKitrick	Text Region	02. Climate Trends			3	3	15	16 The proper comparison is not between the US and the world as a whole since every country is warming faster than the world as a whole. The proper comparison is between the US and the land average of the globe. It can't be the case that every country is warming faster than the average of all countries.	Given the frequent focus on global mean surface temperatures for annual reporting and climate targets, authors think that it is appropriate to use that as a reference point when comparing the rate of US warming. A note was added to the text to inform the reader that the US is warming at approximately 22% faster than the global land average (based in NOAA 5.1 land numbers). The sentence was subsequently removed during edits in response to the NASEM peer review.
Daniel	Feldman	Text Region	02. Climate Trends			3		16	The following statement must be supported by a peer-reviewed citation: "This has consequences for the United States, which over the past fifty years has been warming about 68% faster than the planet as a whole."	A citation is not required because the rates of warming in the United States and the globe are readily computed with existing on-line tools such as NCEI's Climate at a Glance. The 68% number does not appear in their peer-reviewed paper describing the NOAA GlobalTemp 5.1 dataset, but is a simple result of comparing the US fields (including Alaska and Hawaii) to the global mean surface temperature over the past 50 years.
Harold	Brooks	Text Region	02. Climate Trends			3	3	17	19 Adjusting for inflation alone would lead to more billion-dollar disasters over time because of population and wealth increases. The difference between inflation and wealth adjustments for tornadoes is discussed in Brooks, H. E., & Doswell, C. A., 2001. Normalized damage from major tornadoes in the United States: 1890,Äì1999. Weather Forecasting, 16, 168,Äì176. and Simmons, K. M., D. Sutter, and R. Pielke, 2012: Normalized tornado damage in the United States: 1950-2011, Environmental Hazards, 1-16.	Thank you for your comment. Authors agree that a combination of increased exposure (i.e., values at risk of possible loss); increased vulnerability (i.e., where we build; how we build); and increased frequency (i.e., of some types of extremes) results in an increase in billion-dollar disasters. Authors note that the Billion Dollar Disasters website at NCEI makes this point as well, thus have incorporated this information into the revised draft.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Ross	McKitrick	Text Region	02. Climate Trends		3	3	17	19	Your disaster claims are not adjusted for the massive increase in the stock of buildings and equipment since the 1980s. Even if you have adjusted for price inflation, it is obviously the case that a weather event can do more damage now than 40 years ago because there are a lot more homes, buildings, and stockpiles of physical wealth in the path. This comment also applies to p. 14	Thank you for your comment. Authors agree that a combination of increased exposure (i.e., values at risk of possible loss); increased vulnerability (i.e., where we build; how we build); and increased frequency (i.e., of some types of extremes) results in an increase in billion-dollar disasters. Authors note that the Billion Dollar Disasters website at NCEI makes this point as well, thus have incorporated this information into the revised draft.
Thomas	Knutson	Text Region	02. Climate Trends		3			22	I suggest changing "torrential rainfall from Hurricane Harvey..." to "extreme multi-day rainfall from a stalled Hurricane Harvey"	As this report is for the general public, authors feel "torrential rainfall" is both more evocative and resonant.
Thomas	Knutson	Text Region	02. Climate Trends		3	3	31	32	Something seems off here. I don't believe extreme heat is the leading cause of summertime death and illness in the U.S. (What about heart disease?) Please reword.	Thank you for the suggestion. Authors have added the following sentence: "Extreme heat is also responsible for a host of other health impacts including exacerbating cardiovascular, kidney and respiratory diseases, affecting mental health, interpersonal violence, and issues with pregnancy (Chapter 15)." The sentence was subsequently removed during edits in response to the NASEM peer review.
John	Christy	Whole Page	02. Climate Trends		3				There is a convolution of ‚Äúconfidence-claims‚Äù in the document between two ideas; (1) knowing ‚Äúwhat‚Äù has happened versus (2) ‚Äúwhy‚Äù it has happened. There is more confidence in the ‚Äúwhat‚Äù since we have instrumental records to document changes (many of which are not reported properly in this document). However, the ‚Äúwhy‚Äù is far less well-known (unequivocal?, p.2-3). This lack of understanding is simple to demonstrate since knowing how a system ‚Äúunequivocally‚Äù behaves necessarily implies essentially perfect predictive capability for the system as a whole and for its major components. As will be shown, especially in comments on Chapter 3, the current understanding and predictive capability are rather poor. The document has a virtual blind spot as to the role of natural variability and this is most evident when discussing the climate of the United States with a narrow focus on only the last 40 to 70 years. This deliberately, I believe, diverts attention from the major climate variations of the first part of the 20th century (the ‚Äúwhat‚Äù that we know) which could only have been caused by natural variability (i.e. the ‚Äúwhy‚Äù). To say ‚ÄúClimate is Changing, and scientists understand why‚Äù is a claim without sufficient foundation (it fails the predictive rule as will be shown). This is not to say that some of the changes we see are not tied to increases in greenhouse gases (GHGs) because GHGs have no choice but to be thermally active. However, the evidence indicates the real climate system has feedbacks which mitigate the full force of this effect and have little influence on extreme events in any case as will be shown. Further, if ‚Äúscientists understand why‚Äù extreme events happen, then how does one explain the inability of these ‚Äúscientists‚Äù (if they exist) to model the greatest West Coast atmospheric river event of the instrumental record (1861-1862) or the heat wave records of the 1930‚Äôs and 1950‚Äôs? The answer ‚Äú‚Äúthey‚Äù actually don‚Äôt know ‚Äúwhy.‚Äù	The authors disagree with this comment. The attribution of climate change to human activities is well-established science.
Doug	Robbins	Text Region	02. Climate Trends		4	4	14	18	In June, 1988, NASA physicist James Hansen testified to the US Senate that NASA was 99% certain that greenhouse gases of human origin, primarily CO2, were already warming the earth. Thirty five years later, the NCA5 3rd draft concludes that there is a 99% likelihood that greenhouse gases are of human origin, and a 99% likelihood that greenhouse gases are warming the earth. These two points are fundamental to our entire understanding of climate change. Why have these two central assertions not been confirmed as unequivocal scientific fact? What possible additional work needs to be done, and why has it not already been accomplished? NCA5, and every IPCC report is a call to action to undertake a staggering restructuring of society. Is it not reasonable for society and government to demand that the basis for these necessary changes be determined to be true beyond reasonable doubt, and confirmed as unequivocal fact? Society is out of patience, and we are practically out of time to make the necessary transition to a carbon-free economy.	NCA5 uses a specific set of confidence level terms (i.e., low, medium, high, and very high) for Key Messages, and the term "unequivocal" is not among them. However, in the second sentence of the chapter, authors do state that: "The science is unequivocal that increases in atmospheric greenhouse gases are driving many observed trends and changes."
Doug	Robbins	Text Region	02. Climate Trends		4	4	15	18	The confidence and likelihood statements in Key Message 2.1 should be strengthened to ‚Äúunequivocal‚Äù for the anthropogenic cause of rising CO2 and global warming. Evidence that rising CO2 is of human origin includes quantified estimates of emissions from multiple analyses, mapping relating rising atmospheric CO2 to human sources (from satellite and Scripps CO2), declining atmospheric oxygen (Scripps), geographic distribution of declining oxygen, carbon isotopes (Scripps), geographic distribution of changing isotopes, and appropriately quantified volumes for all of the above. This chapter states that it is unequivocal that warming increases with GHG emissions (page 2-37), so anthropogenic warming should also be termed unequivocal. There are no credible alternate theories, observations, or quantification for any competing explanation of rising CO2 or global warming. Any alternate process for generating CO2 and heat also requires an additional process for the disposition of known anthropogenic CO2 and heat. The likelihood of two unobserved processes working in conjunction is orders of magnitude smaller than 1%. The confidence that anthropogenic influences are responsible is significantly higher than 99%. The confidence that anthropogenic influences are not the cause of rising CO2 and warming is several orders of magnitude smaller that 1%. The confidence and likelihood scale (Mastandrea, 2011) adopted for NCA5 is inadequate for representing extreme levels of confidence. At a minimum, ‚Äúvery high confidence‚Äù should be annotated as the maximum confidence on the scale adopted for NCA5.	NCA5 uses a specific set of confidence level terms (i.e., low, medium, high, and very high) for Key Messages, and the term "unequivocal" is not among them. However, in the second sentence of the chapter, authors do state that: "The science is unequivocal that increases in atmospheric greenhouse gases are driving many observed trends and changes."
Gabrielle	Dreyfus	Text Region	02. Climate Trends		4	4	25	27	v¢~Ã~úWhile CH4 and N2O are more powerful greenhouse gases, CO2 is considered the primary greenhouse gas emitted by human activities; in 2020, it accounted for almost 80% of US greenhouse gas emissions (EPA 2021).v¢~Ã~ù COMMENT v¢~Ã~ì This section is missing an accounting of current contributions of anthropogenic GHG to present-day warming (e.g., IPCC AR6 WGI Figure SPM.2). Methane and tropospheric ozone account for over a quarter of GHG radiative forcing globally according to AR6. Presenting the share of CO2 emissions only using GWP100 equivalents obscures the significant contribution of non-CO2 gases to present warming and their importance in slowing warming in the near term (see Key Message 14.5).	Chapter 3 (now cross-referenced) discusses GWP. Chapter 2 authors have also adapted IPCC WGI AR6 Figure 5.4 to provide the 800,000 year records of CO2, CH4, and N20. Authors report the percentage of global warming attributable to national emissions accounting for additional CO2 emissions from land use, land change, and forestry and methane and nitrous oxide emissions.
Daniel	Feldman	Table	02. Climate Trends		4			27	The information Table 2.1 on the lifetime of carbon dioxide is misleading. The chapter is devoted to the greenhouse effect of carbon dioxide, which occurs in the atmosphere. Carbon dioxide is a well-mixed greenhouse gas in the atmosphere, and it varies by far less than 1% in the troposphere and stratosphere. The claim that it varies from a few months to thousands of years can mislead the reader into thinking that the lifetime of the radiative forcing of CO2 in the atmosphere could be as short as a few months. It most definitely is not. See Archer et al, 2009 (https://doi.org/10.1146/annurev.earth.031208.100206) for a review of the lifetime of carbon dioxide in the atmosphere which showed that the minimum lifetime of CO2 in the atmosphere is 200 years. Also, columns of Table 2.1 that list the sources and sinks of carbon dioxide neglect to mention the major role of the biosphere as both a source and a sink of carbon dioxide. This must be included. The net flux from the biosphere is small, but it is the result of sources of carbon dioxide that are far larger than anthropogenic emissions and sinks of carbon dioxide that are also far larger than anthropogenic emissions. Next, the columns of Table 2.1 enumerate the sources and sinks of methane but neglect to mention hydrates and the thawing permafrost as a potentially significant sources, and the hydroxyl radical as the dominant sink of methane.	The authors thank the reader for these comments. There are multiple comments embedded here. First, the authors have clarified that the phrase 'months to thousands of years' refer to the rate at which CO2 moves between the different reservoirs (land, ocean, atmosphere) and not necessarily the lifetime of CO2. The Archer et al. 2009 paper referred by the reader follows closely the IPCC 2007 report, which captures the gradual dissipation of CO2 over time saying, “About 50% of a CO2 increase will be removed from the atmosphere within 30 years, and a further 30% will be removed within a few centuries. The remaining 20% may stay in the atmosphere for many thousands of years.” Second, the authors have also clarified the sources and sinks in more detail in Table 2.1 to address the reader's comment. While the authors agree about the methane sources (these have been added to the revised draft), the authors disagree that the biosphere is a major source of carbon dioxide. Certain processes like deforestation is a source and this has been acknowledged. But respiration by itself is not a major source and typically is dominated by photosynthesis, which is a major sink. This results in the terrestrial biosphere being predominantly a carbon sink (also see Table 5.1 and Figure 5.12 in IPCC, WG1 Chapter 5, Canadell et al. 2021)

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jim	Titus	Text Region	02. Climate Trends		5		1		While concise, the heading is ambiguous because heatwave has two different definitions: (a) periods that are unusually hot; and (b) periods that were unusually hot during an historic period whether or not they are still unusual today. Most people assume the former unless it is explained otherwise, but this document seems to use the latter definition. In some cases, the climate actually is getting more variable, in other cases less variable. In either event, what once was unusually hot occurs more often. The language needs to be more careful to distinguish increased variability from the mathematically obvious fact that when the mean forcing increases, the entire distribution of outcomes becomes warmer.	Authors have changed the title to "Hot extremes are becoming hotter, more frequent, and lasting longer" and added additional text for clarity on various measures of heat extremes and to indicate that trends in daily maximum temperatures follow the pattern of changes in the mean and that minimum temperatures are rising faster than maximum temperatures. Authors do not extensively discuss whether these changes are because of changes in mean or changes in variability.
Kayla	McCauley	Text Region	02. Climate Trends		6	6	1	2	Why 1960-2020? Why discuss China but not Europe? Maybe omit this sentence.	The sentence was removed.
Kayla	McCauley	Text Region	02. Climate Trends		6	6	2	6	Pandemic CO2 seems out of place in a discussion about US emissions.	The authors disagree. This is important context for understanding the cumulative nature of CO2.
Gene	Takle	Figure	02. Climate Trends	8	6	8	6	Figure 2.3 displays a lot of information in a concise form but needs a little more explanation. Labels on each time history plot would seem to indicate a change in the variable	The date range for each variable was added. The caption was updated to provide more information about how the change over the period plotted is calculated (e.g., via fitting the dataset with a localized linear regression – LOWESS – with a bandwidth of 30 years, and differencing the start and end points of the resulting smoothed series).	
Reid	Sherman	Text Region	02. Climate Trends		6	6	13	13	Replace East Coast with Atlantic Coast (and West Coast with Pacific Coast). This type of statement indicates a strong CONUS focus for the document and does not read well for Great Lakes (major inland coasts), Alaska and many Pacific and Caribbean islands with extensive coastline.	Noted and fixed throughout the draft.
Gabrielle	Dreyfus	Text Region	02. Climate Trends		6	7	14	2	COMMENT v¢¬Ã¬ì Good section on masking by cooling aerosols of current warming. Consider adding a sentence to clarify that decarbonization will further reduce emissions of cooling aerosols and that rapid and deep cuts to methane and other short-lived climate pollutants is essential to offset this unmasking. CITE: Szopa S., et al. (2021) Chapter 6: Short-lived climate forcers, in CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS, Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Masson-Delmotte V., et al. (eds.), 6-8 (v¢¬Ã¬úAdditional CH4 and BC mitigation would contribute to offsetting the additional warming associated with SO2 reductions that would accompany decarbonization (high confidence).v¢¬Ã¬ú). See also Intergovernmental Panel on Climate Change (2022) Summary for Policymakers, in CLIMATE CHANGE 2022: MITIGATION OF CLIMATE CHANGE, Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Shukla P. R., et al. (eds.), SPM-30v¢¬Ã¬ìSPM-31 (v¢¬Ã¬úDeep GHG emissions reductions by 2030 and 2040, particularly reductions of methane emissions, lower peak warming, reduce the likelihood of overshooting warming limits and lead to less reliance on net negative CO2 emissions that reverse warming in the latter half of the centuryv¢¬Ã¬¶ Future non-CO2 warming depends on reductions in non-CO2 GHG, aerosol and their precursor, and ozone precursor emissions. In modelled global low emission pathways, the projected reduction of cooling and warming aerosol emissions over time leads to net warming in the near- to mid-term. In these mitigation pathways, the projected reductions of cooling aerosols are mostly due to reduced fossil fuel combustion that was not equipped with effective air pollution controls. Non-CO2 GHG emissions at the time of net zero CO2 are projected to be of similar magnitude in modelled pathways that limit warming to 2vÇ¬ºC (>67%) or lower. These non-CO2 GHG emissions are about 8 [5v¢¬Ã¬ì11] GtCO2-eq per year, with the largest fraction from CH4 (60% [55v¢¬Ã¬ì80%]), followed by N2O (30% [20v¢¬Ã¬ì35%]) and F-gases (3% [2v¢¬Ã¬ì20%]). [FOOTNOTE 52] Due to the short lifetime of CH4 in the atmosphere, projected deep reduction of CH4 emissions up until the time of net zero CO2 in modelled mitigation pathways effectively reduces peak global warming. (high confidence) (3.3, AR6 WG I SPM D1.7)v¢¬Ã¬ú).	Thank you for this suggestion. Authors added the following sentences to the draft: "Reductions of aerosols from reduced fossil fuel combustions will diminish the aerosols' cooling effects (Szopa S. et al. 2021, Shukla et al. 2022). It is thus more critical to rapidly reduce greenhouse gas emissions to limit the warming to 2°C." This was done to emphasize the importance to rapidly reduce GHG emissions to limit warming to 2°C.
Nick	Procopio	Text Region	02. Climate Trends		6	6	19	20	Needs reworded. Consider: "Increased global aerosol emissions have partially counteracted the warming caused by greenhouse gases. Aerosols are more localized and shorter-lived than CO2."	Changed to: "Increased global aerosol emissions have partially counteracted the warming caused by greenhouse gases but, compared to CO2, aerosols are more localized and shorter-lived."
Daniel	Feldman	Figure	02. Climate Trends		7		4		For Figure 2-2, why was July 2002 to December 2021 chosen? Was the trend calculated to account for seasonal cycles in aerosol optical depths? The way that the trend was calculated needs to be made explicit. If the trend was not calculated by taking into account the seasonal cycle in AOD, this figure needs to be revised to start and end in the same month.	Aqua MODIS was launched in May 2002 and started collecting data in July 2002. That is why the record started in July 2002. December 2021 was the latest month available when the figure was generated for the third-order draft. The trend was calculated using deseasonalized anomaly, so the trend was calculated by removing the seasonal cycle. Authors modified the caption to indicate that the trend is calculated using deseasonalized AOD anomaly.
Harry	Dowsett	Text Region	02. Climate Trends		8		13		"mid" Pliocene is incorrect and has been for some time. The Pliocene consists of two stages, the Zanclean and the Piacenzian. What was previously considered mid Pliocene is within the Piacenzian. For correct stratigraphic usage, this interval should be referred to as "Late" Pliocene. Having said that, this does not detract from the inclusion of Pliocene in NCA5. Many still use mid Pliocene, but it really is not correct.	Many recent publications still use the terminology "Mid Pliocene"; see Tierney et al. 2020 (Past climate inform our future, Science) or IPCC WGI contribution to the Sixth Assessment Report.
Gabrielle	Dreyfus	Figure	02. Climate Trends		8				COMMENT v¢¬Ã¬ì Consider reorganizing this figure by anthropogenic contributions to global warming (CO2, CH4, N2O), atmospheric responses (surface, mid trop temp, specific humidity, strat temp), ocean and cryosphere responses v¢¬Ã¬ì the v¢¬Ã¬údecreasing climate trends" grouping may be misinterpreted as lines of evidence of global cooling. Also give period shown (is this through 2019?).	The authors believe the figure is understandable and clear as is, and that the risk of "decreasing trends" grouping being misinterpreted is small.
Risper	Nyairo	Text Region	02. Climate Trends		9	9	5	7	For a non-technical audience, this statement would benefit from a brief explainer, and possibly figures of how much faster the land is warming relative to the ocean, higher latitudes relative to lower ones, and the Arctic relative to the world (although this last one is clarified by the cited reference).	Authors feel that the reference provides needed information for those interested in the specific warming rates of those different regions. Adding in the warming rates of global land vs. ocean, high latitude vs. lower latitude, and arctic region would make the resulting paragraph quite dense, and authors do not feel that this point is essential enough to merit its own figure.
Nick	Procopio	Text Region	02. Climate Trends		9	9	9	11	"while eastern states have warmed less than 1 degree F." Please review this claim. New Jersey State Climatologist data indicates NJ has increased by 3.8 degrees F from 1895-2021.	The sentence has been revised to: "Average annual temperatures in some areas (e.g., parts of the Southwest, upper Midwest, and Northeast) are more than 2°F warmer than they were in the first half of the twentieth century, while parts of the Southeast have warmed less than 1°F."
Thomas	Knutson	Text Region	02. Climate Trends		9	9	13	14	Causal factors for decrease in eastern US seasonal temperatures are stated to be one of 3 reasons listed. Is this a fact or is possible some other unmentioned factor may also be involved? Perhaps some qualification needed.	These are the key factors that have been identified in studies over the past decade. Authors have revised this sentence to reflect this: "These regional differences are most pronounced in the summer: seasonal temperatures in parts of the central and eastern US have decreased. Studies have attributed these regional trends to a combination of natural climate variability (e.g. Weaver 2013, Kumar 2013, Mascioli et al. 2017, Banerjee et al. 2017, Patridge et al. 2018) and human-caused drivers such as irrigation and agricultural intensification (e.g. Mueller et al. 2016, Alter et al. 2017) and aerosol pollution (Leibensperger et al. 2012, Mascioli et al. 2017) (Figure 2.4; Ch. 3)."
Andrew	Carleton	Text Region	02. Climate Trends		9	9	13	13	Such as El Nino and La Nina events. Specific mention of these will help link to what is written on page 12, lines 30-35.	ENSO events influence variability from year-to-year but not on multidecadal timescales. Rather than add multidecadal modes that the public might not recognize, authors decided to keep the sentence as consistent with the mission of accessible language.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Thomas	Knutson	Text Region	02. Climate Trends		9	9	16	25	Here is a relevant analysis concluding that increasing annual-mean precipitation trends over regions of the U.S. since 1901 are detectable (unusual compared natural variability) and attributable at least in part to anthropogenic forcing based on CMIP5 models. See Fig. 3 of Knutson, T. R., & Zeng, F. (2018). Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends, Journal of Climate, 31(12), 4617-4637. https://journals.ametsoc.org/view/journals/clim/31/12/jcli-d-17-0672.1.xml	Thanks for the reference. Authors have added text to discuss the findings of this study.
John	Christy	Whole Page	02. Climate Trends		9				3OD P. 2-9. Claim: US warming faster than the global average. The temperature trend utilized here convolves two somewhat disparate quantities ,Äì the average of the daily maximum (TMax) and daily minimum (TMin). As has been shown in many publications, TMin is highly contaminated by the growth of infrastructure around the stations, no matter how minor, and is thus not an indicator of the background climate which this report should examine (e.g. Christy et al. 2006, 2009, Christy 2013, Kim and Christy, 2022 and numerous references therein). To capture the background climate for use here, one should focus on TMax. As well, the report could also point out the urban climate is definitely warming (and different from a pristine climate) and that has implications, some of which are already discussed in the NCA. To assess what I will call the ,Äúbackground climate,Äù, or that which is more closely tied to the response to extra GHGs, one should investigate the temperature of the troposphere where the response is largest and unaffected by urbanization. The trend of the US (with Alaska) tropospheric temperature (UAH TLT, Christy et al. 2018) is +0.18 C/decade and that of the globe is +0.13 C/decade since 1978. So, yes, the air over the US is warming faster than the global average, but not by much at all. How much of this is due to natural variability? If one simply removes the cooling effect in the first part of the record of the volcanoes, the global trend drops to about +0.10 C/decade (Christy and McNider 2017), a relatively minor rate of change.	Authors disagree with the reviewer that TMin is "highly contaminated by the growth of infrastructure", and would point to papers like Menne et al 2010, Fall et al 2011, Hausfather et al 2013, Wickham et al 2013, and Hausfather et al 2016 which demonstrate: (1) that urban and rural stations are not experiencing a significant difference in warming rates after pairwise homoginization and TOBS baid correction; (2) that local station siting characteristics are not correlated with TMean bias; and (3) both TMin and TMax trends are comparable in the homogenized NOAA dataset and the pristine USCRN network during the period of overlap. Authors also note that biases in TMin do not appear to be present in reanalysis products vs. surface products; while reanalysis may also be subject to bias in input datasets, they do provide an independent check on homogenized surface datasets.
Kayla	McCauley	Whole Page	02. Climate Trends		9				Reference Fig. A4.2	
Michael	Jasinski	Figure	02. Climate Trends		10	10	4	6	This is a really informative chapter with important summary information. However, Figure 2-4 is a bit confusing (to me) for two reasons. 1. First, when one writes "Changes are shown in the difference between..... (1992-2021) and (1901-1960)..." it leaves some ambiguity as to which period was subtracted from the other. One possible rewrite for temperature might be: "Shown is the change in mean temperature from (1901-1960) to (1992-2021).....etc". Also use similar wording for precipitation. 2. Second, the reader might more quickly understand the combined graphic if they were drawn using a consistent color scheme for both trends. That is, say, warmer colors (e.g., red) mean increasing while cooler colors (blue) mean decreasing. Not that big of a deal if it means having to go back to archives of data to recreate. Best regards.	The caption has been updated to make it clear that the mean over each period is being differenced. The color schemes for both temperature and precipitaiton in Figure 2.4 are consistent with those most commonly used in the literature for each variable, so they will remain as is.
Ross	McKitrick	Whole Page	02. Climate Trends		10				Why do you compare a recent 30 year period to a prior 60 year period? Why not compare same-length intervals? And why describe 1901 -1960 as the first "half" of the century?	The practice of comparing the most recent 30-year period to a prior 60-year period is employed here for consistency with previous NCA reports. The term "first half of the last century" is simply a rough verbal approximation for 1901-1960.
Jeff	Peterson	Text Region	02. Climate Trends		11	11	6	6	The text refers to an acceleration in the rate of change of sea level rise (see page 1-4; line 13), but the rate of acceleration, mentioned on page 9-4, is not described in this ,ÁúTrends,Áù chapter and should be added. The text on page 2-11 refers to Appendix, but the discussion on page 14-14 does not address acceleration. Understanding the rate of acceleration of sea level rise is critical to effective planning of response actions. Both NOAA and NASA have documented this acceleration, although both speak to only global rates rather than US coastal rates. Source NOAA: https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level#:~:text=The%20rate%20of%20global%20sea,per%20year%20from%202006%E2%80%932015. Source NASA: https://climate.nasa.gov/news/2680/new-study-finds-sea-level-rise-accelerating/ Page 11; line 6: add the following: ,ÁúIn addition, NOAA reports that the rate of global sea level rise is accelerating: it has more than doubled from 0.06 inches (1.4 millimeters) per year throughout most of the twentieth century to 0.14 inches (3.6 millimeters) per year from 2006,Äì2015.,Áù [Note that 3.6mm/year needs to be aligned with the 3.4mm/year reported on p 2-11; see graphic.]	Authors added further context on the extent of sea level rise acceleration, though retaining the current citation since it includes estimates of sea level rise further back into the 20th century (the Nerem et al. study cited in this comment only encompasses a 25-year record from satellite altimetry).
Reid	Sherman	Text Region	02. Climate Trends		11	11	10	10	Provide additional context for these statements to make this material easier to understand: " gravitational effects from glacier loss driving lower rates in Alaska, and changes in Atlantic Ocean circulation driving higher rates over sea level rise along the mid-Atlantic Coast"	Authors split the highlighted text into multiple sentences and added further context.
Thomas	Knutson	Text Region	02. Climate Trends		11	11	12	12	Would it be fair to say, based on Fig. 4 from Harvey et al. (2021) that both glacial isostatic adjustment (vertical land motion) and changes in Atlantic Ocean circulation contribute to higher rates of SLR along the mid-Atlantic Coast?	Yes. The text has been changed to include the influence of VLM in mid-Atlantic relative SLR.
Richard	McNider	Whole Page	02. Climate Trends		11				There has not been an increase in extreme events. Just go to NOAA data and include the entire climate record. Heat waves have not increased. The occurrence of Record High Temperatures is not increasing 14 of top 15 years with most heat records occurred before 1960. Tornadoes have not increased. Monthly Fraction of US with Very Wet (flood-like) or Very Dry (drought) Conditions have not increased. In fact, for Jan 1895 ,Äì Dec 2020 NOAA/NCDC (20 driest months before 1988. Fires have not increased (see Swetnam et al. 2016 Phil Trans B)	The page discusses changes in sea level, not increases in extreme events.
Kayla	McCauley	Whole Page	02. Climate Trends		11				Reference Fig. A4.10	
Richard	McNider	Whole Page	02. Climate Trends		11				The introduction and throughout mentions that heat waves and droughts are becoming worse. This is not true. If you use the entire climate record the 1930,Äôs and 1950 maximum summer temperatures were greater then. Even your Figure 2.4. Observed Changes in Annual, Winter, and Summer Temperature and Precipitation shows that average summer temps have not increased over most of the East and Midwest. U.S. By the way I think in the interest of fairness on the robustness of climate models that you should present in the same format their projections. I doubt there is much resemblance.	Though this comment seems to reference the wrong page number, in relevant section(s), authors have added discussion of the peak in certain heatwave metrics in the 1930s and added specificity on periods over which trends are discussed for clarity. Authors already discussed regional heterogeneity in trends across CONUS and did not imply that every part of CONUS is warming. Regarding climate model projections, one would not expect them to resemble observed trends precisely because of natural variability and differences in forcings. Since a seemingly random generic statement on the wrong segment of text, no additional action was taken.
Kayla	McCauley	Text Region	02. Climate Trends		12	12	1	15	No mention of ocean heat waves (Fig. A4.11).	Marine heatwaves are discussed in the extreme events sections below Key Message 2.2.
Kayla	McCauley	Text Region	02. Climate Trends		12	12	1	15	Could add marine species (Fig. A4.12)	Marine life and fisheries species are both referenced in this paragraph. No changes made.
Doug	Robbins	Text Region	02. Climate Trends		12	12	13	13	Please specify what kind of reduction, e.g., "global average reduction of pH."	Thank you for this comment. The sentence has been clarified to read "global average trends".
Reid	Sherman	Text Region	02. Climate Trends		13	13	7	7	Explain further: gravitational changes associated with the redistribution of mass on the Earth's surface; this section should point to Ch 3 p. 27, line 15	This theme warranted its own sentence with additional context.
Andrew	Carleton	Text Region	02. Climate Trends		13	13	10	13	Rates of SLR versus past sea level stands. Current SLR rate is likely to be greater.	This comment is not entirely clear, but current rates of SLR are not yet at the fastest rates in the paleo-record, including during the last deglaciation when SLR rates reached cm/yr (10x current rates).
Andrew	Carleton	Text Region	02. Climate Trends		13	13	16	16	ENSO has already been defined on the previous page.	Noted. The TSU will be performing a thorough copyedit.
Meredith	Muth	Text Region	02. Climate Trends		14	14	4	6	The statement "drought risk has been...decreasing elsewhere (medium confidence) might be problematic. I could not easily find justification in the traceable accounts or the document to support this key message, even if with just medium confidence. If this statement is based on precipitation trends, then it should be removed as you can not just look at precipitation as the definition of risk is so much more complicated. In fact, there are several regions outside of the Southwest that are expected to increase their drought 'risk', even though trends show more precipitation, due to compounding factors associated with higher temperatures (increased evapotranspiration) and increased water demand from population increases. The use of the term 'risk' here in this key message is too ambiguous.	Thanks for this comment. We agree and have rewritten the key message and subsequent section to reflect the complexity of different definitions of and drivers of drought, as well as highlighting the uniqueness of the Southwest.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Thomas	Knutson	Text Region	02. Climate Trends		14	14	7	8	Best to reword here as: "Rapid intensification of hurricanes as a proportion of all hurricane intensity changes has increased since the 1980s." Details: There has been an increase in proportion of hurricane intensity changes that qualify as rapid intensification since around 1980. But it is not clear how much of this can be attributed to increasing GHGs with high confidence, but according to one model the changes are highly unusual compared to model-estimated internal variability and the changes are in same direction as the simulated response to anthropogenic forcing (idealized experiment with one model). Going forward natural variability could cause a slowing or even reversal of recent trends.	This suggestion was taken into account and the text revised accordingly.
Jeff	Peterson	Text Region	02. Climate Trends		14	14	7	8	Atlantic hurricanes are one of the most destructive impacts of a changing climate in the U.S. in terms of damage costs and lives lost. NOAA reports that ‚ÄúThe distribution of damage from U.S. billion-dollar disaster events from 1980 to 2022 is dominated by tropical cyclone losses.‚Äù Some 54 percent of all costs from billion-dollar disasters over this period were from hurricanes as were the highest number of deaths (6,890). Source for NOAA quotation: https://www.climate.gov/news-features/blogs/2022-us-billion-dollar-weather-and-climate-disasters-historical-context Although the likelihood of Atlantic hurricanes becoming more intense as a result of climate change is generally accepted (see page 2-3; line 23), new research points to such events as becoming more frequent. A recent study of likely future hurricanes in the Atlantic concluded: ‚ÄúProjected Atlantic TCs become more frequent in the future by approximately 34% during El Niño and negative AMM and by 66% during La Niña and positive AMM, with a significant increase in the portion of intense TCs.‚Äù Source for quotation: https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL100267 Page 14; line 7-8 refers to the increased intensity of hurricanes but not the increasing frequency and should be revised to read: ‚ÄúHurricanes are intensifying more rapidly (high confidence) and causing heavier rainfall and higher storm surges (high confidence) while Atlantic hurricanes are expected to become more frequent.‚Äù	This suggestion was taken into account and is addressed in the "Storms are Changing" section.
Craig	Hanna	Whole Page	02. Climate Trends		14				Both Chapter 2 (page 14) and Appendix 4 (page 8) in the NCA5 report specifically call out the trends in extreme events and the observed billion-dollar weather and climate-related disasters in the U.S. While the ACI supports the findings of the NCA5 in Key Message 2.2 (Chapter 2, page 14), The Risk of Extreme Events Is Increasing, regarding the increase in such extreme events, caution should be taken when making conclusions on the changes in the frequency of these events.	Noted.
Richard	McNider	Whole Page	02. Climate Trends		14				Counting billion-dollar disasters is not a relevant metric. Development, especially along coastlines means than much more infrastructure is available for damage. Same is true for fires in California. I could show you a picture of I where I live on the Gulf Coast which shows the tremendous development since the 1960‚Äôs and 1970‚Äôs.	Thank you for your comment. Authors agree that a combination of increased exposure (i.e., values at risk of possible loss); increased vulnerability (i.e., where we build, how we build); and increased frequency (i.e., of some types of extremes) results in an increase in billion-dollar disasters -- and that's why it's such a relevant metric. Authors note that the Billion Dollar Disasters website at NCEI makes this point as well.
Jim	Titus	Text Region	02. Climate Trends		15	15	1	37	Both sections on page 15 are presented as examples of more extreme, but when you look at the actual details, they mean two different things. The precipitation actually is getting more extreme as the amount in heaviest 1% of days increased 45-60% while total precipitation increased far less--that is truly an increase in variability. (Though it would be helpful to compare the 45-60% to the comparable annual increases.) By contrast, the temperature section is citing literature that measures hot days relative to an historic baseline, so it is unclear whether there is an actual increase in variability or if we just have the expected result in which a given threshold is exceeded more often when you add a few degrees to the entire distribution. The document should take greater care to explain when the issue is increased variability versus a given threshold being exceeded more often without variability increasing. The two are very different.	There are various measures of extreme heat used in the literature and in previous reports, some relative and some exceedances of a specific threshold, each relevant for different systems. Relative thresholds, which are widely discussed in this section, are important because people and systems are likely adapted to their local climate and, even if temperatures don't exceed fixed thresholds, they can be impactful. Authors have added clarity on what is being discussed.
Ross	McKitrick	Text Region	02. Climate Trends		15	15	1	25	The comparison to the 1980s gives the impression of cherry-picking. You have data back to the 19th century. Why pick the 1980s as the start date? You should show a chart of the number of heatwaves back to the start of the 20th century as was done in NCA4.	Authors have updated the text to indicate that "the 1930s remains the peak period for extreme heat in the United States by some measures".
Jim	Titus	Text Region	02. Climate Trends		15		2		This statement is an oxymoron. Something that happens more frequently is no longer unusual. You really mean that what once was unusual is becoming more frequent. The language about heat waves has a similar problem but not quite as bad if one defines heat waves as what would have been exceeded (e.g.) 1% of the time before (e.g.) the industrial revolution or 1960. Still, this language needs to be improved, because if we use the language of variability to communicate that the tails are worse, what do you say if variability does increase?	Authors changed the text to be more specific and clarify that daily max temperature trends tend to follow mean changes: "Extreme daily maximum temperatures measured by exceedances of the 95th percentile of warm season temperatures between 1981-2010 have become more frequent (Rogers et al. 2021) and unusually cold temperatures less frequent across the western US since the 1980s (Rogers et al. 2021), following the greater warming in that region relative to the eastern US (Figure 2.5)." Authors also had removed the word "unusual" for specific definitions. This text was subsequently removed entirely when the "Heatwaves Have Become More Common" subsection of Key Message 2.2 was rewritten in response to National Academies peer review recommendations.
Doug	Robbins	Text Region	02. Climate Trends		15	15	17	17	The text reads "humidity makes warm temperatures feel hotter." Replace with "humidity makes warm temperatures less tolerable."	Authors have implemented the suggestion and moved the discussion of humid heat to the compound extremes section.
Thomas	Knutson	Text Region	02. Climate Trends		15	15	22	23	Add here "and other regions of North America (Knutson and Ploshay 2016; Li et al. 2017). Details: Knutson and Ploshay (2016) and Li et al. (2017) present evidence, using different methods, for an anthopogenic influence on summertimewet bulb globe temperatures (WBGTs) over land, globally and at regional scale. Knutson and Ploshay present a gridpoint-scale model-based attribution of historical increases in summertime heat stress (Wet Bulb Globe Temperature, WBGT) to anthropogenic forcing, including over additional parts of the US than the ones identified in line 22-23. See for example, their Fig. 4a and Fig. 5a). Li et al. (2017) use optimal detection methodology on global land WBGT data, and detect human influence, with warming from greenhouse gases partly offset by cooling from aerosols. They find attributable anthropogenic contributions to observed WBGT over three large regions over North America (western, central, and eastern North America). Both these studies find that, for this time period, changes in WBGT are more detectable than changes in surface air temperature alone. Li et al. find that human influence has greatly increased the odds of record high summertime WBGT. From Li et al: "We estimate that the likelihood of summer mean WGBT exceeding the observed historical record value has increased by a factor of at least 70 at regional scales due to anthropogenic influence on the climate. We further estimate that, in most northern hemispheric regions, these changes in the likelihood of extreme summer mean WBGT are roughly an order of magnitude larger than the corresponding changes in the likelihood of extreme hot summers as simply measured by surface air temperature." Ref: Knutson, T.R., Ploshay, J.J. Detection of anthropogenic influence on a summertime heat stress index. Climatic Change 138, 25-39 (2016). https://doi.org/10.1007/s10584-016-1708-z. Ref: Li, C., Zhang, X., Zwiers, F., Fang, Y. and Michalak, A.M. (2017), Recent Very Hot Summers in Northern Hemispheric Land Areas Measured by Wet Bulb Globe Temperature Will Be the Norm Within 20 Years. Earth's Future, 5: 1203-1216. https://doi.org/10.1002/2017EF000639	Authors added citations to this work in the following sentences: "Humid heat stress is measured by several indicators including wet-bulb temperatures (WBT) and wet-bulb globe temperatures (WBGT). Summer season WBGT is increasing across much of CONUS and their trends have been attributed to human-caused warming (Knutson and Ploshay 2016, Li et al. 2017). Levels of humid heat magnitudes are typically higher over the eastern than the western US, and these humid heat extremes WBTs exceeding the 95th percentile over 1981-2020 are increasing around the Gulf and south Atlantic coasts (Rogers et al. 2021). Parts of the Gulf Coast are experiencing an increase in the number of days with WBGT exceeding 30°C, a threshold with consequences for human health and well-being, have increased by up to 0.5 days per year from 1983-2016 (Tuholske et al. 2021)." This text was subsequently removed entirely when the "Heatwaves Have Become More Common" subsection of Key Message 2.2 was rewritten in response to National Academies peer review recommendations.
Jim	Titus	Text Region	02. Climate Trends		15	15	23	25	The reports cited for marine heat waves do not show that anomously high temperatures occur more often, only that what once was unusually high occurs more often. If the term "heat wave" is clearly defined somewhere in the chapter as unusual relative to a historic baseline, that term is ok; but anomalous and unusual should not be used unless it is still unusual, i.e., there is also an increase in variability. It would not hurt to explicitly distinguish these two concepts somewhere, but at te very least, please avoid inaccurate usage.	The sentence on marine heatwaves in this section does not indicate anything about frequency but rather about expanding geographic impact. No changes were made.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Ross	McKitrick	Text Region	02. Climate Trends		15	16	27	7	Here again your choice of comparison dates look like cherry-picking. In many US locations the data extend back at least to the late 1800s. Why do you only refer to the "last several decades" and in Fig 2.7 do you pick 1958? McKitrick and Christy (2019) Assessing Changes in US Regional Precipitation on Multiple Time Scales Journal of Hydrology vol. 578 Nov 2019, https://doi.org/10.1016/j.jhydrol.2019.124074 showed that trends in US precip data easily change sign as the time scale increases, and that claims about significance of trends in extreme precipitation don't hold up when using the full length of data available.	Chapter 7 of the Climate Science Special Report (NCA4 volume 1) documents an increase in multiple metrics of heavy precipitation since 1900 and 1958 at the national scale (and in most of CONUS except the Southwest for 5-year, 2-day events). Consequenlty, Figure 2.7 and its assessment of trends for 1958-2022 is employed here to ensure contiguity with previous NCA reports. The authors appreciate the suggested reference to McKitrick and Christy (2019) and note their analysis depicts increases in extreme precipitation since 1901 in two regions, albeit with a very small network (<20 stations).
Nick	Procopio	Text Region	02. Climate Trends		15	15	28	29	See "relatively smaller changes in their intensity" is followed by the statement that the heaviest precipitation days have increased by 45-60%, which seems relatively large. Consider rephrasing.	Thanks for pointing out this confusing language. Authors rectified.
Steve	Goodman	Whole Page	02. Climate Trends		15				The information on lightning is a bit dated and with only a narrow focus on fires. Please include this BAMS August 2022 issue reference from the Annual State of the Climate 2021 Supplement p. S79-S81 sidebar 2.1 on lightning and climate change (Sidebar 2.1: Lightning ‚ÄîM. FvüLLEKRUG, E. WILLIAMS, C. PRICE, S. GOODMAN, R. HOLZWORTH, K. VIRTS, AND D. BUECHLER), and if possible include some of our overarching statements on lightning. This is the first time we were invited to contribute to the State of the Climate Special Supplement and the Editor has already asked us to update the trends and anomaly figures through 2022 (Steve Goodman). Blunden, J. and T. Boyer, Eds., 2022: ‚ÄúState of the Climate in 2021,Äù. Bull. Amer. Meteor. Soc., 103 (8), Si,ÄìS465, https://doi.org/10.1175/2022BAMSStateoftheClimate.1	Great to see lightning added to the State of the Climate report. Authors have added a reference to this report and included a statement about the challenges of detecting trends in lightning. Given that there is limited literature on lightning trends in CONUS, the authors decided not to elaborate further in the main body of the chapter. A couple of sentences have been added to the Traceable Account under Major Uncertainties and Research Gaps.
John	Christy	Whole Page	02. Climate Trends		15				3OD P. 2-15. ‚ÄúHeatwaves Have Become More Common.‚Äù This is probably the most egregious of the 3OD claims as it is ‚Äúdeceptive truth,Äù in that it keeps from the reader the full and contradictory facts of the situation. In the US, multi-day heat waves in extreme high temperatures are not becoming ‚Äúhotter, more frequent, larger and longer lasting‚Äù when starting in the early 20th century. This was NOT done by Lyon and Barntson, 2017 (b. 1979), Keellings and Moradkhani 2020 (b. 1981) and Rogers et al. 2022 (b. 1979). So, the heading, to be scientifically accurate, should state: ‚ÄúHeatwaves have become more common if you ignore the period before 1980.‚Äù The following chart, JRC Fig. 1 (I will preface my figures with ‚ÄúJRC‚Äù to separate from the NCA 3OD figures) uses NOAA/NCEI USHCN stations (for some discontinued stations, nearby bias-corrected stations were substituted much as NCEI did with ‚Äúthreaded‚Äù stations). This metric (number of days in 7-day or more heat waves) correlates with Russo et al. 2014 metric of heat wave intensity used in USGCRP CSSR at 0.98. [SEE JRC FIGURE 1 IN SEPARATELY SUBMITTED SUPPLEMENT: ChristyJR_NCA5_3OD_comments_2023_Ch_2.pdf] JRC Fig. 1 The average number of ‚Äúheat-wave‚Äù days by decade (days in runs of at least 7 days in a row in which each value is hotter than the 90th percentile for that date.). NOAA/NCEI data. The evidence is clear that Heatwaves in the conterminous US have not increased. Indeed, the most recent decade (2013-2022) is slightly below the long-term average. While the West has experienced some major events in the last decade, the rest of the country has not, even achieving the lowest number of heatwave days in the century-long record in two regions (Ohio Valley and Upper Midwest). Further, the incidence of daily record high temperatures is not increasing at all. This is demonstrated in JRC Fig. 2 below when using a very short time period of only 100 years (1923-2022). [SEE JRC FIGURE 2 IN SEPARATELY SUBMITTED SUPPLEMENT: ChristyJR_NCA5_3OD_comments_2023_Ch_2.pdf] JRC Fig. 2. Number of daily record high temperatures per station per year from 1100 USHCN stations with at least 94% of data (median is 98%) and which are current through 2022. NOAA/NCEI data	Authors have revised the paragraph to explicitly state that the peak period for extreme heat was the 1930s. The paragraph also provides a more detailed discussion of increases in heat waves in recent decades, including multiple citations and a pointer to the USGCRP indicator. Authors have added specific time periods and heat metrics along with references to USGCRP indicators to support the claims made, and clearly state that the trends are not homogenous and are more prominent in the west.
John	Christy	Whole Page	02. Climate Trends		15				Droughts********** 3OD p 2-15 bottom and 2-16 droughts. When discussing paleo records this section is a clear example of misinformation, i.e. ignoring evidence to that contradicts the claim. One of the clearest examples of this is the use of the paper by Williams et al. 2022 who picked ‚Äú22 years,Äù as the sample size for their analysis. Why 22-years? Because if the period were longer, say, 25-years or more, the statistics would fail since heavy rainfall years of 1998 and earlier would negate the significance. And, the current wet year 2022-23, if included, will put a damper on the statistics as well. If such a paper is cited in the NCA, it will be demonstrated (again) that the NCA document is misleading the public. See https://cliffmass.blogspot.com/2022/02/is-southwest-us-experiencing.html by Prof. Cliff Mass of UW for refutation of Williams et al. with observational evidence. Please include the studies that demonstrate past drought episodes were far longer and drier as demonstrated, for example, by 600 to 1200-year-old tree trunks which grew to maturity on dry ground but today which are well below the surface of current natural lakes in the Sierra Nevada mountains. (see Lindstrom 1990, Morgan and Pomerleau 2012,). This is inarguable evidence that the southwestern droughts of the last millennium were much drier and intense than any today regardless of what Williams et al. claim. Not including this contradictory evidence again places strain on the notion that the NCA5 is a credible document.	Williams et al picked 22 years because, at the time the paper was published, that was the length of the 2000-2021 drought. It is not the consensus of the scientific community that this paper is misinformation. The paper (and others it cites using the North American drought atlas) clearly demonstrate and explain the existence of severe medieval megadroughts that arose through natural variability. However, Williams (2020) clearly demonstrates a role for both natural variability and climate change in the 21st century megadrought, and Cook et al (2021) shows that the risk of similar-length droughts is projected to rise in the future due to warming temperatures driving increased evaporation.
Michael	Jasinski	Figure	02. Climate Trends		16		3	4	In Figure 2.7, please better define in the caption what is the meaning of the numbers inside black circles. Thanks.	The following sentence was added to the caption: "Numbers in black circles depict percent changes at the regional level."
Jeff	Peterson	Text Region	02. Climate Trends		16	16	15	15	Although the likelihood of Atlantic hurricanes becoming more intense as a result of climate change is generally accepted (see page 2-3; line 23), new research points to such events as becoming more frequent. A recent study (Sena et al.) of likely future hurricanes in the Atlantic concluded: ‚ÄúProjected Atlantic TCs become more frequent in the future by approximately 34% during El Niv±o and negative AMM and by 66% during La Niv±a and positive AMM, with a significant increase in the portion of intense TCs.‚Äù Page 16; line 15: Insert: ‚ÄúRecent research points to a significant increase in the future frequency of Atlantic hurricanes (Sena et al. 2022).‚Äù https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL100267	The text was revised by adding sentence to hurricance projections to address some of the disagreements in the literature around this issue.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Thomas	Knutson	Text Region	02. Climate Trends		16	16	17	17	Two important U.S. drought studies to include here: Milly and Dunne (2020) and Su et al. (2021). For the Colorado River, Milly and Dunne (2020) estimate that reduced snow and less reflection of solar radiation has caused increased evapotranspiration in the basin, leading to a 9.3% per degree Celsius decrease in annual mean discharge. While projected precipitation increases may partly counter this effect, they expect an increasing risk of severe water shortages in the basin in the coming century. Ref: Milly, P.C.D., and K. A. Dunne, 2020: Colorado River flow dwindles as warming-driven loss of reflective snow energizes evaporation. Science, vol 367, issue 6483, pp. 1252-1255, https://doi.org/10.1126/science.aay9187 . Su et al. (2021) present a map estimate (see their Fig. 4) of trend in dry area coverage for six different subregions of the CONUS over 1915-2018. Only the southwest U.S. appears as a region with an increase in dry area coverage over this time period in their reconstruction. This would be a good figure for this section. Details of Su et al: dry area is defined as where the total column soil moisture is below the 20th percentile of the entire reconstruction period. They use the Noah-MP land surface model and investigate influence of groundwater and dynamic vegetation phenology in their study. Their land model is forced by observed estimates of surface meteorological forcings, including hourly precipitation, near-surface temperature, near-surface wind, near-surface humidity, downward shortwave and longwave radiation, and surface pressure. Ref: Su, L., Cao, Q., Xiao, M., Mocko, D. M., Barlage, M., Li, D., Peters-Lidard, C. D., & Lettenmaier, D. P. (2021). Drought Variability over the Conterminous United States for the Past Century, Journal of Hydrometeorology, 22(5), 153-1168.ttps://journals.ametsoc.org/view/journals/hydr/22/5/JHM-D-20-0158.1.xml	Thank you for these suggestions! While the Milly and Dunne Colorado River paper deserves to be discussed in depth (and, we believe, is discussed in the regional chapters) we cite it as an example of how the changing characteristics of precipitation affect complex drought risk. We have also included the Su et al paper and highlighted the finding of the Southwest as the only region in which dry area is increasing.
Molly	Woloszyn	Text Region	02. Climate Trends		16	16	20	22	Flash droughts are NOT just short lived events. They can be, but they also can become a longer event - this is the most recent consensus of the flash drought community. Most recent publication on this topic of flash drought: https://journals.ametsoc.org/view/journals/bams/103/10/BAMS-D-21-0288.1.xml	Authors have clarified that the definition of flash drought reflects rapid onset, not short duration.
John	Christy	Whole Page	02. Climate Trends		16				3OD p. 2-15,16. Rainfall is becoming more extreme and flood risk is increasing. Again, the authors focus on a ‚Äútoo-short‚Äù time period to support their views (since 1958) and show in 3OD Fig. 2.7 an increase in ‚Äúextremes‚Äù in all regions for a few metrics. This is a highly misleading diagram and will fail close inspection. First, McKitrick and Christy 2019 tested these NCA claims and found that if the trends are begun at specific points-in-time (e.g. 1901 or 1958 as NCA has always done) some are mildly significant. However, when using longer or shorter periods (e.g. as in 150 or 40 years, McKitrick and Christy) the ‚Äúsignificance disappears‚Äù. McKitrick and Christy 2019 is a heavily peer-reviewed paper that was not mentioned in the 3OD but should as it directly contradicts the NCA claims and the public should be aware of this. Additionally, using the same data from McKitrick and Christy, but updated to deal with these claims here, I have focused on 42 Pacific Coast stations with complete daily precipitation records from water-year 1893-94 (through 20 Jan 2023 to include the 50-day Atmospheric River or AR event of 2022-23). All stations are west of the Pacific Coast Divide. JRC Fig. 3 is the distribution in time of the 26 heaviest 5-day event totals of the past 130 years (i.e. nominally the heaviest event per every five years.). These would represent the main impulse of a major AR event that would likely initiate flooding. [SEE JRC FIGURE 3 IN SEPARATELY SUBMITTED ATTACHMENT: ChristyJR_NCA5_3OD_comments_2023_Ch_2.pdf] JRC Fig. 3. Distribution in time in 5-year intervals of the 26 heaviest 5-day precipitation events in 42 stations west of the Pacific Divide. A ‚Äúyear‚Äù is the water-year beginning on 1 August of the year prior to the identified year in the x-axis. As shown above, the major wet period of the 1997-98 ENSO event had a considerable impact generating the most extreme events. However, the next ten 5-year periods with the most events were all prior to 1998 and none since. There is no trend toward increasing incidence of heavy 5-day periods (also true for 3-day, 14-day and 30-day) and thus it is clear evidence that does not support the claims made in 3OD which include the claim that AR events are getting wetter (p. 2-13)	The authors acknowledge the concern that trends are sensitive to the duration and starting point of the record. This is widely understood in the scientific community and that is why we specify the timeperiod we use. We refer the reviewers to the climate change special report which did examine trends over different timeperiods demonstrating this. Using too long a record is likely to result in dampened trends because it captures multidecadal variability. Trend detection might be challenging using too short a record also due to natural variability. Our figures use a relatively long period of ~70 years using the NClim dataset that captures the period where human-caused warming is most pronounced. We also review studies that examine different recent timeperiods using multiple data sources in a systematic manner, including Kunkel et al. 2020 that analyze GHCN data over multiple timeperiods, the same dataset studied in McKitrick and Christy 2019. However, McKitrick and Christy 2019 use a very small subset of stations in areas - Pacific Coast and the SE coast, which are not entirely comparable to the reported regional scale trends. Further, the supplemental analysis here is hard to decipher since it stacks extreme events from mutliple stations across the Pacific Coast into one timeseries. Analyzing trends in such a timeseries is not meaningful with how analysis of climate trends are conducted within the climate science community.
Thomas	Knutson	Text Region	02. Climate Trends		17			12	There is also no long-term trend in the frequency of U.S. landfalling *major* hurricanes since the late 19th century (Vecchi et al. 2021), so the sentence should read "hurricanes or major hurricanes".	The author team deems this suggestion to be redundant, since "hurricane" by definition encapsulates all tropical cyclones above a particular magnitude, which inherently includes both minor and major hurricanes.
Thomas	Knutson	Text Region	02. Climate Trends		17	17	15	15	Suggested text to add regarding recent Atlantic TC increases since the 1970s: "Decreasing anthropogenic aerosol forcing over the Atlantic is suggested to have contributed to the increase in frequency of North Atlantic tropical storms and hurricanes combined since 1980 (Murakami et al. (2020); in their model, greenhouse gas warming alone produces a decreasing long-term trend in Atlantic tropical storms and hurricanes. Multidecadal variations of tropical North Atlantic vertical wind shear and associated major hurricane frequency are well-correlated to a subsurface ocean "fingerprint" of multidecadal variations in the Atlantic Ocean Meridional Overturning Circulation (AMOC), and these inferred multidecadal ocean circulation variations are more likely due to internal variability than changes in aerosol forcing according to Yan et al. (2017; 2019). Refs: Murakami, H., T. L. Delworth, W. F. Cooke, M. Zhao, B. Xiang, and P.-C. Hsu, 2020: Detected climatic change in global distribution of tropical cyclones, Proc. Nat. Acad. Sci., 117 (20), 10706-10714, www.pnas.org/cgi/doi/10.1073/pnas.192250011. Yan, X., Zhang, R. & Knutson, T.R. The role of Atlantic overturning circulation in the recent decline of Atlantic major hurricane frequency. Nat Commun 8, 1695 (2017). https://doi.org/10.1038/s41467-017-01377-8. Yan, X., Zhang, R., & Knutson, T. R. (2019). A multivariate AMV index and associated discrepancies between observed and CMIP5 externally forced AMV. Geophysical Research Letters, 46, 4421-4431. https://doi.org/10.1029/2019GL082787	The commenter is correct, but the focus of the paragraph is on trends rather than their causes, so the material was not added.
Thomas	Knutson	Text Region	02. Climate Trends		17		26		I suggest you point out there is disagreement among studies on this conclusion: "...increased since 1900 according to Grinsted et al., (2019), although a previous study using a different methodology inferred no increase in U.S. normalized hurricane damage over 1900-2005 (Pielke et al. 2008). Ref: Pielke, R. A., Jr., J. Gratz, C. W. Landsea, D. Collins, M. A. Saunders, and R. Musulin, 2008: Normalized hurricane damage in the United States: 1900-2005. Nat. Hazards Rev., 9, 29, https://doi.org/10.1061/(ASCE)1527-6988(2008)9:1(29).	Although Pielke et al. (2008) were pioneers in a loss normalization context, their approach has been challenged on statistical grounds -- e.g., F. Estrada, W.W. Botzen, R.S. Tol, Economic losses from US hurricanes consistent with an influence from climate change. Nat. Geosci. 8, 880–884 (2015). Furthermore, Pielke et al. only examined trends through 2005 and have not published an updated assessment since.
Thomas	Knutson	Text Region	02. Climate Trends		17		28		You may want to add something about century-scale model-based reconstructions of Atlantic basin TC activity (which are basically in disagreement) here: "Century-scale model-based reconstructions of historical Atlantic basin tropical cyclone activity from models forced by reanalyses or sea surface temperatures give conflicting results and appear model-dependent (Emanuel, 2021; Chan et al. 2021; Chand et al. 2021). Refs: Emanuel, K. Atlantic tropical cyclones downscaled from climate reanalyses show increasing activity over past 150 years. Nat Commun 12, 7027 (2021). https://doi.org/10.1038/s41467-021-27364-8 Chan, D., G. A. Vecchi, W. Yang, and P. Huybers, 2021: Improved simulation of 19th- and 20th-century North Atlantic hurricane frequency after correcting historical sea surface temperatures. Science Advances, Vol 7, Issue 26, DOI: 10.1126/sciadv.abg693 Chand, S.S., Walsh, K.J.E., Camargo, S.J. et al. Declining tropical cyclone frequency under global warming. Nat. Clim. Chang. 12, 655\u2013661 (2022). https://doi.org/10.1038/s41558-022-01388-4	The authors took the comment into account and removed the last sentence in the paragraph.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Harold	Brooks	Text Region	02. Climate Trends		17	17	34	35	"Tornado Alley" is not a well-defined concept, which is why it was put in quotes in Gensini and Brooks (2018). The changes discussed in that paper are relatively small, but statistically significant, but any claim that "Tornado Alley" has shifted requires a change in definition. This was discussed in more detail in Brooks, H., C. Doswell III, and M. Kay, 2003: Climatological estimates of local daily tornado probability for the United States. Wea. Forecasting, 18, 626,Äì640, https://doi.org/10.1175/1520-0434(2003)018,0626:CEOLDT.2.0.CO;2.	Quotation marks were added to the term.
Doug	Robbins	Text Region	02. Climate Trends		18	18	15	15	The text reads "...fires were more frequent between 1992 and 2012." More frequent than what, by comparison?	Authors revised to: "Both lightning-caused and human-caused fires experienced increasing trends between 1992 and 2012 (Balch et al. 2017)."
Daniel	Feldman	Figure	02. Climate Trends		18		21		The statement "The increasing trend in lightning-caused fires is therefore largely driven by the increasing aridity in the western United States that results in drier and more flammable vegetation" needs to be supported by a citation. The increase in lightning-caused fire could be for many other reasons, including increased surface winds when lightning occurs, preferential increase lightning in fire-prone areas, changes in the density of lightning strikes, changes in fuel moisture that are independent of aridity, etc.	The reviewers point was noted and the sentence removed.
Jim	Titus	Text Region	02. Climate Trends		18		22		This sentence is a bit too cute or political for what is otherwise a straightforward scientific summary. It's a bit of a leap as well, since one does not know who is "our". Does that mean the authors? The citizens of the US? Are China and India included in "our" in a US Government document? That would be unusual, but even then, the future depends as much or more on what people not yet born decide to do. It would be better to use understated language such as future climate change depends on how much humanity changes to atmosphere.	This comment was echoed to a certain extent by National Academies peer reviewers. As such, authors have reframed the Key Message 2.3 title to "Some further climate change is inevitable. How much depends on the choices we make now." The use of third person has been retained for clarity and impact since a global application, not referring to the authors themselves or any particular subset of humanity.
Nick	Procopio	Text Region	02. Climate Trends		18	18	31	35	The changes in unit from C to F seem to unnecessarily complicate the comparison. "For every additional 1DegreesC of global warming, the average US temperature is projected to increase by around 2.5DegreesF." Consider keeping units consistent.	Authors have worked to streamline this discussion, and are following the volume-wide units guidance provided by the editorial team make it consistent.
Thomas	Knutson	Text Region	02. Climate Trends		18	18	34	35	Use the same units for temperature change (either deg F or deg C) within a given sentence.	Authors have worked to streamline this discussion, and are following the volume-wide units guidance provided by the editorial team make it consistent.
John	Christy	Whole Page	02. Climate Trends		18				Example of unsupported claim (one of many) that is sermonizing********** ,ÂúKey Message 2.3. The Future is in our hands,Âù As demonstrated above, extreme events are not confidently related to GHG emissions and, as demonstrated, do not pose a threat (see comments on Ch 3 for our current lack of understanding about the physical climate system.) Without an understanding of natural variability, or as this document assumes, natural variability is unimportant and not consequential, such sermonizing here might represent the sentiment of the authors, but it cannot stand up to scientific cross-examination. As I have demonstrated before the US Congress (without rebuttal), if the United States ceased to exist today, the GHG impact on the climate system would be essentially imperceptible by 2100 (about 0.1 C if models are useful). So, Key Message 2.3 is not true, the climate ,ÂúFuture,Âù is not in our (US) hands. However, the consequence of making energy less affordable and inaccessible is very clear and dangerous to humankind. So, yes, the ,ÂúFuture [OF HUMAN THRIVEABILITY] is in Our Hands,Âù and we should support the expansion of affordable energy into the lives of those much less fortunate than us (who are the rich few) so they too can experience longer and better lives. I lived in Africa and can say with all confidence - without energy, life is brutal and short. If the NCA5 is going to allow sermons, then people with alternate views based on real evidence should be given a chance to preach.	It is scientific fact that future climate changes depend on human emissions trajectories, which depend on societal choices.
John	Christy	Figure	02. Climate Trends		20	20	1	5	3OD Fig. 2.9. Precipitation changes Models are incapable of predicting precipitation changes. As noted in Christy and McNider 2016, the models failed to replicate variability and trends for both temperature and precipitation in Alabama. Similarly, for Minnesota, simple annual averages of precipitation varied from 400 mm to 950 mm per year relative to an observational mean of 660 mm. This wide range represents major errors in the moist thermodynamics of the models related to latent heat and moisture convergence (not shown but available on request.). At the very least, the authors should place error bars on the grid-point values of precipitation changes and I suspect most will cross ,Áúzero change,Âù.	Stippling has been added to Figure 2.9 to show areas of model agreement and disagreement. While model biases persist and are discussed extensively in Chapter 3, it is not consistent with the scientific literature that there are "major errors in the moist thermodynamics of the models".
Thomas	Knutson	Text Region	02. Climate Trends		21	21	3	4	The Wright et al. (2015) study projects an increase in TC rainfall rates over the U.S. for post-landfalling TCs, and so is more directly relevant to U.S. impacts (though it is just a single modeling study). Alternatively, Knutson et al. 2020 is a multi-study assessment, but for global and individual basins, not the U.S. Wright, D.B., Knutson, T.R. & Smith, J.A. Regional climate model projections of rainfall from U.S. landfalling tropical cyclones. Clim Dyn 45, 3365\u20133379 (2015). http://dx.doi.org/10.1007/s00382-015-2544-y	The distinction between the papers is well taken; however, given that the suggested paper covers only the eastern U.S. and portions of the U.S are in other tropical cyclone basins, inclusion of a global assessment was deemed appropriate.
Thomas	Knutson	Figure	02. Climate Trends		23	23	11	15	Figure 2.12 was derived from Fig. SPM.5 in IPCC AR6. but an important/informative additional perspective from the AR6 is in their Fig. 8.19 (c,f,i), which shows that over the US/N. America, most of the total column soil moisture projections did not meet their "Robust change" criteria, because less than 80% of the models agreed on the sign of the change (for 9-22 models, SSP1-2.6, SSP2-4.5, and SSP5-8.5). This important information about lack of robustness of model changes is missing in Fig. 2.12. What fraction of the underlying models agree on the sign in Fig. 2.12 (or Fig. SPM.5)?	The figure has been removed.
Thomas	Knutson	Text Region	02. Climate Trends		23		21		Note the 5% faster winds and increase in proportion of Cat 4-5 hurricanes in Knutson et al. 2020 both refer to global TC activity, not Atlantic only, where the average projected wind increase is about 3% and the proportion of hurricanes reaching Cat 4-5 levels was not assessed specifically for the Atlantic basin (only globally). So I recommend modifying the end of sentence as follows: "(with winds 3% faster for Atlantic basin hurricanes at a GWL of 2 deg C) and an increase globally in the proportion of Category 4-5 hurricanes."	The text has been adjusted to more clearly distinguish global vs. basin trends, given that the Atlantic and Pacific basins are both important for US tropical cyclone activity.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Thomas	Knutson	Text Region	02. Climate Trends		24		3		Suggested addition: "For U.S. (CONUS) or North American landfalling tropical cyclone activity, published projections report some projected changes of concern, but these often differ between studies (depending on the modeling method used) or projected changes are non-significant (Jing et al. 2021, Garner et al. 2021, Knutson et al. 2022, Zhang et al. 2020). One study projects that tropical cyclone rainfall-surge joint hazard is greatly increased by higher rainfall amounts driven by higher cyclone intensities and slower propagation speeds, with further joint risk from sea level rise (Gori et al. 2022); in contrast only small/nonsignificant changes of tropical cyclone propagation speed are projected byZhang et al. (2020) for most near-US coastal regions. One study projects increased threat of extratropically transitioned storms for the northeast U.S. (Liu et al. 2017). In summary, these U.S. and North America landfalling tropical cyclone studies do not yield high confidence projections, apart from sea level rise influence on inundation risk, because they are based on single studies or exhibit major differences between studies; further, the projections are generally not supported yet by a detectable anthropogenic influence in observations." Background Details: Garner et al. (2021) project tropical cyclones to form closer to the U.S. southeast coast and to propagate more slowly along the coast in a future warming scenario. Similarly, Knutson et al. (2022) project that a greater fraction of Atlantic TCs will make landfall over CONUS and that basinwide intensities will increase slightly. This led to a greater projected number of CONUS landfalling category 4-5 hurricanes despite fewer total tropical cyclones and hurricanes projected for the Atlantic basin as a whole in Knutson et al (2022). Jing et al. (2021) compare North American landfalling TC projections from three modeing approaches: the GFDL HiFLOR climate model, Emanuel's statistical-deterministic TC downscaling framework, and a new TC statistical model (Jing and Lin 2020). They report relatively small and not statistically significant changes in landfall intensities and in the return period of various landfall intensities. An exception was a projected increase in 100-yr return level of landfall intensity for the northeastern U.S. in the HiFLOR model, though the other two modeling approaches did not support this projected change. Gori et al. (2022) project large increases in the joint hazard from tropical cyclone rainfall and surge due to increased rainfall drivers by increased storm intensities and	Thank you for the comment and the additional context. The authors chose to focus primarily on the more certain aspects of tropical cyclone trends. Some additional text and references have been added to address these uncertainties, although the complete suggestion can not be due to space considerations.
Reid	Sherman	Text Region	02. Climate Trends		24	24	29	29	Missing metric equivalents; this text reads very different from prior text. The language needs to align more with p 13 lines 3-17 and pp. 11 and 12 full pages	Units have been changed to inches and feet everywhere in this chapter for uniformity.
Jeff	Peterson	Text Region	02. Climate Trends		24	25	36	5	The text on page 24 line 37 refers to long-term risks of sea level rise of 4-7 feet in the event of temperatures over 2 degrees C and rapid and irreversible ice loss. Recent science points to potential ice loss sooner than 100-150 years without the assumption of greater than 2 degree temperature increases (e.g., ‚Äúless than a decade‚Äù). The current text at page 24; line 36 reads: ‚ÄúAt a 2¬∞C GWL, it is very unlikely, but not impossible, that sea level rise in CONUS would exceed 4 feet in 2100 and 7 feet in 2150. At higher GWLs, such extreme sea level rise becomes more likely within the next 100,Äì150 years. The total rise in sea level that will be realized beyond 2150 can differ by many feet depending on global warming levels over the next 50,Äì100 years due to the potential for rapid and irreversible loss of ice from Greenland and Antarctica starting next century.‚Äù These sentences should be revised as follows: ‚ÄúIt is unlikely, but not impossible, that sea level rise in CONUS would exceed 4 feet in 2100 and 7 feet in 2150. Such sea level rise becomes more likely due to the potential for rapid and irreversible loss of ice from Greenland and Antarctica.‚Äù	The suggested change would not be consistent with calibrated language regarding uncertainty. Additionally, the most recent papers on Greenland and Antarctic ice loss indicate that rapid rates are exceedingly unlikely prior to 2100. Those recent studies are cited here and language regarding irreversible retreat reflects the findings therein. Aouthors opt to keep the language on this topic as is.
Nick	Procopio	Text Region	02. Climate Trends		25	25	13	13	Fix typo in "3 to billion Joules per square meter". Remove "to" or update as a range.	Noted. The TSU will be performing a thorough copyedit.
Jeff	Peterson	Text Region	02. Climate Trends		27	27	12	13	Delete ‚Äúin far-future sea level rise.‚Äù	The text was revised to "sea level rise beyond 2100".
Jeff	Peterson	Text Region	02. Climate Trends		27	27	15	15	Although the period of a home mortgage is commonly 30 years, infrastructure plans often include time horizons of 50 or 100 years. Homes financed for 30 years require roads, sewers, power, and related services that often are in place for much longer than 30 years. Large commercial and industrial investments are also often in place for far longer than 30 years. Planning for new homes or other infrastructure with just a 30-year time horizon will dramatically underestimate the risk of inundation by rising seas for many projects in coastal areas. Revise the sentence to delete ‚ÄúOn timescales relevant to infrastructure planning (around 30 years),‚Äù	Authors agree that 30 years does not capture the infrastructure design life well. The expected design life varies substantially based on the type of infrastructure ranging from 10-20 years for pavements to 100 years for bridges. Authors have revised the text to replace 30 years with a range and clarify that the period refers to the design life of infrastructure.
Weston	Fisher	Whole Page	02. Climate Trends		27				The use of long-term cumulative impact assessment process at the national and regional planning levels is essential both as a vehicle for assessing impacts but also for developing alternative mitigation and strategies to 2050 and beyond.	Thank you for the comment.
Gabrielle	Dreyfus	Text Region	02. Climate Trends		28	28	32	33	∨C¬Ã¬úAs the Arctic warms and permafrost thaws, this ancient carbon may be mobilized to the atmosphere, primarily as CO2, with a small fraction (about 3%) emitted as methane.∨C¬Ã¬ù COMMENT ∨C¬Ã¬ì This statement could be strengthened by putting the relatively small share of methane emissions in perspective by adding ∨C¬Ã¬ú∨C¬Ã¬¶ emitted as methane PROJECTED TO CAUSE 40∨C¬Ã¬ì70% OF WARMING FROM PERMAFROST THAW THIS CENTURY∨C¬Ã¬ù. CITE: Schuur E. A. G. ∨C¬Ã¬¶ Turetsky M. (2022) Permafrost and Climate Change: Carbon Cycle Feedbacks From the Warming Arctic, Annual Review of Environment and Resources 47(1): 343∨C¬Ã¬ì71 https://doi.org/10.1146/annurev-environ-012220-011847, 350 (∨C¬Ã¬úMethane emissions from thawing permafrost (included within that total ∨C¬à¬º0.5∨C¬Ã¬ì2 Pg C per year estimate) are projected to cause 40∨C¬Ã¬ì70% of total permafrost-affected radiative forcing in this century, even though CH4 emissions are much less than CO2 by mass (26, 27).∨C¬Ã¬ù).	Thank you for the comment. The revised chapter draft includes this comment.
Gabrielle	Dreyfus	Text Region	02. Climate Trends		29	29	1	19	Section on ∨C¬Ã¬úTipping Elements Could Lead to Regional Rapid Changes∨C¬Ã¬ù COMMENT: Recommend including the findings of a major synthesis on climate tipping points published in September 2022: Armstrong McKay et al. (2022) identify 16 ∨C¬Ã¬úcore" climate tipping points, with 6 likely to occur between 1.5∨Ç¬ººC and 2∨Ç¬ººC using the more restrictive definition of ∨C¬Ã¬úwhen change in part of the climate system becomes (i) selfperpetuating beyond (ii) a warming threshold as a result of asymmetry in the relevant feedbacks, leading to (iii) substantial and widespread Earth system impacts.∨C¬Ã¬ù The discussion of thresholds (∨C¬Ã¬úparticular GWL∨C¬Ã¬ù) should mention risks associated with tipping cascades, where one element shifting states lowers the threshold for abrupt shifts in other systems. CITE: Armstrong McKay D. I., Staal A., Abrams J. F., Winkelmann R., Sakschewski B., Loriani S., Fetzer I., Cornell S. E., RockstrVÉ¬ðm J., & Lenton T. M. (2022) Exceeding 1.5∨Ç¬ººC global warming could trigger multiple climate tipping points, Science 377(6611): eabn7950, 1∨C¬Ã¬ì10, 7 (∨C¬Ã¬úCurrent warming is ~1.1∨Ç¬ººC above preindustrial and even with rapid emission cuts warming will reach ~1.5∨Ç¬ººC by the 2030s (23). We cannot rule out that WAIS and GrIS tipping points have already been passed (see above) and several other tipping elements have minimum threshold values within the 1.1 to 1.5∨Ç¬ººC range. Our best estimate thresholds for GrIS, WAIS, REEF, and abrupt permafrost thaw (PFAT) are ~1.5∨Ç¬ººC although WAIS and GrIS collapse may still be avoidable if GMST returns below 1.5∨Ç¬ººC within an uncertain overshoot time (likely decades) (94).∨C¬Ã¬ù). See also Wunderling N., Donges J. F., Kurths J., & Winkelmann R. (2021) Interacting tipping elements increase risk of climate domino effects under global warming, Earth Syst. Dyn. 12(2): 601∨C¬Ã¬ì619, 614 (∨C¬Ã¬úIn this study, we show that this risk increases significantly when considering interactions between these climate tipping elements and that these interactions tend to have an overall destabilising effect. Altogether, with the exception of the Greenland Ice Sheet, interactions effectively push the critical threshold temperatures to lower warming levels, thereby reducing the overall stability of the climate system. The domino-like interactions also foster cascading, non-linear responses. Under these circumstances, our model indicates that cascades are predominantly initiated by the polar ice sheets and mediated by the AMOC. Therefore, our results	Authors have added a reference to Armstrong McKay et al. (2022) in the text, but do not have room to cover tipping elements at length in this chapter. Instead, interested readers are pointed to the relevant literature.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jeff	Peterson	Text Region	02. Climate Trends		29	29	30	30	The text on page 29; line 30 ‚ÄúExtreme Sea Level Rise Cannot Be Ruled Out‚Äù makes a critically important point for planning of response strategies but lacks sufficient explanation of the reasons for these estimates (e.g., description of the known unknowns related to ice-sheet processes and feedbacks) and the probability of these projections occurring. It would be helpful to include a discussion on how well the rapidly evolving understanding of ice sheet dynamics are represented in the climate models on which SLR is predicted (e.g., changes in albedo due to the accumulation of meltwater on the surface of ice, or the impacts of changes in ocean circulation patterns on marine-terminating glaciers). Note that although line 23 on page 2-29 refers to a 1% probability, table 2.4 of the NOAA sea level rise scenarios report indicates a 20% probability of 1.5m of sea level rise by 2100 in the case of high impact very high emissions scenario.	Authors have added several sentences reviewing the current state of sea level projections are the source of remaining uncertainty in ice sheet models, and the prospect for improvement in coming years. With regard to the 1% probability threshold, this is based on a range of GWLs of 1.5-4°C in line with the rest of the chapter.
Gabrielle	Dreyfus	Text Region	02. Climate Trends		30	30	12	20	√¢¬Ã¬úRapid reductions in emissions can still limit global temperature changes to well below 2√Ç¬∞¬∞C (Meinshausen et al. 2022). Global temperatures can be limited to 1.5√Ç¬∞¬∞C above preindustrial levels by 2100 in scenarios where global emissions reach net zero in the middle of this century with modest deployments of net-negative emissions thereafter (Rogelj et al. 2018), although most scenarios have at least some midcentury temperature overshoot, which could result in irreversible consequences to global ecosystems (Ch. 8; O'Neill et al. 2022). Still, the degree to which climate change will continue to worsen is in large part up to humans. The faster and the further we cut emissions, the less future warming will occur, and the safer we will be from climate change.√¢¬Ã¬ù COMMENT: √¢¬Ã¬úNet zero√¢¬Ã¬ù as used here is vague. Clarify that limiting temperatures to 1.5C requires net-zero CO2 and deep cuts to methane and other short-lived climate pollutants by 2050 with CDR later this century. Scenarios that limit warming to 1.5C with limited to no overshoot have more rapid and deeper cuts to methane and other short-lived climate pollutants. CITE: Intergovernmental Panel on Climate Change (2022) Summary for Policymakers, in CLIMATE CHANGE 2022: MITIGATION OF CLIMATE CHANGE, Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Shukla P. R., et al. (eds.), SPM-22 (√¢¬Ã¬úC.1.2 In modelled pathways that limit warming to 2√Ç¬∞¬∞C (>67%) assuming immediate action, global net CO2 emissions are reduced compared to modelled 2019 emissions by 27% [11√¢¬Ã¬ì46%] in 2030 and by 52% [36-70%] in 2040; and global CH4 emissions are reduced by 24% [9√¢¬Ã¬ì53%] in 2030 and by 37% [20√¢¬Ã¬ì60%] in 2040. In pathways that limit warming to 1.5√Ç¬∞¬∞C (>50%) with no or limited overshoot global net CO2 emissions are reduced compared to modelled 2019 emissions by 48% [36√¢¬Ã¬ì69%] in 2030 and by 80% [61-109%] in 2040; and global CH4 emissions are reduced by 34% [21√¢¬Ã¬ì57%] in 2030 and 44% [31-63%] in 2040. There are similar reductions of non-CO2 emissions by 2050 in both types of pathways: CH4 is reduced by 45% [25√¢¬Ã¬ì70%]; N2O is reduced by 20% [-5 √¢¬Ã¬ì 55%]; and F-Gases are reduced by 85% [20√¢¬Ã¬ì90%].√¢¬Ã¬ù). Intergovernmental Panel on Climate Change (2022) Summary for Policymakers, in CLIMATE CHANGE 2022: MITIGATION OF CLIMATE CHANGE, Contribution of Working Group III to the Sixth Assessment	This is a helpful comment, and authors have updated the text to emphasize that the net-zero dates in question refer to CO2, and must be accompanied by deep cuts to methane and other short-lived climate pollutants to minimize overshoot.
Gene	Takle	Whole Page	02. Climate Trends	18	30	23	15		A conspicuous model bias in CMIP5 and previous generations is a warm and dry bias in IPCC/CNA region in historical simulations. This becomes problematic in future	Authors made a general statement about potential model biases.
Jim	Titus	Traceable Account	02. Climate Trends		31	37	1	37	This section should explain the process for validating references. As an assessment, virtually all of the statements are based on a report cited. But in many cases, the references are too vague to be useful or for one to be confident that the document actually says what is asserted. The most extreme case is when an IPCC or USGCRP report is cited for a single fact; but even when a journal article is cited for a detail that is not the thrust of the paper, one has no way of knowing whether the paper actually says that. Some publications have fact checkers which look up every reference to make sure it says what is asserted; some publications such as law journals require the author to provide a copy of the page where a fact appears (unless it is obvious from the article title). Some publications just trust authors. Whatever the process, it should be stated.	Thank you for this comment. Where applicable, we have cited the subsections in the IPCC report and/or specific articles.
Andrew	Carleton	Text Region	02. Climate Trends		32	32	18	19	Consider including agricultural drought, which was mentioned earlier in the chapter.	Thank you. The drought language has been substantially revised in response to this and other comments.
Reid	Sherman	Text Region	02. Climate Trends		34	34	17	17	Hail - This is the first mention in text as a type of hazard; next mention is Ch 3 p. 42 line 28.	Authors added text under "Storms are Changing" header: "Thunderstorms are associated with other important hazards including hail and cloud-to-ground lightning. Direct observational records for these hazards are largely insufficient for identifying trends due to factors including observer baises, limited length of the record, and changes in the observing systems (Allen and Tippet 2015; Fullerkrug et al. 2022). However, days with environmental conditions conducive to producing large hail (>5cm) have become more frequent over the central and eastern US and parts of the Pacific Northwest (Tang et al. 2019)."
Craig	Hanna	Whole Page	02. Climate Trends		34				As mentioned in the Major Uncertainties and Research Gaps section (Chapter 2, page 34), it is important to take into account the differences in regional exposures and how they have changed over time. Regarding this and other mentioned gaps in the research, the Academy is pursuing an update to the Actuaries Climate Index (ACI) [https://actuariesclimateindex.org/home/] to incorporate reanalysis data, and is also actively working to update the Actuaries Climate Risk Index (ACRI) [https://www.actuary.org/sites/default/files/2020-01/ACRI.pdf] to account for exposure changes and economic loss data. While the NCA5 report presents the increase in extreme events alongside the billion-dollar disaster events, the ACRI is designed to more directly correlate the increase in extreme events with economic losses.¬†	Thank you for the comment.
Jeff	Peterson	Text Region	02. Climate Trends		37	37	3	3	Delete ‚ÄúOn longer timescales (2100 and beyond),,‚Äù.	Sea level rise projections prior to 2100 are considerably more certain than after 2100, so this qualification is appropriate and necessary.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jim	Titus	Text Region	02. Climate Trends		38	56	4	26	A large fraction of the references here are too vague to be useful, because they cite long documents to support specific points that in fact only appear on a single page or a small section. Nowhere does the traceable accounts section mention a process for validating references, so the inference one draws is that the assertions are somewhere in the document (we hope), but no one knows precisely where. A better approach would be to cite the specific page (or subsection) that supports the proposition, unless the proposition cited is the entire point of the article cited. That probably means that page or subsections should be cited with IPCC report, while the entire article in Nature would be fine.	Thank you for this comment. Where applicable, we have cited the subsections in the IPCC report and/or specific articles.
James	Balder	Whole Chapter	02. Climate Trends						As an environmentalist and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible (radio, television, social media, etc.), and useful to the public and policymakers.	Thank you for the feedback! The leadership team is planning a comprehensive communications strategy and will take this into account.
Arie	Mobley	Whole Chapter	02. Climate Trends						This information is so important for people to understand. It affects long term decisions like where to buy a home or start a business. Please continue collecting and distributing this important information. Climate change is causing real changes and we are not responding fast enough to decrease our CO2 emissions and other factors that contribute to climate change.	Thank you for the feedback.
Gail	Barton	Whole Chapter	02. Climate Trends						There is far too much to read and then have the pressure of timing out in twenty minutes. I have found the process far too time consuming, first in just logging on to the site as it took me multiple tries and addressing to Reply who answered and tried to encourage me, and difficult to comment on specifics of such a long draft.. I came to comment from the Union of Concerned Scientists and support their actions to inform the public of the on-going dire situation our climate is experiencing. I hope that your NCA5 Third Order Draft is expedient in addressing every problem so we can get on with protecting our environment with out complicating the time frame! Sincerely, G Barton	Thank you for the feedback.
Nick	Procopio	Whole Chapter	02. Climate Trends						Consider adding information from two reports that discuss rainfall projections in New Jersey (DeGaetano 2021 & DeGaetano and Tran 2021).	The New Jersey trends are best handled in Chapter 21 (Northeast). This comment has been forwarded to them.
Emma	Conrad-Rooney	Whole Chapter	02. Climate Trends						Key messages 1 and 2 should be revised to follow the Risk-Based Framework.	The author team feels that KM1.1 and KM1.2 are clear as written.
John	Christy	Whole Chapter	02. Climate Trends						These are references cited in my comments for Chapter 2 References Christy, J.R., W.B. Norris, K. Redmond and K. Gallo, 2006: Methodology and results of calculating central California surface temperature trends: Evidence of human-induced climate change? J. Climate, 19, 548-563. Christy, J.R., W.B. Norris and R.T. McNider, 2009: Surface temperature variations in East Africa and possible causes. J. Clim. 22, DOI: 10.1175/2008JCLI2726.1. Christy, J.R., 2013: Monthly temperature observations for Uganda. J. Applied Meteor. Clim. 52, 2363-2372. DOI: 10.1175JAMC-D-13-012.1. Christy, J.R. and R.T. McNider, 2016: Time series construction of summer surface temperature for Alabama, 1883-2014, and comparisons with tropospheric temperatures and climate model simulations. J. Appl. Meteor. Climatol., 55, DOI:10.1175/JAMC-D-15-0287.1 Christy, J.R. and R.T. McNider, 2017: Satellite bulk tropospheric temperatures as a metric for climate sensitivity. A-P J. Atmos. Sci., 53(4), 1-8, DOI:10.1007/s13143-017-0070-z. Christy, J.R., R.W. Spencer, W.D. Braswell and R. Junod, 2018: Examination of space-based bulk atmospheric temperatures for climate research. Int. J. Remote Sens., 39:11, 3580-3607, DOI:10.1080/01431161.2018.1444293. Kim, D. and J.R. Christy: 2022: Detecting impacts of surface development near weather stations since 1895 in the San Joaquin Valley of California. J. Theor. App. Climatology, DOI: 10.1007/s00704-022-04107-3. Lindstrom, S.G., 1990: Submerged tree stumps as indicators of Mid-Holocene aridity in the Lake Tahoe Basin. J. Calif. and Great Basin Anthro. 12(2). McKitrick, R. and J.R. Christy, 2019: Assessing changes in US regional precipitation on multiple time scales. J. Hydro. 578, (2019), DOI.ORG/10.1016/j.jhydrol.2019.124074. Morgan, C. and M.M. Pomerleau, 2012: New evidence for extreme and persistent terminal medieval drought in California's Mt. Sierra Nevada. J. Paleolimno. 47:2020.7313. https://doi.org/10.1007/s10933	Authors have reviewed the references supplied, as they relate to comments scattered throughout the collation.
Joel	Lisonbee	Whole Chapter	02. Climate Trends						Thanks for the opportunity to comment. The term "flash drought" should be used to describe the rate of drought onset or intensification and should not be used to denote a short-duration drought event. More information about this distinction can be found in Otkin et al. (2022: https://journals.ametsoc.org/view/journals/bams/103/10/BAMS-D-21-0288.1.xml) On page 2-16 on lines 20-22 it mentions "These events [flash droughts] are relatively short-lived". But this is not always the case as the 2012 central US drought began as a flash drought but lasted for over a year. The 2017 upper mid-west flash drought also lasted through the growing season. There is an example of a flash drought in Australia that began rapidly and lasted 3+ years (Nguyen et al. 2019: https://doi.org/10.1088/1748-9326/ab2103). On page 2-32 on lines 19-20 flash drought is mentioned as the opposite of a multidecadal megadrought. This should probably read "...drought and can be defined on timescales ranging from several weeks to multidecadal megadroughts." A review paper by Lisonbee et al. 2021 (https://stateclimate.org/pdfs/journal-articles/2021_1-Lisonbee.pdf) talks about the difficulties in defining flash drought and the ambiguity of the term that has perpetuated in the literature.	Thanks for this comment. The writing team agrees that the previous text was unclear, and have revised it to clarify that "flash drought" refers to rapid onset or intensification. Authors have deleted "relatively short-lived", added Otkin 2022 and Lisonbee 2021 to the reference list, and revised the sentence on page 2-32 as suggested.
Craig	Hanna	Whole Chapter	02. Climate Trends						Throughout Chapter 2 Climate Trends and Appendix 4 Indicators, NCA5 primarily focuses on the need for and use of appropriate metrics to monitor changes in the physical, ecological, and societal systems associated with climate change. Along with the institutions mentioned in page 3 of Appendix 4, Indicators, the American Academy of Actuaries---in conjunction with the major professional actuarial organizations in North America (the Casualty Actuarial Society, the Society of Actuaries, and the Canadian Institute of Actuaries)---has developed the ACI, which is an objective indicator of the frequency of extreme weather and sea level changes. The latest methodological version, ACI 1.1, has been active since April 2019 and is updated on a quarterly basis. Unlike some of the trends mentioned in NCA5, the ACI specifically measures deviations from a reference period to highlight the extremes rather than other measures such as longer-term averages or cumulative annual amounts. The ACI can be viewed in total, broken down into its constituent six parts, and/or viewed by the 12 different regions within the United States and Canada. Underlying parts of the index is data derived from the National Oceanic and Atmospheric Administration's (NOAA's) Global Historical Climatology Network dataset, as well as reanalysis data from NOAA's National Centers for Environmental Prediction.¬†	Noted. ACI 1.1 is somewhat akin to the U.S. Climate Extremes Index (CEI) proposed by Karl et al. (1986), which has the goal of summarizing and presenting a complex set of multivariate and multidimensional climate changes in the United States. Multivariate indices like ACI and CEI have utility in communicating changes in extremes, but Chapter 2 focuses primarily on univariate metrics of change, which are generally easier to interpret by nonspecialists.
Craig	Hanna	Whole Chapter	02. Climate Trends						Chapter 2 Climate Trends and Appendix 4 Indicators: The Actuaries Climate Index (ACI) and the Actuaries Climate Risk Index (ACRI) are additional sources of information that aggregate data on the trends noted within the chapter but are related to specific reference periods, thus providing additional perspectives on the impacts of the trends.	Noted. ACI 1.1 is somewhat akin to the U.S. Climate Extremes Index (CEI) proposed by Karl et al. (1986), which has the goal of summarizing and presenting a complex set of multivariate and multidimensional climate changes in the United States. Multivariate indices like ACI and CEI have utility in communicating changes in extremes, but Chapter 2 focuses primarily on univariate metrics of change, which are generally easier to interpret by nonspecialists.
Andrew	Carleton	Whole Chapter	02. Climate Trends						A comprehensively written chapter on climate trends. For the most part, my specific text region comments are minor edits and a couple of suggestions to link a given concept back to what was already mentioned earlier in the chapter (e.g., agricultural drought).	Thank you for the feedback!

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Doug	Robbins	Whole Chapter	02. Climate Trends						Sea level is a proxy for global climate, rising or falling according to volumes of grounded ice and ocean temperature. Studies (Lambeck et al, 2014, Rohde, unpublished metastudy) show that sea level has been stable for the past 6000 years after rising rapidly during deglaciation. The stability of the global climate for the past 6000 years refutes the suggestion that current trends are the result of natural cycles.	It is unclear what this comment is suggesting to change in the current text, so authors note the point and that nothing in this comment is contradicted by the sea level text as written.
Doug	Robbins	Whole Chapter	02. Climate Trends						The confidence and likelihood scale adopted for NCA5 (Mastandrea, 2011) has an insufficient range to appropriately communicate the likelihood of key findings in the report. The assigned probabilities of ‚Äúvirtually certain, very high confidence,‚Äù and ‚Äúextremely unlikely,‚Äù fail to capture higher and lower probabilities which would provide meaningful information to the reader. As an example, the lifetime probability for an individual of dying in a car wreck (1:107) would be given the same description (‚Äúextremely unlikely,‚Äù) as the probability of being eaten by a T-Rex. The difference in the likelihood of these events is materially significant for policy and individual behavior. An extended range of likelihood categories or guidance on the assignment of unequivocal fact would address this problem.	Authors have been instructed to use the IPCC uncertainty and confidence lexicon for report standardization. However, in response to comments such as yours and by the National Academies peer review, the use of terms like "unequivocal" have been endorsed by program leadership to capture established fact.
Stephen	Penningroth	Whole Chapter	02. Climate Trends						Chapter 2, Climate Trends, does a good job of describing the parameters of climate change, the growing risks of extreme weather events, and projections of temperature increases under different Shared Socioeconomic Pathways. What is lacking is a sense of the clear and present dangers to humanity and our global civilization inherent in temperature increases of 4 C or more projected by the IPCC. Chief among these dangers are irreversible tipping points that have the potential to push parts of the climate system to new states that may lock in continued warming beyond humanity's capacity to mitigate or adapt to. Chapter 2 mentions tipping elements briefly, citing papers from 2008 and 2016 and referencing a forthcoming publication by Wang et al. on "proposed regional tipping elements." Be this unpublished manuscript as it may, there are recent articles that address the risk of crossing regional tipping points beginning as low as 1.5 C: Armstrong McKay et al, Exceeding 1.5 C Global Warming Could Trigger Multiple Climate Tipping Points. Science, 9 September 2022, https://www.science.org/doi/10.1126/science.abn7950; and Wunderling et al, Global Warming Overshoots Increase Risk of Climate Tipping Cascades in a Network Model. Nature Climate Change, 22 December 2022, https://www.nature.com/articles/s41558-022-01545-9. There is also a growing scientific consensus that regardless of how fast emissions are reduced, temperatures will overshoot 1.5 C for some unknown length of time because of the imbalance that past emissions have already built into earth's energy system, e.g., Hansen et al, Global Warming in the Pipeline, https://arxiv.org/abs/2212.04474v2. Awareness of the risk that increasing temperatures are driving the climate toward tipping points that pose an existential threat to human civilization has led some scientists to advocate for restoring the climate through a combination of reducing emissions, removing GHGs, and cooling the planet through solar radiation management, beginning with refreezing the Arctic. Examples are the Centre for Climate Repair at Cambridge University in England founded by Sir David King, https://www.climaterepair.cam.ac.uk/; the Healthy Planet Action Coalition, https://www.healthyplanetaction.org/; and Mirrors for Earth's Energy Rebalancing, meer.org. The urgent	The Armstrong McKay et al paper was not published at the time the third-order draft was finalized. Authors have added a reference to it in the section on climate tipping elements in the fourth-order draft. The reviewer's question about solar radiation management is beyond the scope of the chapter.
Reid	Sherman	Whole Chapter	02. Climate Trends						Did not find a mention of traditional environmental knowledge in trends chapter -- even for qualitative information.	The complexities of TEK and the wide range of peoples, cultures, and individuals who are in posession of such knowledge mean that it deserves a comprehensive, respectful, and nuanced treatment that is simply not possible within the word limits of this chapter. Authors agree that it is important to acknowledge these modes of knowing, but this is best addressed in sectional and regional chapters that can do justice to this knowledge.
Deirdre	DesJardins	Whole Chapter	02. Climate Trends						This chapter should reference the divergence between observations of Tropical Pacific sea surface temperatures and other variables and climate model projections. At this point the possibility that the climate models are either not capturing a transient La-Nina like response or underrepresenting internal variability creates deep uncertainty in regional projections of future precipitation trends. For more details, see the synthesis on NOAA's ENSO blog: How the pattern of trends across the tropical Pacific Ocean is critical for understanding the future climate https://www.climate.gov/news-features/blogs/how-pattern-trends-across-tropical-pacific-ocean-critical-understanding-future As Lee et al. state in On the future zonal contrasts of equatorial Pacific climate: Perspectives from Observations, Simulations, and Theories https://www.nature.com/articles/s41612-022-00301-2 the challenge ahead is to determine whether the observed record of a strengthening zonal SST gradient is indeed a forced response, or a product of natural variability on decadal and longer timescales, or perhaps even misleading due to data and sampling problems. Next, if it can be deduced that the observed strengthening is indeed forced, then why is it not simulated by climate models? Alternatively, if it can be concluded that the observed record is dominated by natural variability, can models reproduce this variability, and when will a forced signal emerge? Answering these questions requires a fundamental analysis of mechanisms of variability and change in observations and models, considering all the relevant physical processes. This work must be open to the idea that climate models, as currently formulated, may be deficient in their representations of past and future changes in tropical Pacific climate. Until this issue is resolved, many aspects of future projections that are strongly influenced by the tropical Pacific ‚Äì including future regional climate, teleconnected climate risks, and the oceanic uptake of CO2 ‚Äì will be highly uncertain.	We agree that this poses issues regarding model credibility. However, it is outside the scope of this chapter. Because the pattern effect and models' ability to capture observed SST patterns are active areas of study, this information is best discussed in Chapter 3, Earth System Processes.
Rachel	Licker	Text Region	03. Earth System Processes		3	22	3	25	It would be powerful and accurate to include the role of fossil fuel burning in this Key Message. For instance, the first sentence could be edited to "Human activities--primarily emissions of greenhouse gases from fossil fuel use--have caused..." Ensuring that fossil fuels are mentioned in high-profile places like KMs will help to build industry accountability for climate change.	The chapter text has been revised to incorporate the suggestion.
Andrew	Carleton	Text Region	03. Earth System Processes		3	3	10	11	As a general statement, probably should reverse the order here to warms the surface and the air, which is more correct physically and on average in terms of solar radiation absorption at the surface and reradiation of longwave and the convective fluxes.	The order has been reversed as suggested.
Nick	Procopio	Text Region	03. Earth System Processes		3	3	12	12	Change "including changes in circulations" to "including changes in circulation." The word "circulation" should be singular.	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		3	3	12	12	Specify as atmospheric and oceanic circulations.	Done.
Reid	Sherman	Text Region	03. Earth System Processes		3	3	13	13	Replace "ice caps" with ice sheets for consistency with previous chapters, Figure 3.10, and Cryosphere section of this chapter. Also recommend a search in this document for similar terms.	Replaced "ice caps" with "ice sheets".

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Doug	Robbins	Text Region	03. Earth System Processes		3	3	21	23	The confidence statement for global warming in Key Message 3.1 should be strengthened to ‚Äúunequivocal,Äù. Evidence that rising CO2 is of human origin includes quantified estimates of emissions from multiple analyses, observations on various geographic and temporal scales connecting human sources of CO2 with rising atmospheric CO2, depletion of atmospheric oxygen in stochiometric agreement with estimates of fossil fuel consumption and deforestation, atmospheric carbon isotope changes consistent with fossil fuel origins, and the geographic distribution of changes in CO2, oxygen, and carbon isotopes consistent with fossil fuel emissions in the Northern Hemisphere, dispersing to the Southern Hemisphere over time. Exchanges between atmosphere and carbon sinks, mentioned as a source of uncertainty on pages 3-35 and 3-36, do not show evidence of seasonal or long-term instability changing the accumulation of CO2 in the atmosphere. There are no credible alternate theories, observations, or quantification for any competing explanation for rising CO2 other than human activities. Any alternate process for generating CO2 and heat also requires an additional process for the disposition of known anthropogenic CO2 and heat. The likelihood of two unobserved processes working in conjunction is orders of magnitude smaller than 1%. Chapter 2 states that it is unequivocal that warming increases with GHG emissions (page 2-37), so anthropogenic warming should also be considered unequivocal.	The word "unequivocally" has been added to KM3.1 to strengthen it and maintain consistency with KM 2.1 in Chapter 2.
Doug	Robbins	Text Region	03. Earth System Processes		3	3	21	23	In June, 1988, NASA physicist James Hansen testified to the US Senate that NASA was 99% certain that greenhouse gases of human origin, primarily CO2, were already warming the earth. Thirty five years later, the NCA5 3rd draft concludes that there is a 99% likelihood that greenhouse gases are of human origin, and a 99% likelihood that greenhouse gases are warming the earth. These two points are fundamental to our entire understanding of climate change. Why, after 35 years, have these two central assertions not been confirmed as unequivocal scientific fact? What possible additional work needs to be done, and why has it not already been accomplished? NCA5 is a call to undertake a staggering restructuring of society. Is it not reasonable for society to demand that the basis for these changes be determined to be true beyond reasonable doubt, and confirmed as unequivocal fact? The claim of "very high confidence", according to the uncertainty framework for NCA5 (Mastandrea, 2011) is no better than the confidence that three 9s will win a hand of 5 card stud poker. We have a right to expect more from this report. Without a clear statement of fact on its most fundamental claim, NCA5 is not relevant for policy. Society is out of patience, and we are practically out of time to make the necessary transition to a carbon-free economy.	The word "unequivocally" has been added to KM3.1 to strengthen it and maintain consistency with KM 2.1 in Chapter 2.
Ross	McKitrick	Text Region	03. Earth System Processes		3	3	22	25	It is understandable that language around attribution reflects high confidence because the climatology literature has been stuck for decades in the optimal fingerprinting paradigm associated with Allen and Tett (1999) and Allen and Stott (2003). Repeated applications of the method keeps generating positive findings; the problem is that the propensity of the method to generate false positives has only just started to be revealed. A clue to the problem was raised in Jones et al (2016) where it was note that the 2-variable (ANTH+NAT) signal detection regression seemed to yield significance but the 3-variable version (GHG+AERO+NAT) generally failed, even though the effects of the anthropogenic forcings were supposedly well-understood in each case. They raised, without answering, the question of whether the method is flawed. In McKitrick (2021) I have showed that the theory underlying the methods is indeed flawed. Allen and Tett (1999) introduced a biased and inconsistent estimator and misapplied the Gauss-Markov Theorem to erroneously claim it was valid. They also proposed a meaningless test that provides no information about whether fingerprinting regressions are misspecified. Note that my paper has been in print for a year and a half and Allen and Tett have declined to reply. In McKitrick (2022) I showed that the Total Least Squares algorithm of Allen and Stott (2003) also yields positively biased results when the signal detection regression is underspecified and the signals are negatively correlated. Optimal fingerprinting studies assume that the noise variances across models are all equal and all correspond to those in the observed climate, and on this basis TLS yields unbiased coefficients. But if the assumption is not true (which is likely the case) TLS is extremely unstable and biased. Taken together these papers show that the extensive application of TLS along with the Allen-Tett matrix weighted regression method (even using regularization methods rather than the Moore-Penrose pseudo inversion recommended by Allen and Tett to generate the matrix weights) yields biased and inconsistent results prone to false positives. 1/3	The reviewer's claim that "temperatures and anthropogenic forcings differ by one or more orders of integration which implies they are empirically independent" is false. This conclusion could only be valid in the limit of long time scales -- i.e., you can't determine orders of cointegration in noisy short timeseries like temperature even if dependence would be CO2 quadratic, but of course it is not. It is well known that radiative forcing depends approximately on the logarithm of CO2 and at current concentrations weakly sublinear (Myhre et al. 2006; Xhang and Haigh 2013). This comment continues to miss the point as there are multiple lines of evidence for the attribution of a significant human influence on global mean surface air temperature. IPCC AR6 WGI Chapter 3 (Section 3.3.1.1) discusses the issue in depth. In fact, some of these lines of evidence do not rely on regression techniques. For instance Ribes et al. (2017) present a statistical method without regression, concluding "We find that most of the observed warming over this period (+0.65 K) is attributable to anthropogenic forcings (+0.67 ± 0.12 K, 90% confidence range), with a very limited contribution from natural forcings (−0.01 ± 0.02 K)." Regarding the issues surrounding regression, this has also been examined in multiple papers. Most recently, Cummins et al. (2022) considered whether attribution via regression might be spurious. They conclude "It is therefore concluded that, at least in the case of GMST, detection and attribution of climate change trends is very likely not spurious regression. Furthermore, detection of significant cointegration between observations and model output indicates that the least-squares estimator is "superconsistent", with better convergence properties than might previously have been assumed." Authors believe the criticism of Cummins et al. unfounded and cannot consider unpublished work in any event according the NCA5 guidelines. The comment also mischaracterizes the findings of Phillips et al. (2020) which states: "The findings indicate that 7 out of 9 of the GCM reported TCS values lie within the 95% empirical confidence interval computed econometrically from the GCM output." Hence, the statements in KM3.1 are robust and require no modification. Citations: Cummins, D.P., Stephenson, D.B. & Stott, P.A. Could detection and attribution of climate change trends be spurious regression? Clim Dyn 59, 2785–2799 (2022). https://doi.org/10.1007/s00382-022-06242-z. Myhre, G., F. Stordal, I. Gausemel, C. J. Nielsen, and E. Mahieu (2006), Line-by-line calculations of thermal infrared radiation representative for global condition: CFC-12 as an example, J. Quant. Spectrosc. Radiat. Transfer, 97, 317–331, doi:10.1016/j.jqsrt.2005.04.015. Ribes, A., Zwiers, F.W., Azais, JM. et al. A new statistical approach to climate change detection and attribution. Clim Dyn 48
Ross	McKitrick	Text Region	03. Earth System Processes		3	3	22	25	Meanwhile in the econometrics literature a different challenge has emerged related to the fact that temperatures and anthropogenic forcings differ by one or more orders of integration which implies they are empirically independent. Beenstock (2012), Balcombe et al. (2019) and Razzak (2022) have all shown that anthropogenic forcings exhibit I(1) or I(2) nonstationarity while temperatures and natural forcings are are either trend stationary (I(0) around a trend) or I(0). This would be consistent with anthropogenic forcing dominating the temperature data only if anthropogenic forcings and temperatures are cointegrated but these authors have found this not to be the case; likewise Philips et al (2020) failed to find direct cointegration between anthropogenic forcings and temperatures. Cummins et al (2022) cast the signal detection problem into a cointegrating regression form which implies that if temperatures are I(1) then signal detection regressions are potentially consistent but not if temperatures are I(0). They did not test their temperature series. I have done so for a paper currently under review and found they are I(0), which implies the parameter in their attribution model measuring sensitivity to greenhouse gases must be zero. You should be aware that these challenges to the confidence of attribution exist. It has taken 20 years for people outside the field of climatology to begin digging seriously into the subject. Ideally climatologists would have done so already but these analyses require specific training in advanced regression methods and it is apparently uncommon for people in the climate field to have such training. 2/3	The reviewer's claim that "temperatures and anthropogenic forcings differ by one or more orders of integration which implies they are empirically independent" is false. This conclusion could only be valid in the limit of long time scales -- i.e., you can't determine orders of cointegration in noisy short timeseries like temperature even if dependence would be CO2 quadratic, but of course it is not. It is well known that radiative forcing depends approximately on the logarithm of CO2 and at current concentrations weakly sublinear (Myhre et al. 2006; Xhang and Haigh 2013). This comment continues to miss the point as there are multiple lines of evidence for the attribution of a significant human influence on global mean surface air temperature. IPCC AR6 WGI Chapter 3 (Section 3.3.1.1) discusses the issue in depth. In fact, some of these lines of evidence do not rely on regression techniques. For instance Ribes et al. (2017) present a statistical method without regression, concluding "We find that most of the observed warming over this period (+0.65 K) is attributable to anthropogenic forcings (+0.67 ± 0.12 K, 90% confidence range), with a very limited contribution from natural forcings (−0.01 ± 0.02 K)." Regarding the issues surrounding regression, this has also been examined in multiple papers. Most recently, Cummins et al. (2022) considered whether attribution via regression might be spurious. They conclude "It is therefore concluded that, at least in the case of GMST, detection and attribution of climate change trends is very likely not spurious regression. Furthermore, detection of significant cointegration between observations and model output indicates that the least-squares estimator is "superconsistent", with better convergence properties than might previously have been assumed." Authors believe the criticism of Cummins et al. unfounded and cannot consider unpublished work in any event according the NCA5 guidelines. The comment also mischaracterizes the findings of Phillips et al. (2020) which states: "The findings indicate that 7 out of 9 of the GCM reported TCS values lie within the 95% empirical confidence interval computed econometrically from the GCM output." Hence, the statements in KM3.1 are robust and require no modification. Citations: Cummins, D.P., Stephenson, D.B. & Stott, P.A. Could detection and attribution of climate change trends be spurious regression? Clim Dyn 59, 2785–2799 (2022). https://doi.org/10.1007/s00382-022-06242-z. Myhre, G., F. Stordal, I. Gausemel, C. J. Nielsen, and E. Mahieu (2006), Line-by-line calculations of thermal infrared radiation representative for global condition: CFC-12 as an example, J. Quant. Spectrosc. Radiat. Transfer, 97, 317–331, doi:10.1016/j.jqsrt.2005.04.015. Ribes, A., Zwiers, F.W., Azais, JM. et al. A new statistical approach to climate change detection and attribution. Clim Dyn 48

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Ross	McKitrick	Text Region	03. Earth System Processes		3	3	22	25	References: Balcombe, Kevin, Iain Fraser and Abhijit Sharma (2019) Is radiative forcing cointegrated with temperature? A further examination using a structural time series approach." Management of Environmental Quality 30(5) DOI 10.1108/MEQ-12-2018-021. Beenstock, M., Y. Reingewertz and N. Paldor (2012). ¬ìPolynomial cointegration tests of anthropogenic impact on global warming." Earth System Dynamics 3:173-188 doi:10.5194/esd-3-173-2012 Cummins, D., D.B. Stephenson and P.A. Stott. (2022). ¬ìCould detection and attribution of climate change trends be spurious regression?" Climate Dynamics March 2022 https://doi.org/10.1007/s00382-022-06242-z McKitrick, Ross R (2022) On the choice of TLS versus OLS in climate signal detection regression. Climate Dynamics 10.1007/s00382-022-06315-z McKitrick, Ross R (2021) Checking for Model Consistency in Optimal Fingerprinting: A Comment. Climate Dynamics August 2021 https://doi.org/10.1007/s00382-021-05913-7 Phillips, P.C.B., T. Leirvik and T. Storelvmo (2020) ¬ìEconometric estimates of Earth¬ís transient climate sensitivity" Journal of Econometrics 214 pp. 6¬ó32. https://doi.org/10.1016/j.jeconom.2019.05.002 Razzak, Weshah A. (2022). "The Econometrics of Global Warming," Journal of Economics and Econometrics, vol. 65(2), pages 13-47. 3/3	This comment is listing the references cited in Comment IDs 174936 and 174937, which have been considered by the writing team.
Michael	Jasinski	Text Region	03. Earth System Processes		3		24		Please add after ICESat-2 the citation: Markus et al. 2017	The citation has been added.
Rachel	Licker	Text Region	03. Earth System Processes		4	18	4	18	Suggest "absorbed by" rather than "removed by" since the carbon remains in the oceans and land (therefore isn't really "removed").	The chapter text has been revised to incorporate the suggestion.
Rachel	Licker	Text Region	03. Earth System Processes		4	31	4	31	The comma after "CH4" looks like it's in subscript. Edit to regular script.	Noted. The TSU editorial staff will perform a thorough copyedit.
Rachel	Licker	Text Region	03. Earth System Processes		4	36	5	4	"HCFCs" is not defined in the list in the first sentence of this paragraph, but should be since it is referred to on page 5, line 3.	Noted. The TSU editorial staff will perform a thorough copyedit.
Reid	Sherman	Text Region	03. Earth System Processes		4	4	6	6	Suggest use of a Figure or Table for this information for WMGHG.	The author team decided not to add a table due to space limitations.
Gabrielle	Dreyfus	Text Region	03. Earth System Processes		4	4	11	14	v¢¬Ã¬úPreindustrial to present day (1750v¢¬Ã¬ì2019) increases in WMGHGs contributed 11 the bulk of the total human-caused forcing, with increases in CO2 contributing an ERF of 2.16 vÇ¬± 0.26 Wmv¢¬Ã¬ì2, followed by 0.54 vÇ¬± 0.11 Wmv¢¬Ã¬ì2 from CH4, 0.41 vÇ¬± 0.08 Wmv¢¬Ã¬ì2 from halogenated compounds, and 0.21 vÇ¬± 0.03 Wmv¢¬Ã¬ì2 from N2O (Forster et al. 2021).v¢¬Ã¬ù COMMENT: This radiative forcing account by concentration rather than by emission excludes the contribution to radiative forcing from O3 resulting from CH4 emissions. Recommend adding a sentence noting that the total radiative forcing directly and indirectly attributable to methane emissions is 1.21 (0.90 to 1.51) W m-2 for emission-based estimate versus 0.54 W m-2 for abundance-based estimate (Szopa et al. 2021). CITE: Szopa S., et al. (2021) Chapter 6: Short-lived climate forcers, in CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS, Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Masson-Delmotte V., et al. (eds.), 6-47 (v¢¬Ã¬úFor methane emissions, in addition to their direct effect, there are indirect positive ERFs from methane enhancing its own lifetime, causing ozone production, enhancing stratospheric water vapor, and influencing aerosols and the lifetimes of HCFCs and HFCs (Myhre et al., 2013b; Ov¢¬Ã¬öConnor et al., 2021). The ERF from methane emissions is considerably higher than the ERF estimate resulting from its abundance change. The central estimate with the very likely range is 1.21 (0.90 to 1.51) W m-2 for emission-based estimate versus 0.54 W m-2 for abundance-based estimate (cf. section 7.3.5). The abundance-based ERF estimate for CH4 results from contributions of its own emissions and the effects of several other compounds, some decreasing CH4 lifetime, notably NOx, which importantly reduce the CH4 abundance-based ERF.v¢¬Ã¬ù). See also Mar K. A., Unger C., Walderdorff L. & Butler T. (2022) Beyond CO2 equivalence: The impacts of methane on climate, ecosystems, and health, ENVIRON. SCI. POLICY 134: 127v¢¬Ã¬ì136, 129 (see Table 1 on Present-day anthropogenic radiative forcing directly and indirectly attributable to CH4 and its chemistry, showing that the radiative forcing contributed by methane to ozone formation, CO2 formation, increased stratospheric water vapor, and reduction in sulfate aerosol formation are 0.241 W m-2, 0.018 W m-2, 0.05 W m-2, and 0.1 W m-2, respectively, in	The paragraph has been revised to note the difference between abundance- and emissions-based ERF estimates which are discussed in more detail in a subsequent paragraph. Szopa et al. (2021) has been cited in the text discussing indirect effects.
Gabrielle	Dreyfus	Text Region	03. Earth System Processes		4	4	22	24	v¢¬Ã¬úObservational evidence points to microbial sources (agriculture, waste, and wetlands) as the predominant cause of the increase in global growth in atmospheric CH4 since 2006 (Schaefer et al. 2016; Lan et al. 2021).v¢¬Ã¬ù COMMENT: Given the active research on drivers of year-to-year variability in methane growth rate, consider rephrasing that differentiates between anthropogenic and natural drivers along the lines of: v¢¬Ã¬úWhile anthropogenic emissions primarily from agriculture and waste and secondarily from energy production are likely the main cause of increasing atmospheric methane levels over the last two decades, natural sources of methane appear to be increasing emissions as part of wetlands and permafrost feedbacks.v¢¬Ã¬ù CITE: Other studies suggest a more limited increase in recent emissions from natural wetlands compared to agriculture and waste and energy production sectors, as well as reductions in atmospheric oxidative capacity. See Zhang Z., et al. (2021) Anthropogenic emissions are the main contribution to the rise of atmospheric methane (1993-2017), NATv¢¬Ã¬ôL SCI. REV. 9(5): nwab200, 1v¢¬Ã¬ì13, 1 (v¢¬Ã¬úOur emission scenarios that have the fewest biases with respect to isotopic composition suggest that the agriculture, landfill, and waste sectors were responsible for 53vÇ¬±13% of the renewed growth over the period 2007-2017 compared to 2000-2006; industrial fossil fuel sources explained an additional 34vÇ¬±24%, and wetland sources contributed the least at 13vÇ¬±9%. The hypothesis that a large increase in emissions from natural wetlands drove the decrease in atmospheric vé¬¥13C-CH4 values cannot be reconciled with current process-based wetland CH4 models. This finding suggests the need for increased wetland measurements to better constrain the contemporary and future role of wetlands in the rise of atmospheric methane and climate feedbacks. Our findings highlight the predominant role of anthropogenic activities in driving the growth of atmospheric CH4 concentrations.v¢¬Ã¬ù). See also United Nations Environment Programme (2021) EMISSIONS GAP REPORT 2021: THE HEAT IS ON v¢¬Ã¬ì A WORLD OF CLIMATE PROMISES NOT YET DELIVERED, 47 (v¢¬Ã¬úOver the last two decades, the main cause of increasing atmospheric methane is likely increasing anthropogenic emissions, with hotspot contributions from agriculture and waste in South and South East Asia, South America and Africa, and	The content of the chapter has changed. The sentence about what is driving the observed increase of methane over the last two decades has been modified to: "Observational evidence points to microbial sources (agriculture, waste, and natural wetlands) as the predominant cause of the increase in global growth in atmospheric CH4 since 2006 (Schaefer et al. 2016; Lan et al. 2021) with a smaller contribution from fossil fuel production." Authors added an explicit mention of possible changes in natural emissions by including the term "natural" in front of wetlands. There is currently not strong evidence of permafrost driving observable changes in atmospheric methane. Authors also included mention of a role for increases due to fossil fuels. According to atmospheric inversions, the breakdown is thought to be roughly 80% microbial and 20% fossil (Basu et al., 2022).

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Gabrielle	Dreyfus	Text Region	03. Earth System Processes		4	4	25	30	v¢~Ã¬úIn addition to its direct effect on radiative forcing, CH4 also has an indirect influence through its chemical effects on other climate drivers including CO2, ozone, stratospheric water vapor, aerosols, and halogenated gases. This leads to an increased effect of CH4 on the amount of energy trapped in the Earth system. Over 100 years, a given mass of CH4 emissions is about 30 times more efficient at trapping energy in the climate system than the same emitted mass of CO2 (Forster et al. 2021).v¢~Ã¬ù COMMENT: Recommend also adding a sentence on the 20-year impact being over 80 times greater, as this is an relevant metric when considering mitigation strategies that can slow warming in the near term, as highlighted in Chapter 1 and Chapter 14. Also see comment above for integrating the information on indirect influence by adding a sentence in the earlier paragraph on radiative forcing noting that the total radiative forcing directly and indirectly attributable to methane emissions is 1.21 (0.90 to 1.51) W m-2 for emission-based estimate versus 0.54 W m-2 for abundance-based estimate (Szopa et al. 2021). CITE: Szopa S., et al. (2021) Chapter 6: Short-lived climate forcers, in CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS, Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Masson-Delmotte V., et al. (eds.), 6-47 (v¢~Ã¬úFor methane emissions, in addition to their direct effect, there are indirect positive ERFs from methane enhancing its own lifetime, causing ozone production, enhancing stratospheric water vapor, and influencing aerosols and the lifetimes of HCFCs and HFCs (Myhre et al., 2013b; Ov¢~Ã¬ôConnor et al., 2021). The ERF from methane emissions is considerably higher than the ERF estimate resulting from its abundance change. The central estimate with the very likely range is 1.21 (0.90 to 1.51) W m-2 for emission-based estimate versus 0.54 W m-2 for abundance-based estimate (cf. section 7.3.5). The abundance-based ERF estimate for CH4 results from contributions of its own emissions and the effects of several other compounds, some decreasing CH4 lifetime, notably NOx, which importantly reduce the CH4 abundance-based ERF.v¢~Ã¬ù).	The chapter text has been revised to incorporate the suggestion.
Gabrielle	Dreyfus	Text Region	03. Earth System Processes		4	4	35	37	v¢~Ã¬úWMGHGs also include many manufactured gases with atmospheric lifetimes greater than several decades, such as sulphur hexafluoride (SF6), hydrofluorocarbons (HFCs), chlorofluorocarbons (CFCs), and perfluorocarbons (PFCs).v¢~Ã¬ù COMMENT: Do you mean v¢~Ã¬úhydrochlorofluorocarbons (HCFC)v¢~Ã¬ù here in place of HFCs which have a weighted average lifetime of 15 years?	All halogenated compounds are considered here, including HCFCs. Authors have clarified that the lifetimes for the compounds range from months to decades encompassing the short-lived and long-lived forcings.
Rachel	Licker	Text Region	03. Earth System Processes		5	11	5	13	This section should describe ozone production in the stratosphere as well, since the second half of the paragraph deals exclusively with stratospheric ozone, which is produced differently than it is in the troposphere.	The chapter text has been revised to incorporate the suggestion.
Jesse	Freeman	Whole Page	03. Earth System Processes		6				s	
Thomas	Knutson	Figure	03. Earth System Processes		7		1		Fig. 3.1: It would be useful to show observed global mean temperature as an additional curve on panel (c) as well as in panel (a).	The figure has been revised to incorporate the suggestion.
David	Dokken	Figure	03. Earth System Processes		7	7	1	7	Update Figure 3.1c to show attributed GSAT change relative to 1850-1900 period to ensure consistency with Figure 3.1a,b	The figure has been revised to incorporate the suggestion.
Rachel	Licker	Figure	03. Earth System Processes		7	1	7	7	The abbreviation "anthro" may not be intuitive to lay audiences and is not defined in the caption. Suggest either spelling out "anthropogenic" or defining the word in the caption.	The figure has been revised to incorporate the suggestion.
John	Christy	Whole Page	03. Earth System Processes		7				Climate drivers********** As I,Âve indicated earlier, knowing the ‚Äúwhy‚Äù of climate change is far more uncertain than this document suggests. NCA 3OD Fig. 3.1 (a reconstruction of IPCC AR6 Fig. 3.8) demonstrates this lack of understanding. Firstly, the aerosol-cooling ‚Äúdriver,Âù in models is not well-known. The impact of aerosols computed as a temperature change over the past 100+ years in the CMIP-6 models (from AR6 Fig. 3.8) range from -1.0 to +0.1¬∞¬∞C. This represents a 200% range of uncertainty in the response relative to the median value, and even then it is not known if the actual value is within this range. This is a metric that is not directly measurable and so is essentially guestimated. Thus, this easily demonstrates, using AR6 (and NCA5) information that the ‚Äúwhy‚Äù due to the aerosol ‚Äúdriver,Âù is not as well-known as claimed. The uncertainty of the GHG ‚Äúdriver,Âù (response) over the past 100+ years is similarly murky. The models range in response from +1.0 to +2.2¬∞¬∞C ‚Äì a range of uncertainty of over 1¬∞¬∞C, or 65% of the median. As AR6 Fig. 3.8 shows, even by significant ‚Äútuning,Âù the models (see below on tuning), many fall outside of the target temperature range (which was known ahead of time, so there should be no surprise that many models came close). Thus, it is easy to demonstrate from AR6 (and NCA5) that the ‚Äúwhy‚Äù due to GHG ‚Äúdriver,Âù is not well-known as claimed. [JRC FIG. 6 IN SEPARATE SUPPLEMENTARY ATTACHMENT FILE: ChristyJR_NCA5_3OD_comments_2023_Ch_3.pdf] JRC Fig 6. Copy of Fig. 3.8 IPCC AR6 with annotations that explain the diagram and text. One clear example of the scientific uncertainty is found in the highly regarded HadGEM3-OC31-LL model. This model,Âös aerosol ‚Äúdriver,Âù equates to -1.0 ¬∞¬∞C (too cold?), but its GHG ‚Äúdriver,Âù is +2.0 ¬∞¬∞C (too hot?) which when added together, lands the outcome at +1.0 ¬∞¬∞C (‚Äújust right?‚Äù). The models have such wide ranges in the response to the ‚Äúdrivers,Âù that the conclusion must be there are significant uncertainties in how the aerosols and GHGs impact the climate system, not to mention the physical thermodynamical/dynamical processes. This is clear evidence that ‚Äúscientists,Âù do not understand ‚Äúwhy‚Äù the climate system behaves as it does ‚Äì very well at all	The uncertainty in ECS is discussed in the subsection on Climate Sensitivity and Climate Feedback. While it is clear that uncertainty in aerosol forcing remains large, the errors in the Sherwood et al. (2020) paper have been corrected as indicated in the version currently online. The authors note that none of the errors affected their final results. The most egregious error was in the context of a supporting argument. After reading both (Sherwood et al., 2020; Lewis, 2022), authors find the most obvious difference is the selection of an informative prior in the former and a non-informative prior in the latter as the basis for similar Bayesian analyses. Despite the claim of (Lewis, 2022), authors do not feel that it is as objective as the reviewer claims. That being said, authors are not convinced of the superiority of either approach. In the limit of large data, all else being equal, the choice of prior is irrelevant. But all else is not equal and the data is not large. Hence, differences between the two very different results on the lower bound of ECS are likely not solely due to the choice of prior and the "subjective" and "objective" methodologies. To ascertain the validity of either method, NCA5 authors would have preferred that they both be demonstrated as "fit for purpose" to estimate the ECS confidence interval, possibly in a "perfect model" context. However, authors feel that neither have demonstrated such. As an assessment of the existing literature and not as a creator, the writing team's job is to make a judgement about what is in the literature. To that end, NCA5 authors rely heavily on the recent IPCC AR6 report. In order for the NCA5 to contradict this more thorough assessment of the ECS literature, the writing team would have to find compelling evidence to support such a statement. Authors do not on the basis of this single paper (Lewis, 2022). However, authors do feel that both teams should provide a more convincing argument as to fitness for purpose. While some modeling groups do tune to match observed global average surface air temperature trends, it is not a widespread practice (Hourdin et al., 2020; Schmidt et al., 2020). Indeed, if it were a widespread practice, the range of climate sensitivity among CMIP6 models would have decreased from earlier ensembles (CMIP5). The opposite has happened (Zelinka et al., 2020), so this point is not particularly relevant. Regarding the second part of this comment, NCA5 authors note that the reviewer has neglected that anthropogenic warming occurs with a strong background of natural variability. As natural variability increases as spatial scales decrease, one should not expect observed climate variables at the scale of individual states to agree with the mean of a multi-model, multi-realization simulation. Rather do the observations lie within the envelope of simulation results. So the reviewer's claim has no bearing on quantifying the human influence of Alabama temperature within the noise. Furthermore, the dust bowl was inarguably a random event exacerbated by the land usage practices of the 1930s. Unless a simulation had the unlikely coincidence of placing such a random event exactly at the right time, comparison of modelled temperature trends beginning in the 1930s to
Rachel	Licker	Text Region	03. Earth System Processes		8	4	8	5	Correct the sentence construction here to either "depends both on the ERF from a double of CO2 and on the sum..." or "depends on both the ERF... and the sum..."	Noted. The TSU editorial staff will perform a thorough copyedit.
Gene	Takle	Text Region	03. Earth System Processes	22	8	22	9	Information only. No replay expected: A key paper not cited is Feng et al. [Z. Feng et al., Nat. Commun. 7, 13429 (2016)]. This paper explains the very consequential increase in moisture	Thank you for the comment.	

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Licker	Figure	03. Earth System Processes		9	1	9	6	It is unclear what the vertical blue bar on the left side of this figure represents. Similarly, the graphics on the right side (satellite, time series, and mammoth) do little to add to the figure. For one, the paleoclimate record goes much farther back than 1850 and has little to do with mammoths. Suggest deleting these extraneous illustrations.	Figure 3.3 to be kept as is. The vertical blue bar is a design element intended to ensure consistency across graphics for the web deployment. The illustrations are a harmless measure to indicate records across time -- modern technology and paleo reconstructions. The plot does not imply that paleo stops at 1850.
Gene	Takle	Text Region	03. Earth System Processes		22	10	22	10	Suggest adding: "An example of consequential seasonal amplification of precipitation is described by Feng et al. (2016) in which enhanced moisture transport in April-	While this observed trend is important for the region in which it occurs, its implications are primarily on temperature rather than the hydrologic cycle (which is the focus of this Key Message), and subsequent work (Song et al., 2022) found increased moisture transport by the GPLLJ in the last few decades is mainly driven by decadal variability rather than anthropogenic forcing. Given the word count limits and the regionally specific nature of this observed trend, it would be a better fit for a regional or agriculture chapter. Citation: Song, F., Leung, L. R., Feng, Z., Chen, X., & Yang, Q. (2022). Observed and projected changes of large-scale environments conducive to spring MCS initiation over the US Great Plains. Geophysical Research Letters, 49, e2022GL098799. https://doi.org/10.1029/2022GL098799.
Richard	McNider	Whole Page	03. Earth System Processes			10			Climate Sensitivity and Climate Feedback While there may be some reduction in climate sensitivity uncertainty there is still considerable uncertainty. While climate sensitivity has largely employed surface temperatures the real measure of climate sensitivity must include the deep troposphere. See Christy, J.R. and McNider, R.T., 1994. Satellite greenhouse signal. Nature, 367(6461), pp.325-325 and Christy, J.R. and McNider, R.T., 2017. Satellite bulk tropospheric temperatures as a metric for climate sensitivity. Asia-Pacific Journal of Atmospheric Sciences, 53(4), pp.511-518. This is where heat is supposed to accumulate. Here deep warming then leads to increased moisture holding and positive water vapor feedbacks Observed trends in Tmax and Tmin for the rest of the globe have shown that in many areas the warming has been in nighttime temperatures (Tmin). This is seen in Figure 11.2 in the AR6 document. The geographical distribution of annual Tmax and Tmin seen in the left panel of figure 11.9 is telling. Over most of the land mass warming in Tmax is modest or nonexistent. Only in parts of Europe and possibly data questionable areas in the Andes and tropical South America have maximum annual temperatures warmed significantly. Most of the warming is occurring at night and in high northern latitudes (see fig 11.9 middle panel). Asymmetric trends in Tmax and Tmin have varied over time it and appears that the variation in asymmetry is related to precipitation/cloudiness. The far right panel in figure 11.9 shows an increase in the number of days having extreme (90 percentile Tmax). However, this is likely due to the number of extreme dry days and is not representative of the slow accumulation of heat in the atmosphere which is best captured in annual Tmax. It should be noted that CMIP 3 models did not consistently capture the magnitude of the asymmetry in warming (see McNider et al.2012 JGR) with models warming Tmax at nearly the same rate as Tmin though CMIP5 and CMIP6 have been somewhat better in capturing the asymmetry. As discussed in Christy and McNider 2017, differences between empirical and modeled surface-defined values of transient climate response (TCR) and equilibrium climate sensitivity (ECS) were noted in the IPCC (In Climate Change 2013: The Physical Science Basis. T. F. Stocker et al. Eds., Cambridge University Press, 1029-1136.) The IPCC indicated that model-calculated ECS was on average greater than	Given the important role of surface temperature in setting the conditions to which the atmosphere adjusts and its measure of the heat content of the upper ocean, the surface temperature is the fundamental variable with which climate sensitivity has been defined. While it is important to evaluate changes in tropospheric temperatures, as well as many other climate variables, for consistency with estimates of climate sensitivity and the other factors determining its changes, tropospheric temperatures are not as fundamental as surface temperature. Indeed, trends in tropospheric temperature over the satellite era are sensitive to many factors beyond climate sensitivity. Casas et al. 2023 – 10.1029/2022JD037523 find that trends in tropospheric temperature also depend on ocean heat uptake, aerosols, and internal climate variability. In another study, once accounting for internal variability, the observed trends in tropical mid-tropospheric temperature are consistent with climate sensitivity values in the same range as stated here in the draft text (see Figure 3c of Po-Chedley et al. PNAS 2022 – 10.1073/pnas.2209431119). Authors agree that some CMIP6 models likely have a value of climate sensitivity that is too large (and the text of this draft says so), but this only applies to models with climate sensitivity exceeding 5°C (Sherwood et al. 2020 – 10.1029/2019RG000678; Hausfather et al. 2022 – 10.1038/d41586-022-01192-2).
Richard	McNider	Whole Page	03. Earth System Processes			11			Regional Patterns While the mean global surface temperature has increased since the 1970,Âós especially over land, the pattern and metrics have not been as consistent with models as this report and AR6 indicate. As noted in the report, most of the rise in temperatures has come at high latitudes in the northern hemisphere. The rise in these sub and Arctic areas have largely come during winter and reflect a distribution of heat through destabilization of the pervasive shallow inversion. Models from CMIP3-5 and CMIP6 have continually underestimated this high latitude warming (Swanson, K.L., 2013. Emerging selection bias in large,Âêscale climate change simulations. Geophysical Research Letters, 40(12), pp.3184-3188). This may have many reasons in the complex, snow, ocean environment but one fundamental reason may be the inability of coarse resolution models to handle properly the stable boundary layer (see McNider, R.T., Steeneveld, G.J., Holtslag, A.A.M., Pielke Sr, R.A., Mackaro, S., Pour,ÂêBiazar, A., Walters, J., Nair, U. and Christy, J., 2012. Response and sensitivity of the nocturnal boundary layer over land to added longwave radiative forcing. Journal of Geophysical Research: Atmospheres, 117(D14) and Bintanja, R., Van der Linden, E.C. and Hazeleger, W., 2012. Boundary layer stability and Arctic climate change: A feedback study using EC-Earth. Climate dynamics, 39, pp.2659-2673). As discussed in Swanson 2013 CMIP 3 and CMIP5 models continually underestimated Arctic warming but overestimated warming in the remainder of most of the globe especially in the tropics (Swanson 2013 GRL, Christy and McNider 2017 JGR) This has continued through CMIP6. Thus, model agreement in global temperature is in part due to compensating errors at high and low latitudes. The winter Arctic and nighttime warming are important in that both represent shallow warming in the surface inversion and not an accumulation of heat in the deep atmosphere. As discussed in McNider et al 2012 this warming due to destabilization of the inversion largely represents a redistribution of heat not an accumulation of heat. While downward radiation from GHG may be responsible for the destabilization, McNider et al 2012 showed that most of the warming at the surface is due to the mixing of warm air from aloft in the inversion and only 10% due to direct heating from the downward GHG. It is thus, very possible, that the warming in the Arctic is due to destabilization of the nocturnal	The point about the warming in northern hemisphere high latitudes being driven by a complex set of processes, some of which may be poorly captured in models, is a good one. Accordingly, authors have added a sentence in this section, which includes one of the citations mentioned by the reviewer: "The high latitudes of the northern hemisphere warm the most of any region, although the reasons for this are complex and may involve processes poorly captured by GCMs (Bitanja et al., 2012)." It is beyond the scope of this chapter to go into much more detail about Arctic processes however. In this section authors now do acknowledge multiple reasons for model/observation disagreement, including missing processes and internal variability.
Richard	McNider	Whole Page	03. Earth System Processes			12			Uncertainty This is one of the better sections of the report. Too bad the rest of the report does not reflect this uncertainty. However, I am still not sure that it truly reflects the difference between observations and models. Thus, I am not sure model bias is being included.	Good point. Authors have added the following text to the end of the clause on lines 12-13: "... as well as incomplete understanding of climate processes and associated model bias with respect to observations ..."
Rachel	Licker	Text Region	03. Earth System Processes		14	8	14	19	This is the clearest explanation of the CMIP6 projections I've ever read. Bravo!	Thank you!
Andrew	Carleton	Text Region	03. Earth System Processes		16	16	23	23	Could briefly make the link between the butterfly effect mentioned here and climatic variability mentioned on page 12, lines 5-6 and page 28, line 16.	Good idea. Authors have added the following text to the sentence on page 16, line 23: "... butterfly effect, which can subsequently alter the chaotic sequence of weather and climate events ..." and have added the following text to the end of the sentence on page 28, lines 16-17: "... and by variability due to the chaotic dynamics within the atmosphere (the so-called butterfly effect)."
Kevin	Reed	Text Region	03. Earth System Processes		18	18	14	20	It should be noted, that event attribution work has extend beyond single events, but to hazards throughout an entire season. For example, the work here on the 2020 Hurricane Season: Reed, K.A., Wehner, M.F. & Zarzycki, C.M. Attribution of 2020 hurricane season extreme rainfall to human-induced climate change. Nat Commun 13, 1905 (2022). https://doi.org/10.1038/s41467-022-29379-1	Sentence revised to: "Recent methodological advances have widened the classes of weather events analyzed (Herring et al. 2022, 2019, 2018; Reed et al. 2022; Wehner et al. 2019)."

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Thomas	Knutson	Figure	03. Earth System Processes		18	18	15	18	Change to: "For example, studies have concluded that anthropogenic climate change made a 2016 extreme..." (Note that the current statement as written in the draft seems to present the attribution of these events to anthropogenic forcing as factual (100% certainty), with no confidence qualifiers included...)	The reviewer is correct: This statement requires the IPCC calibrated language. Using the flowchart designed for IPCC AR6 WGI Chapter 11, the likelihood level is determined to be very likely due to multiple independent analyses using different methods, models, and observations. The flowchart can be found in Friederike E.L. Otto, Luke J. Harrington, David Frame, Emily Boyd, Kristian Cedervall Lauta, Michael Wehner, Ben Clarke, Emmanuel Raju, Chad Boda, Mathias Hauser, Rachel A. James, Richard G. Jones (2020): Towards an inventory of the impacts of human-induced climate change. Bulletin of the American Meteorological Society, https://doi.org/10.1175/BAMS-D-20-0027.1.
Andrew	Carleton	Text Region	03. Earth System Processes		20	20	6	6	damping or reducing. Dampening means not what you intend here, I think.	Text has been revised accordingly.
Doug	Robbins	Figure	03. Earth System Processes		21	22	1	2	Figure 3.8 The horizontal axis of this figure is unquantified and unclear. The meaning of the entire figure is unclear.	The top panel is intentionally qualitative, for two reasons: (1) it is a schematic that roughly represents an overall pattern, but not specifics; and (2) the specific magnitudes vary from place to place. Authors have revised the labeling, layout, and color scheme in this plot to increase clarity.
Rachel	Licker	Figure	03. Earth System Processes		21	1	21	3	In the upper panel, an illustrative x-axis would make clearer that the distributions shown represent the amount of precipitation in an extreme event. As is, it is unclear what is being plotted.	Authors have revised the labeling, layout, and color scheme in this plot to increase clarity.
Thomas	Knutson	Figure	03. Earth System Processes		22	22	18	21	For a differing view see the analysis of Su et al. 2021, which concludes: "Consistent with earlier work, dry area coverage in all [CONUS] subregions except the Southwest has decreased [over the past century]." Background: See especially their Fig. 4 which is an estimate of the trend in dry area coverage for different subregions of the CONUS over 1915-2018, with dry area is defined as where the total column soil moisture is below the 20th percentile of the entire reconstruction period. (This figure would be appropriate to include in the NCA5 Ch. 2 or 3.) Only the southwest U.S. appears as a region with an increase in dry area coverage over this time period in their reconstruction. They use the Noah-MP land surface model and investigate influence of groundwater and dynamic vegetation phenology in their study. Their land model is forced by observed estimates of surface meteorological forcings, including hourly precipitation, near-surface temperature, near-surface wind, near-surface humidity, downward shortwave and longwave radiation, and surface pressure. It is hard to reconcile their conclusions with the conclusion in lines 18-21, although perhaps by "surface drying" the NCA5 draft refers to only the top few cm of soil, as opposed to column soil moisture. The Su et al. study clear points toward a different response of agricultural drought (soil moisture) to warming in CONUS than implied by the current statement in the draft. Ref: Su, L., Cao, Q., Xiao, M., Mocko, D. M., Barlage, M., Li, D., Peters-Lidard, C. D., & Lettenmaier, D. P. (2021). Drought Variability over the Conterminous United States for the Past Century, Journal of Hydrometeorology, 22(5), 1153-1168. https://journals.ametsoc.org/view/journals/hydr/22/5/JHM-D-20-0158.1.xml	See response to Comment 174294. The decrease in dry area outside of the southwest US over 1915-2008, which the reviewer argues contradicts the current paragraph, has a substantial influence of the observed increase in precipitation over much of the eastern US over this time period, which has a large component of internal variability and thus is likely unforced. In contrast, the focus of the current section is on mechanisms that could lead to forced changes in the hydrologic cycle. A reference to Su et al. (2021) has been added to a subsection associated with the Extreme Events Key Message.
Sean	Fleming	Text Region	03. Earth System Processes		22	22	22	30	Chapter 3, page 22, lines 22-30: rephrase this passage a little more carefully. Snowpack decreases in much of the western US, and particularly the Pacific Northwest, predominantly change the timing of river flows, shifting runoff generation from spring to winter. That does effectively reduce available water resources, especially with parallel changes in evapotranspiration and in some areas precipitation. But a key point here is that extreme flood events are likely increasing ‚Äì whereas the passage as currently written could be easily misread as implying the opposite.	Thanks so much for pointing out this important point of potential confusion! Authors of course agree that the increase in extreme flood events from increased precipitation intensity and also rain on snow events are certainly a concern -- in addition to the impacts of decreased snowpack on water resources. Text has been added at the beginning and end of the paragraph to make this more clear.
Rachel	Licker	Text Region	03. Earth System Processes		24	7	24	7	There is a space missing between "high" and "(RCP8.5)"	Noted. The TSU editorial staff will perform a thorough copyedit.
Doug	Robbins	Figure	03. Earth System Processes		25	25	7	8	There is no mention of the physics of heat transfer between the atmosphere and oceans, or the uncertainty or conditions associated with that transfer (e.g. storms, cloudiness, temperature, winds, waves). Understanding the processes of heat transfer would inform future models, and might reveal potential changes in the heat-buffering capacity of the ocean.	The transfer of heat between ocean and atmosphere has been noted in the revised text. The scope of this section does not readily allow for more detail on the heat exchange with the atmosphere.
Rachel	Licker	Text Region	03. Earth System Processes		25	7	25	8	Change "is" to "has been" because it is unclear whether the ocean can continue to absorb excess heat at the level it has under higher warming scenarios. (See articles within https://e360.yale.edu/features/how_long_can_oceans_continue_to_absorb_earths_excess_heat.)	The sentence has been modified to change "is" to "has been".
Reid	Sherman	Text Region	03. Earth System Processes		27	27	12	12	The sea level discussion is spread across multiple chapters and should be integrated with better cross-chapter citations. For example, link this text to Ch 2 climate trends discussion on sea level rise.	The sea level discussion in this chapter is being coordinated with Chapter 2 and other chapters. Chapter 3 provides an overview of the key processes that lead to sea-level change globally and regionally.
Thomas	Knutson	Figure	03. Earth System Processes		27		21		It would be good to provide a reference here to support this statement.	The Sweet et al. (2022) reference has been added here.
Andrew	Carleton	Text Region	03. Earth System Processes		28	28	20	20	distributions	Noted. The TSU editorial staff will perform a thorough copyedit.
Thomas	Knutson	Text Region	03. Earth System Processes		29	29	10	13	Suggested addition (if TC landfall projections belong here): "p. 2-24, line 3: Suggested addition: "For U.S. (CONUS) or North American landfalling tropical cyclone activity, published projections report some projected changes of concern, but these often differ between studies (depending on the modeling method used) or projected changes are non-significant (Jing et al. 2021, Garner et al. 2021, Knutson et al. 2022, Zhang et al. 2020). One study projects that tropical cyclone rainfall-surge joint hazard is greatly increased by higher rainfall amounts driven by higher cyclone intensities and slower propagation speeds, with further joint risk from sea level rise (Gori et al. 2022); in contrast only small/nonsignificant changes of tropical cyclone propagation speed are projected by Zhang et al. (2020) for most near-US coastal regions. One study projects increased threat of extratropically transitioned storms for the northeast U.S. (Liu et al. 2017). In summary, these U.S. and North America landfalling tropical cyclone studies do not yield high confidence projections, apart from sea level rise influence on inundation risk, because they are based on single studies or exhibit major differences between studies; further, the projections are generally not supported yet by a detectable anthropogenic influence in observations." Background Details: Garner et al. (2021) project tropical cyclones to form closer to the U.S. southeast coast and to propagate more slowly along the coast in a future warming scenario. Similarly, Knutson et al. (2022) project that a greater fraction of Atlantic TCs will make landfall over CONUS and that basinwide intensities will increase slightly. This led to a greater projected number of CONUS landfalling category 4-5 hurricanes despite fewer total tropical cyclones and hurricanes projected for the Atlantic basin as a whole in Knutson et al (2022). Jing et al. (2021) compare North American landfalling TC projections from three modeing approaches: the GFDL HiFLOR climate model, Emanuel's statistical-deterministic TC downscaling framework, and a new TC statistical model (Jing and Lin 2020). They report relatively small and not statistically significant changes in landfall intensities and in the return period of various landfall intensities. An exception was a projected increase in 100-yr return level of landfall intensity for the northeastern U.S. in the HiFLOR model, though the other two modeling approaches did not support this projected change. Gori et al. (2022) project large increases in the joint hazard from	This comment has been forwarded to the Chapter 2 (Trends) writing team.
Thomas	Knutson	Figure	03. Earth System Processes		29	29	11	13	(Key Message 3.12) Based on the drought discussion, the key message can be misinterpreted to imply that human activities are increasing drought frequency. Rather the discussion further down on p. 3-32, lines 2-13 refers to amplifying drought severity (not frequency) at least in some regions so far. My recommended re-wording to Key Message 3.12 would be: "Human activities are affecting climate system processes in ways that are expected to increase the frequency and intensity of many, but not all climate extremes, including heat waves, wildfire, heavy rainfall and coastal flooding, and to amplify drought severity (medium to high confidence)." Further, the authors should attach specific confidence levels to each specific phenomena (or groups of phenomena that have the same confidence level), so that the reader can readily interpret which phenomena/changes are assessed as medium confidence versus ones that are assessed as high confidence, etc.	Removing drought from here would lead to the implicit argument that anthropogenic climate change has not contributed to drought in the US, which is not true. Instead of removing drought, authors have changed "frequency and intensity" to "frequency and/or intensity" and specified drought types sensitive to observed and projected changes in potential evapotranspiration.
Andrew	Carleton	Text Region	03. Earth System Processes		29	29	17	18	have	Noted. The TSU editorial staff will perform a thorough copyedit.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Thomas	Knutson	Text Region	03. Earth System Processes		29		35		Modify to: "...(Patricola and Wehner 2018; Liu et al. 2019). However, an assessment of published tropical cyclone modeling studies indicated, on average, a projected tropical cyclone precipitation rate increase that was close to the rate of increase in atmospheric water vapor (Knutson et al. 2020)."	The related statement has been modified to reflect the review comment as: "Precipitation associated with hurricane increases by at least as much as water vapor (Knutson et al. 2020), and the heaviest events can increase at an even greater rate (Reed et al 2022, Patricola and Wehner 2018, Guzman and Jiang 2021)." Citations: Kevin A. Reed, Michael F. Wehner, Colin M. Zarzycki (2022) Attribution of 2020 Hurricane Season Extreme Rainfall. Nature Communications 13, 1905. https://www.nature.com/articles/s41467-022-29379-1 Guzman, O., Jiang, H. Global increase in tropical cyclone rain rate. Nat Commun 12, 5344 (2021). https://doi.org/10.1038/s41467-021-25685-2
Andrew	Carleton	Text Region	03. Earth System Processes		29	29	36	36	are	Noted. The TSU editorial staff will perform a thorough copyedit.
Reid	Sherman	Text Region	03. Earth System Processes		30	30	22	22	It would be helpful to include information on the effect of changes in water cycle to the land surface-increase in mass wasting, etc (Ask Jonathan Godt USGS) or point to land use/cover chapter; some text at p. 50, lines 1-2.	Authors now cross-reference Chapter 6 (Land Cover and Land-Use Change), as follows: "See Chapter 6 for more information regarding the effect of changes in the water cycle on land surface-increase in mass wasting."
Thomas	Knutson	Text Region	03. Earth System Processes		32		9		Add here: Dry area coverage, based on reconstructed total column soil moisture, has increased over the southwest U.S. over the past century, but has increased in other regions of CONUS (Su et al. 2021). Ref: Su, L., Cao, Q., Xiao, M., Mocko, D. M., Barlage, M., Li, D., Peters-Lidard, C. D., & Lettenmaier, D. P. (2021). Drought Variability over the Conterminous United States for the Past Century, Journal of Hydrometeorology, 22(5), 1153-1168. https://journals.ametsoc.org/view/journals/hydr/22/5/JHM-D-20-0158.1.xml	The leading sentence of this paragraph was revised and the second sentence now includes areal coverage of soil moisture in the United States since 1915. "Observed projected hydroclimatic changes in response to external forcing are highly season- and region-dependent over the United States, especially in the West (Marvel et al. 2021). Since 1915, dry area coverage, based on reconstructed total column soil moisture, has increased over the Southwest U.S., but decreased in other regions of the United States (Su et al. 2021)."
Andrew	Carleton	Text Region	03. Earth System Processes		33	33	13	13	Because. Since causes confusion when not referring specifically to time, which is a theme of this chapter.	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		34	34	32	32	a strong increase	Noted. The TSU editorial staff will perform a thorough copyedit.
Doug	Robbins	Figure	03. Earth System Processes		35	36	7	8	To address the first uncertainty mentioned in lines 10 through 17, global atmospheric oxygen is depleted annually in stochiometric agreement with published estimates of fossil fuel consumption and deforestation, confirming those estimates. Oxygen depletion is a measure of anthropogenic CO2 emissions from fossil fuels and deforestation. Secondly, exchanges between atmosphere and carbon sinks, mentioned as a source of uncertainty on pages 3-35 and 3-36, do not show evidence of seasonal or long-term instability changing the accumulation of CO2 in the atmosphere. Any material contributions or removal of CO2 in the atmosphere would be reflected in the records of the Scripps CO2 observation network. Atmospheric CO2 increases as a steady function of 41% of human CO2 emissions, as noted in chapter 2. No material anomalies are noted in the Scripps records for either CO2 or carbon isotopes. There are no credible alternate theories, observations, or quantification for any competing explanation for rising CO2 other than human activities. Any alternate process for generating CO2 and heat also requires an additional process for the disposition of known anthropogenic CO2 and heat. The likelihood of two unobserved processes working in conjunction is orders of magnitude smaller than 1%.	This comment appears to be intended to help make a strong case that fossil fuel emissions are unequivocally responsible for the observed growth in atmospheric CO2. Authors did not mention atmospheric O2 and it's depletion over time due to burning of fossil fuels in combination with possible changes in biospheric productivity because of some complications in attributing biosphere-driven changes to land-use change and due to possible carbon cycle climate feedbacks.
Andrew	Carleton	Text Region	03. Earth System Processes		35	35	12	12	Because. Since causes confusion when not referring specifically to time, which is a theme of this chapter.	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		35	35	18	18	the lack	Noted. The TSU editorial staff will perform a thorough copyedit.
Nick	Procopio	Text Region	03. Earth System Processes		35	35	20	20	"Atmospheric" should be changed to "atmosphere" in this sentence.	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		35	35	26	26	implies	Noted. The TSU editorial staff will perform a thorough copyedit.
Nick	Procopio	Text Region	03. Earth System Processes		36	36	3	3	There is either an unintended quotation mid-sentence or a missing second quotation in the following statement: "There is very high confidence that emissions of greenhouse gases have caused nearly all global warming observed over the industrial era" at the beginning of the paragraph." Also, the phrase "at the beginning of the paragraph" appears to be included in error.	Edited. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		36	36	3	3	Unclear what is meant by at the beginning of the paragraph, inserted at the end of this sentence.	Noted. The TSU editorial staff will perform a thorough copyedit.
Nick	Procopio	Text Region	03. Earth System Processes		36	36	29	29	Strike second "to" in the following phrase: "estimate is now thought to be biased low to relative to the climate sensitivity for CO2 doubling"	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		36	36	29	29	biased low relative to the climate sensitivity	Noted. The TSU editorial staff will perform a thorough copyedit.
Harry	Dowsett	Text Region	03. Earth System Processes		36		35		This interval is no longer known as the Mid Pliocene. Unfortunately many use it to be consistent with earlier literature, but the correct stratigraphic terminology is "Mid Piacenzian (Pliocene)." The interval was known as Mid Pliocene when the Pliocene was divided into three stages (Zanclean, Piacenzian and Gelasian). The Gelasian is now considered Quaternary and what was the mid Pliocene warm period is correctly called mid Piacenzian warm period. Probably not a significant point but feel it should be pointed out.	Authors have chosen to leave the text as is for reasons of traceability and public comprehension.
Andrew	Carleton	Text Region	03. Earth System Processes		37	37	15	15	damping or reducing. Dampening means not what you intend here, I think.	Good point. Changed to "reducing".
Andrew	Carleton	Text Region	03. Earth System Processes		37	37	34	34	those from	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		38	38	18	18	Should be capitalized first letters as Northern Annular Mode.	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		38	38	29	29	These reflect	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		39	39	17	17	like a 1% annual increase	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		40	40	11	13	They have revealed. They have also enabled	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		41	41	13	13	past and future climates	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		42	42	6	6	only one planet Earth.	Noted. The TSU editorial staff will perform a thorough copyedit.
Thomas	Knutson	Traceable Account	03. Earth System Processes		42	42	25	26	The draft here states: "Hurricane precipitation has been among the most studied, and it is clear that it has been increased by climate change." This sounds like a statement of fact, which is not yet supported by the science. Suggested edit: "Hurricane precipitation has been among the most studied, and recent assessment concluded there is high confidence, from modeling studies, physical understanding, and studies of extreme precipitation in general, that hurricane rainfall rates have very likely increased and will continue to increase due to anthropogenic climate change." If more detail on traceable account is needed here, there are two recent assessments of the impact of anthropogenic climate change on tropical cyclone rainfall rates. IPCC AR6 concluded: "Event attribution studies and physical understanding indicate that human-induced climate change increases heavy precipitation associated with tropical cyclones (high confidence), but data limitations inhibit clear detection of past trends on the global scale." (SPM, p. 9). WMO TC Expert Team (Knutson et al. 2020) concluded: "For TC precipitation rates, there is at least medium-to-high confidence in an increase globally, with a median projected increase of 14%, or close to the rate of tropical water vapor increase with warming, at constant relative humidity."	The affected text has been changed to: "Hurricane precipitation has been among the most studied, and recent assessment has concluded that there is high confidence from modeling and satellite studies as well as physical understanding that hurricane rainfall rates have very likely increased and will continue to increase due to anthropogenic climate change(Seneviratne et al., 2021). Event attribution studies and physical understanding indicate that human-induced climate change increases heavy precipitation associated with tropical cyclones (high confidence), but data limitations inhibit clear detection of past trends on the global scale." (SPM, p. 9). Partly based on CMIP5 models, WMO TC Expert Team (Knutson et al. 2020) concluded: "For TC precipitation rates, there is at least medium-to-high confidence in an increase globally, with a median projected increase of 14%, or close to the rate of tropical water vapor increase with warming, at constant relative humidity." However recent higher resolution modeling studies, particularly event attribution studies, find that hurricane precipitation increases at a rate substantially higher than that of water vapor alone, implying dynamical as well as thermodynamical changes (e.g. Reed et al., 2021, 2022; Risser and Wehner, 2017; van Oldenborgh et al., 2017; Wang et al., 2018). A recent satellite based study reinforces this interpretation (Hallam et al., 2023)."
Reid	Sherman	Text Region	03. Earth System Processes		42	42	31	31	Derecho - this needs to be described since it is not very common or widely known.	Authors have suggested that this term be added to the Glossary.
Andrew	Carleton	Text Region	03. Earth System Processes		42	42	37	37	especially for the CONUS	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		43	43	1	1	increases in soil moisture or increased soil moisture	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		44	44	2	2	either Southern Hemisphere or southern hemisphere	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		44	44	9	9	relevant to	Noted. The TSU editorial staff will perform a thorough copyedit.
Nick	Procopio	Text Region	03. Earth System Processes		44	44	10	10	Add "the" to "Since the NCA4, one of the most¬Ö"	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		44	44	10	10	one of the most	Noted. The TSU editorial staff will perform a thorough copyedit.
Thomas	Knutson	Traceable Account	03. Earth System Processes		45		1		extensive, rather than extensively	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		45	45	1	1	and extensive documentation	Noted. The TSU editorial staff will perform a thorough copyedit.
Thomas	Knutson	Traceable Account	03. Earth System Processes		45		22		"used to" rather than "used the"	Noted. The TSU editorial staff will perform a thorough copyedit.
Nick	Procopio	Text Region	03. Earth System Processes		45	45	22	22	Change "the" to "to", "inorganic compounds dissolved in interior ocean waters are used to".	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		45	45	22	22	are used to estimate	Noted. The TSU editorial staff will perform a thorough copyedit.
Nick	Procopio	Text Region	03. Earth System Processes		46	46	12	12	The number 4 in CH4 should be a subscript.	Noted. The TSU editorial staff will perform a thorough copyedit.
Nick	Procopio	Text Region	03. Earth System Processes		46	46	14	14	The word "process" should be plural, "difficult to model due to difficult-to-quantify processes"	Noted. The TSU editorial staff will perform a thorough copyedit.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Nick	Procopio	Text Region	03. Earth System Processes		46	46	16	17	Commas are needed in "climate models disagree widely on the future response of carbon exchanges between the oceans land biosphere and atmosphere to continued fossil fuel emissions"	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		47	47	5	5	allows for	Noted. The TSU editorial staff will perform a thorough copyedit.
Reid	Sherman	Text Region	03. Earth System Processes		47	47	20	20	Recommend clear and additional information on Ice Sheet Research Gaps given the low confidence (Line 1-2 p. 48).	A sentence has been added: "Continued and additional observations of the ice sheets - and ocean and atmosphere that surround them - are needed to resolve these uncertainties. Additionally, advances in ice sheet modeling that potentially leverage these observations are a priority to narrow future estimates of ice mass loss."
Andrew	Carleton	Text Region	03. Earth System Processes		48	48	8	8	subtropical highs	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		48	48	20	20	Depending on how it is decided to state Southern Hemisphere or southern hemisphere on page 44, line 2, then Northern Hemisphere or northern hemisphere should be consistent.	Noted. The TSU editorial staff will perform a thorough copyedit.
Thomas	Knutson	Traceable Account	03. Earth System Processes		48		25		Could add to this list: "and observed vs. model-simulated historical trends in sea level pressure (Knutson and Ploshay, 2021)" Reference: Knutson, T. R., & Ploshay, J. (2021). Sea Level Pressure Trends: Model-Based Assessment of Detection, Attribution, and Consistency with CMIP5 Historical Simulations, Journal of Climate, 34(1), 327-346. https://journals.ametsoc.org/view/journals/clim/34/1/JCLI-D-19-0997.1.xml	The suggestion has been implemented.
Andrew	Carleton	Text Region	03. Earth System Processes		48	48	36	36	Depending on how it is decided to state Southern Hemisphere or southern hemisphere on page 44, line 2, then Northern Hemisphere or northern hemisphere should be consistent, as also on page 48, line 20.	Noted. The TSU editorial staff will perform a thorough copyedit.
Thomas	Knutson	Traceable Account	03. Earth System Processes		49		4		Add: "For historical century-scale regional trends in sea level pressure, large differences were found between different observational estimates from gridded datasets and reanalysis reconstructions (Knutson and Ploshay 2021). Ref: Knutson, T. R., & Ploshay, J. (2021). Sea Level Pressure Trends: Model-Based Assessment of Detection, Attribution, and Consistency with CMIP5 Historical Simulations, Journal of Climate, 34(1), 327-346. https://journals.ametsoc.org/view/journals/clim/34/1/JCLI-D-19-0997.1.xml	This example of uncertainty in observed and simulated trends has been added.
Andrew	Carleton	Text Region	03. Earth System Processes		49	49	11	11	jet streams	Noted. The TSU editorial staff will perform a thorough copyedit.
Andrew	Carleton	Text Region	03. Earth System Processes		49	49	15	15	responses	Noted. The TSU editorial staff will perform a thorough copyedit.
Thomas	Knutson	Traceable Account	03. Earth System Processes		50		10		You could mention here: "Confidence in model-based assessment of changes in frequency or intensity of extreme events can be enhanced in cases where a detectable anthropogenic trend in the extreme metric, or closely related metric, has been found. However, this is not the case for many types of extreme events, such as those related to long-term changes in circulation patterns."	The following two sentences were added. "Confidence in model-based assessments of changes in frequency or intensity of extreme events can be enhanced in cases where a detectable anthropogenic trend in an extreme, or closely related metric, has been found. However, this is not the case for some extreme event types, including those related to long-term changes in circulation."
Andrew	Carleton	Text Region	03. Earth System Processes		50	50	34	34	in the western US	Noted. The TSU editorial staff will perform a thorough copyedit.
Michael	Jasinski	Text Region	03. Earth System Processes		63		14		T. Markus, T. Neumann, A. Martino, W. Abdalati, K. Brunt, B. Csatho, S. Farrell, H. Fricker, A. Gardner, D. Harding, M. Jasinski, R. Kwok, L. Magruder, D. Lubin, S. Luthcke, J. Morison, R. Nelson, A. Neuenschwander, S. Palm, S. Popescu, C.K. Shum, B.E. Schutz, B. Smith, Y. Yang, J. Zwally. The ice, cloud, and land elevation Satellite-2 (ICESat-2): science requirements, concept, and implementation, Remote Sens. Environ., 190 (2017), pp. 260-273, 10.1016/j.rse.2016.12.029	This reference has been cited when ICESat-2 is mentioned in the main text and the reference has been added.
David	Daye	Whole Chapter	03. Earth System Processes						I'm a 60 year sailboat sailor in the lower Great Lakes, once a minor successful regional youth and college racing competitor, and casual recreational sailor still today. I experience profound changes in sailing weather from global warming For sailboats the weather isn't the venue of our activity, its our engine. And as for the most ancient and primitive peoples who first sailed thousands of years ago from the Nile to Polynesia and beyond, we sailors today can't operate or control our engine --we can only wait for our engine to act, then exploit its behavior. Each day of each weather system known in any given region has a different behavior, that we experience as a profile of its winds. What is the immediate median speed? How are the speeds oscillating over periods of minutes? How, if at all, are the speeds trending over periods of hours? Same questions for wind directions. How variable are the winds from median-- how different are the gusts and the lulls from the median? Are the directional shifts toward one side higher in speed than those from the other side? When I learned to sail in the late 60's, the answers to these questions were often best learned from my grandfathers' generation. I'm the grandfather generation today, but the worst thing I could do for a sailing grandson would be to pass on my local knowledge, which is hopelessly outdated. Some of my familiar weather patterns now go elsewhere, but many of them have entirely ceased to exist. Some of the richest, most successful and socially influential leaders on earth, public and private, relax or race sailboats from 2-hour weekend dinghy races to traversing the great oceans. They all live what I'm living. Where are they in this crisis?	Thank you for the comment.
Emma	Conrad-Rooney	Whole Chapter	03. Earth System Processes						All key messages should be revised to follow the Risk-Based Framework	The key messages were written to follow the NCA5 suggested format.
Andrew	Carleton	Whole Chapter	03. Earth System Processes						Another comprehensively written and highly informative chapter. Although I suggest a large number of text region edits, these are mostly minor and involve small grammar issues (plural vs. singular usage, missing linking words such as the, substituting Because for Since when writing a chapter that has a strong theme of time, etc.). These edits should be very quick for the authors to address.	Thank you for the careful review and constructive comments.
Weston	Fisher	Whole Chapter	03. Earth System Processes						The chapter should include some reference to the relationship to overshoot of other planetary boundary conditions contributing to the global deterioration of the biosphere. e.g., species loss, decline in biodiversity, disruption of the nitrogen/phosphorus cycle from agricultural activities, degradation of marine and freshwater systems, introduction of novel entities, etc. It is unwise to view climate change impacts in isolation from other alarming planetary changes associated with human activities. Please review the recent work of the Stockholm Resiliency Centre.	This chapter focuses on Earth system processes that play a role in climate change and connecting climate change to its impacts. This comment may be considered in developing the scope of the National Nature Assessment.
Rose	Daily	Figure	04. Water		3	3	8	8	Figure 4.1 I noticed there are no events listed for the year 1987. Is this because there truly were no billion-dollar water-related disasters? Or is it because there is a lack of data for that year? Maybe this could be clarified in the caption of the figure since it is the only year with 0 events listed.	Thanks for the close examination of Figure 4.1. There were no qualifying events in 1987. We have revised the caption with other information, but are not able to add this note due to word count limits.
Jessica	Evans	Text Region	04. Water		3	3	13	15	AMWA and WUCA recommend changing the sentence to read "However, climate change is expected to strain water quantity in many regions and degrade water quality for people and ecosystems" to emphasize early in the chapter that climate change affects both water quality and quantity.	Thank your for this suggestion. The text has been revised to clarify that both water quantity and quality are affected by climate chanage.
Nick	Procopio	Figure	04. Water		3				Are these billion-dollar disasters normalized to the value of a dollar from a certain year, for example were the values all converted to 2022 dollars? If so, add this to the description. A billion dollars was worth more in 1980 so this comparison only makes sense if the values are normalized.	We appreciate this request for clarification. All costs have been CPI adjusted to 2023.
Ross	McKitrick	Figure	04. Water		3	3		12	This wording is very misleading. Your data are not adjusted for increased numbers of buildings and equipment and other stuff in the path of weather events. So you haven't shown that extreme weather events are increasing, let alone that climate change is causing it. Either present properly-normalized data or leave the chart out. If you want to show a graph of weather events show that, but don't show a graph of economic damages and assume it measures climate-related weather events.	We have revised the caption to explain what the figure is showing.
Jessica	Evans	Figure	04. Water		3				This is a very powerful figure that clearly demonstrates that there is an increasing trend in the frequency of water-related disasters in the US. However, the number of billion dollar "drought" events has remained at 1 throughout time (slightly less frequent pre-2000, 11 in 20 years vs. 18 in 22 years). AMWA and WUCA propose the authors add a footnote or qualifier to describe how the drought count differs from other counts, such as tropical cyclones. It's unclear what the count reflects. It appears that although multiple basins, states, and other areas have a drought declared in a given year, the count reflects an amalgamation of basins and/or states?	This is an excellent comment. Multi-year, continuous events are problematic for this type of figure. The developers of the figure explain that drought and wildfire events are treated differently than other events: "The U.S. billion-dollar disaster analysis focuses on distinct, discrete events, with the exception of drought and wildfire, which we have historically assessed as regional, seasonal-scale events, given the slow onset and aggregative impacts of these hazards." For drought, it is helpful to look at the map view of historical disasters rather than the time series shown in our chapter. Both display options are available at the https://www.ncei.noaa.gov/access/billions/ webpage. Our word count limit prevents us from adding this explanation to the caption.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Ross	McKitrick	Text Region	04. Water		4	4	9	13	The statement "Extreme precipitation incidents are more intense and more frequent" is not true. McKitrick and Christy (2019) Assessing Changes in US Regional Precipitation on Multiple Time Scales Journal of Hydrology vol. 578 Nov 2019, https://doi.org/10.1016/j.jhydrol.2019.124074 showed that trends in US precip data easily change sign as the time scale increases, and that claims about significance of trends in extreme precipitation don't hold up when using the full length of data available.	Chapter 2 (Climate Trends) states that "there is robust evidence that human-caused warming has contributed to increases in the frequency and severity of the heaviest precipitation events across nearly 70% of the US" (pg. 2-15) and "Basic physical understanding and climate models both provide robust explanations for the links between climate change and observed changes in these extremes: this is why we also have very high confidence that storms are delivering more rainfall" (pg. 2-35). Chapter 3 (Earth Systems Processes) elaborates on why this is and will continue to occur (e.g. under KM3.8 and Figure 3.8). While the authors of this chapter (Chapter 4: Water) disagree with the comment that upward trends in extreme precipitation don't hold up under scrutiny, the need for consistency throughout the entire assessment means that such a comment is best directed to Chapter 2 and 3, from which subsequent chapters draw guidance on climate trends and their causes.
Nick	Procopio	Figure	04. Water		4				Does wildfire occurrence or magnitude really impact disinfection by-products? Check this claim embedded in the figure.	We thank the commenter for this suggestion. We have added a reference to the caption that substantiates the statement.
Kieran	Yeatman-Biggs	Text Region	04. Water		5	5	3	4	This sentence could be reworded from "But barriers arise from legal and regulatory institutions that have been in place for decades or even centuries, locking in practices that hinder adaptation" to "Legal and regulatory institutions have enforced barriers that have been in place for decades..."	Thank you for this suggestion. We prefer the original language that evokes the inertia in the system.
Jessica	Evans	Text Region	04. Water		5	5	3	5	AMWA and WUCA recommend the authors add clarifying citations to the sentence, "But barriers arise from legal and regulatory institutions that have been in place for decades or even centuries, locking in practices that hinder adaptation." Without them, it is unclear which legal or regulatory barriers the authors are referencing.	This general statement in the introduction is supported with more detail in KM 4.3. The barriers are manifold across the country. We have added some references to support the statement.
Jessica	Evans	Text Region	04. Water		5	5	5	7	AMWA and WUCA recommend altering the statement, "The Nation's aging water infrastructure, designed under regulations and standards appropriate to an unchanging climate, is deteriorating and threatening public health" to instead emphasize the need for signficant public investments. As representatives of water utilities, AMWA and WUCA caution against portraying the state of water infrastructure in a tone that instills fears in the public about the safety of drinking water and instead describes how utilities can invest in their infrastructure. Significant investments in upgrading and installing resilient infrastructure will require either funding in the form of increased rates for customers, which threatens affordability of water for many households, or other public funding.	We understand the position of the utilities, but the NCA5's mission and that of the utilites may not align perfectly. There are many current examples of failed or failing infrastructure in the present day. We have pointed the reader to the water chapter in the NCA4 (Lall et al 2018) which had a Key Message focused on deteriorating infrastructure and remains relevant. As you are aware, the NCA can not make policy or funding recommendations.
Jessica	Evans	Text Region	04. Water		5	5	10	16	AMWA and WUCA appreciate the inclusion of positive movement on climate adaptation and encourage the authors to include citations on best practices and case studies in this early paragraph of the chapter.	Thank you for this suggestion. Due to word count considerations, we have added references to the discussion in KM 4.3.
Reid	Sherman	Text Region	04. Water		5	5	16	16	Is it really risks posed by a "changing water cycle," or climate risks that lead to a more unpredictable water cycle?	Thank you for the comment. We prefer the original wording and feel it is substantiated by the text of the chapter and others' key messages that are cited.
Jessica	Evans	Text Region	04. Water		5	5	17	26	In this Key Message 4.1 section, there are two references to "Many regions (19)" or "Many locations (24). Since most readers will view only the key messages, it would be helpful to eliminate words in other sections and add in parentheses or following the words the regions that are included.	Thank you for this observation. We have revised the Key Message language to be more specific and have added pointers to the regional chapters in the body of the text where appropriate.
Emma	Conrad-Rooney	Text Region	04. Water		5	5	18	26	To follow the Risk-Based Framework, Key Message 1 should include what can be done about these highlighted problems.	The chapter is organized according to the risk-based framework to the extent possible with limited space. The first KM establishes the context by describing the range of physical trends and projections in hydrologic variables, followed by the second KM, which identifies existing vulnerabililties and impacts and future risks to communities, followed by the third KM, which discusses adaptation activities to reduce risk. We've revised the wording of this KM but not to address this comment specifically.
Michael	Jasinski	Text Region	04. Water		5		27	28	Suggest expanding more on the sentence that begins with "Water cycles through....." to also include energy balance. Maybe something like: .....Since the water cycle is connected with the energy cycle through evaporation, trends in precipitation, temperature, and net radiation further impact trends on all interrelated land and water and energy stores and fluxes, including soil moisture, infiltration, and groundwater recharge and runoff. Changes to these components are occurring.....	Due to word count limits, the Water chapter does not go into energy balance and energy's role in water resources. However, these topics are covered in detail in Chapters 2 and 3. We have modified the paragraph to elaborate on the water cycle.
Ross	McKitrick	Text Region	04. Water		5	5	31	32	Same comment as above. The assertion that climate change has caused changes in US precipitation and incidence of extremes is contradicted by published evidence.	Chapter 2 (Climate Trends) states that "there is robust evidence that human-caused warming has contributed to increases in the frequency and severity of the heaviest precipitation events across nearly 70% of the US" (pg. 2-15) and "Basic physical understanding and climate models both provide robust explanations for the links between climate change and observed changes in these extremes: this is why we also have very high confidence that storms are delivering more rainfall" (pg. 2-35). Chapter 3 (Earth Systems Processes) elaborates on why this is and will continue to occur (e.g. under KM3.8 and Figure 3.8). While the authors of this chapter (Chapter 4: Water) disagree with the comment that upward trends in extreme precipitation don't hold up under scrutiny, the need for consistency throughout the entire assessment means that such a comment is best directed to Chapter 2 and 3, from which subsequent chapters draw guidance on climate trends and their causes.
Thomas	Knutson	Text Region	04. Water		5		32		Here is some suggested text for Chapter 3 under KM 3.8 that is also relevant here: "Observed annual-mean precipitation trends (1901-2010) show pronounced increases over much of the central, north-central, and northeastern U.S. that are detectable (i.e., unusual compared to simulated natural variability) and partly attributable to human influence according to CMIP5 models (Knutson and Zeng 2018). " Ref: Knutson, T. R., & Zeng, F. (2018). Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends, Journal of Climate, 31(12), 4617-4637. https://journals.ametsoc.org/view/journals/clim/31/12/jcli-d-17-0672.1.xml [Background: Note that century-scale trends (Fig. 3 of Knutson and Zeng, 2018) were generally less detectable changes for seasonal means than annual means, except for the fall season over the eastern U.S. This is likely due to the lower signal-to-noise ratio (higher noise for seasonal means compared to annual means). Also their analysis found detectable increasing trends over parts of the U.S., but not strong evidence of detectable decreases, even in the southwest U.S. The observed trends were compared with model-simulated 110-yr trends (internal variability) at gridpoint scale to assess where the trends are detectable, and compared to CMIP5 historical runs to assess consistency with anthropogenically forced trends.]	Thank you for this suggestion and reference. The Water chapter's focus is primarily on terrestrial water, leaving most of the precipitation discussion to Chapters 2 & 3. The Chapter 3 authors have offered this response: The water cycle changes we discuss in our chapter emphasize different aspects of the water cycle like the relationship between mean and extreme precipitation, seasonality, role of vegetation, etc, while the comment is about specific mean precipitation changes in certain US regions, without explaining the associated processes. The suggested sentence would be out of place for our chapter since it only discusses statistical estimates and doesn't address or reconcile them with any processes.
Sean	Fleming	Figure	04. Water		6	6	8	9	Figure 4.3: please provide a proper literature citation, not just ‚ÄúSource: University of Colorado at Boulder‚Äù.	Please see the revised caption and notice the link to the figure metadata, where you will find all of the source information.
Michael	Jasinski	Text Region	04. Water		6		16		Please add our citation after Tercek's to read: ....opposite (Tercek et al. 2021; Jasinski et al. 2019). These.... Note to Lead Chapter Author: We have contributed significant research to the body of work on CONUS terrestrial hydrology trends. A full suite of NCA trends is publicly available at the NASA GES-DISC. I have added the full citation to the References in a separate comment. I'm sure you have a ton of work on your desk, but if you would like to discuss any of our trends please do not hesitate to contact me. Best.	Thank you for this reference. It will inform our discussions of trends for the hydrologic variables in KM4.1. We have added your findings to our text where appropriate, and will add the reference to our bibliography.
Jessica	Evans	Figure	04. Water		6				Please explain or reference why RCP4.5 is shown instead of RCP8.5.vÇ¬†Please explain whether RCP4.5vÇ¬†is seen asvÇ¬†more plausible for planning purposesvÇ¬†vs.vÇ¬†RCP8.5, or if does it not matter when looking at mid-century results.	RCP4.5 was considered for analysis for two primary reasons. First, the choice of a specific emissions scenario (RCP4.5 vs. RCP 8.5) has a very limited influence on climate change response by a mid-21st century time horizon. Second, based on the recent literature, inlcuding the IPCC AR6 WGIII report, the RCP 8.5 represents a highly unlikely scenario and is only useful as a high-end, high risk scenario. We have included this explanation in the Traceable Accounts for KM 4.1.
Sean	Fleming	Figure	04. Water		7	7	7	7	Figure 4.4: please provide a proper literature citation, not just ‚ÄúSource: University of Colorado at Boulder‚Äù.	Please see the revised caption and notice the link to the figure metadata, where you will find all of the source information.
James	Smith	Whole Page	04. Water		7				May I suggest the effects of the decrease in river flow, from glaciers receding from global warming, and snowpacks, needs to explained and quantified, such as on farmland, the lowering of food quantities and how many less people can be supported by food, and the metropolitan areas effected by rising water costs.	Thank you for your comment. We agree that the resulting impacts for projected changes to snow are missing from this passage. While we can't expand our chapter content to explicitly discuss food security and water rate-setting, we think the the central premise of this comment is important to include. We added text to discuss the overlapping impact of increases in water demand and decreases in snow water supplies, with special focus on the Western US, where these impacts are expected to be the greatest. The included references contain results that pertain to the more detailed portions of this comment.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jessica	Evans	Figure	04. Water		7				Please explain or reference why RCP4.5 is shown instead of RCP8.5.vÇ¬†Please explain whether RCP4.5vÇ¬†is seen asvÇ¬†more plausible for planning purposesvÇ¬†vs.vÇ¬†RCP8.5, or if does it not matter when looking at mid-century results.	RCP4.5 was considered for analysis for two primary reasons. First, the choice of a specific emissions scenario (RCP4.5 vs. RCP 8.5) has a very limited influence on climate change response by a mid-21st century time horizon. Second, based on the recent literature, inlcuding the IPCC AR6 WGIII report, the RCP 8.5 represents a highly unlikely scenario and is only useful as a high-end, high risk scenario.
Sean	Fleming	Figure	04. Water		8	8	6	7	Figure 4.5: please provide a proper literature citation, not just ‚ÄúSource: University of Colorado Boulder, NOAA NCEI, and CISESS NC,Äù. This is particularly important because some aspects of the projected SWE changes are different from other studies, which for example show slight increases in some parts of the Yellowstone area.	Please see the revised caption and notice the link to the figure metadata, where you will find all of the source information. It is possible that other models show other results, but without a citation it is difficult to comment on the differences. Though it does not include a peak SWE figure, the Northern Great Plains chapter (Chapter 25) provides regional projection information.
Thomas	Knutson	Text Region	04. Water		8		15		Important additional reference to add here is Su et al. (2021) -- see for example their Fig. 4: Reference: Su, L., Cao, Q., Xiao, M., Mocko, D. M., Barlage, M., Li, D., Peters-Lidard, C. D., & Lettenmaier, D. P. (2021). Drought Variability over the Conterminous United States for the Past Century, Journal of Hydrometeorology, 22(5), 1153-1168. https://journals.ametsoc.org/view/journals/hydr/22/5/JHM-D-20-0158.1.xml	Thank you for the suggestion. We have added this reference.
Thomas	Knutson	Text Region	04. Water		8		16		Change to: "Projections suggest that *summer column* soil moisture will decrease..." (Fig. 4.6 refers to summer soil moisture; annual mean column soil moisture decreases significantly mainly over the southwest US and south central US but without much significant change in other CONUS regions (see for example Marvel et al. 2021, Fig. 8b)).	Thank you for the clarification on season. We will insert "summer". While "column soil moisture" is the technically correct term, it's not necessary in this context, where "total moisture" adequately conveys the meaning. See the figure metadata for more information about data sources.
Jessica	Evans	Figure	04. Water		8				Please explain or reference why RCP4.5 is shown instead of RCP8.5.vÇ¬†Please explain whether RCP4.5vÇ¬†is seen asvÇ¬†more plausible for planning purposesvÇ¬†vs.vÇ¬†RCP8.5, or if does it not matter when looking at mid-century results.	RCP4.5 was considered for analysis for two primary reasons. First, the choice of a specific emissions scenario (RCP4.5 vs. RCP 8.5) has a very limited influence on climate change response by a mid-21st century time horizon. Second, based on the recent literature, inlcuding the IPCC AR6 WGIII report, the RCP 8.5 represents a highly unlikely scenario and is only useful as a high-end, high risk scenario.
Thomas	Knutson	Text Region	04. Water		9		3		Use the term "summer total column soil moisture" (if that is what is plotted, rather than "summer soil moisture"). Projections of surface soil moisture differ from column soil moisture so it is important to clearly identify which is being shown/discussed.	Thank you for the clarification on season. We will insert "summer". While "column soil moisture" is the technically correct term, it's not necessary in this context, where "total moisture" adequately conveys the meaning. See the figure metadata for more information about data sources.
Sean	Fleming	Figure	04. Water		9	9	6	7	Figure 4.6: please provide a proper literature citation, not just ‚ÄúSource: Source: University of Colorado Boulder, NOAA NCEI, and CISESS NC,Äù. Also change ‚ÄúData not available for the US Caribbean,Äù to ‚ÄúProjections not available for the US Caribbean,Äù; for most scientists, engineers, and the general public, the term ‚Äúdata,Äù is reserved for observational data, not model projections, so this caption would be misleading in widely read report like NCA5.	Please see the revised caption and notice the link to the figure metadata, where you will find all of the source information. The NCA5 strives for consistency across chapters for projection discussions. The information that is plotted is projection data.
James	Smith	Whole Page	04. Water		9				May I suggest the % of groundwater aquifers mined needs to be explained (34% Holocene (75 ‚Äì 11,800 years ago), and 28% Pleistocene (>11,800 years ago) https://www.nature.com/articles/s43247-022-00473-y). As well the % of the lowering of groundwater aquifer levels faster than replenished by rain and subsequent economic impacts on systems. The Ogallala Aquifer is near exhaustion (https://www.google.com/search?gs_ssp=eJzj4tDP1TeItzBLN2D0ESshPT8zJScxJVEgsLM1MSy0CAHawCRc&q=ogallala+aquifer&oq=olgala+aqui&aqs=chrome.1.69i57j46i10i13i512j0i10i13i512j0i390.31965j0j7&sourceid=chrome&ie=UTF-8).	We appreciate the suggestion and are familiar with the work referenced here. We chose not to get into the concept of groundwater age in this section. This is a nuanced concept that will require significant text to make clear to a general audience and we did not feel that we could do this within our space limitations. For example, just because you are pumping old water doesn't mean it is unsustainable (as is acknowledged in the reference provided). And pumping 'young' water is an indication that it could be more susceptible to contamination but its not a guarantee. Furthermore, the impact of climate change on these relationships is not well understood (and is not addressed in the provided reference). Our focus here is really on climate change impacts on groundwater and not the broader issue of groundwater sustainability. We have also left the issues of specific aquifers to the regional chapters due to space limitations in our chapter.
Jessica	Evans	Figure	04. Water		9				For the Colorado River basin in the Southwest, soil moisture in both the summer (monsoon indicator) and fall (initial conditions for water year hydrology model used by Colorado River Basin Forecast Center) are important indicators of that water year's expected runoff efficiency. It would be really useful for the southwest, and other snow-dominant water supply systems to have a figure of the fall soil moisture condition projections. Recognizing that the authors have very strict word count limitations, the authors could potentially include the fall soil moisture projection graph in the Appendix 4: Indicators chapter.	We appreciate this suggestion and understand the value of a better understanding of fall soil moisture projections. We don't have space to add another figure, however. The Indicators Appendix does not produce projection figures--they provide figures based on observed data.
Jessica	Evans	Figure	04. Water		9				Please explain or reference why RCP4.5 is shown instead of RCP8.5.vÇ¬†Please explain whether RCP4.5vÇ¬†is seen asvÇ¬†more plausible for planning purposesvÇ¬†vs.vÇ¬†RCP8.5, or if does it not matter when looking at mid-century results.	RCP4.5 was considered for analysis for two primary reasons. First, the choice of a specific emissions scenario (RCP4.5 vs. RCP 8.5) has a very limited influence on climate change response by a mid-21st century time horizon. Second, based on the recent literature, inlcuding the IPCC AR6 WGIII report, the RCP 8.5 represents a highly unlikely scenario and is only useful as a high-end, high risk scenario.
Thomas	Knutson	Text Region	04. Water		10	10	9	11	Change to: "Increases in *annual mean precipitation and* heavy precipitation events are projected to increase annual runoff...". The 2 cited references deal more with flooding and hydrologic extremes than annual mean runoff, and so maybe should be cited in the next section, not here. An important reference on annual discharge changes is the following for the Colorado River: Milly and Dunne (2020). Milly and Dunne "estimate that annual mean [Colorado River] discharge has been decreasing by 9.3% per degree Celsius of warming because of increased evapotranspiration, mainly driven by snow loss and a consequent decrease in reflection of solar radiation. Projected precipitation increases likely will not suffice to fully counter the robust, thermodynamically induced drying. Thus, an increasing risk of severe water shortages is expected." Ref: Milly, P.C.D., and K. A. Dunne, 2020: Colorado River flow dwindles as warming-driven loss of reflective snow energizes evaporation. Science, vol 367, issue 6483, pp. 1252-1255, https://doi.org/10.1126/science.aay9187	Thank you for this suggestion. We have added this reference.
Sean	Fleming	Figure	04. Water		10	10	14	20	Figure 4.7 and its caption are technically incorrect as currently presented. It‚Äôs an important, but easily fixable, terminology error. The figure depicts what its caption purports to be changes in river flow as raster images, but river flow is not a spatially distributed variable and it cannot be meaningfully gridded like this. River flow only happens in river channels that drain their upstream watersheds; the fundamental spatial nature of river hydrology is ignored in this map. Taken literally, Figure 4.7 implies the entire US is under a single gigantic river! Maps showing streamflow trends instead attribute the changes to (a) the corresponding measurement or modeling point on the river channel (typically corresponding to a USGS streamgage) which integrates all upstream effects, or (b) to that upstream watershed or subwatershed area as a whole; see Figures 25.3 and A4.8, respectively, in the NCA5 TOD for good examples of what this should look like. In contrast, Figure 4.7 doesn‚Äôt actually show river runoff/streamflow. What I can only presume is shown here (the text provides no explanation to the reader, which is also unacceptable) is the net water balances of grid cells in a land surface model. There‚Äôs nothing wrong with that per se, but it has to be called what it is. Apart from being a scientific gaffe, this misrepresentation has public-outreach consequences. These reports are read by a very wide variety of people, and raster maps of ostensible ‚Äústreamflow‚Äù or ‚Äúrunoff‚Äù changes like these are susceptible to deep misinterpretation by readers untrained in hydrology, because there‚Äôs no acknowledgement here that the runoff available at a given location on a major river is sourced from locations far (potentially 100s of kilometers) upstream experiencing different hydroclimatic changes. For example, Figure 4.7 implies one could read off changes in Columbia River runoff in Portland by simply looking at the map pixel corresponding to Portland ‚Äì but in reality, Columbia River flows at Portland are of course driven mainly by snow, rain, and glacier melt in the distant mountains of Idaho, Montana, British Columbia, etc., and the climate changes in those headwaters are very different from Portland. Obvious susceptibility to this kind of misreading undermines the basic purpose of the NCA5 report. Mistakes like this will also likely compromise the credibility of the NCA5 with practicing water resource scientists, engineers, and managers who understand the basic point that the runoff you see at a given point on a river comes from the entire upstream watershed area. Getting this right is also important for	We thank the reviewer for the comment. Streams integrate runoff across the landscape and unrouted runoff changes are often used as a surrogate for changes in streamflow. That is the intention of this figure. Figure captions were constrained by a severe overall word limit for the chapter, which has now been relaxed slightly. We have changed the figure title and caption to better communicate its content and purpose.
Jessica	Evans	Figure	04. Water		10				Please explain or reference why RCP4.5 is shown instead of RCP8.5.vÇ¬†Please explain whether RCP4.5vÇ¬†is seen asvÇ¬†more plausible for planning purposesvÇ¬†vs.vÇ¬†RCP8.5, or if does it not matter when looking at mid-century results.	RCP4.5 was considered for analysis for two primary reasons. First, the choice of a specific emissions scenario (RCP4.5 vs. RCP 8.5) has a very limited influence on climate change response by a mid-21st century time horizon. Second, based on the recent literature, inlcuding the IPCC AR6 WGIII report, the RCP 8.5 represents a highly unlikely scenario and is only useful as a high-end, high risk scenario.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Reid	Sherman	Figure	04. Water		11				Is the scientific understanding bar at the bottom of this figure overlay cautious, perhaps leading people to hesitate considering future possibilities for flooding?	We have changed the phrasing from "high" and "low" confidence to "higher" and "lower". This should stand the test of time better than the original wording, since there is progress being made on the science that will lead to greater confidence in the coming years.
Thomas	Knutson	Text Region	04. Water		12	12	2	3	Fig. A4.9 is based on the SPEI methodology, which has been questioned in terms of fitness for climate change application by some drought/climate researchers (e.g., Berg and Sheffield, 2018, from a soil moisture perspective). The EPA Climate Indicators website (where such a map is found) includes this caveat: "The underlying method for calculating SPEI does not account for variables such as solar radiation, humidity, and wind speed that can all influence drought conditions. As a result, the SPEI shown here is more reflective of the influence of temperature. This is a limitation and potential source of uncertainty in interpreting drought conditions." Therefore, as an alternative examination of inferred past soil-moisture drying trends, see the column soil moisture-based drying trend map obtained from the Noah-MP land surface model forced by observed boundary condition changes over the 20th century, including hourly precipitation, near-surface temperature, near-surface wind, near-surface humidity, downward shortwave and longwave radiation, and surface pressure (Su et al., 2021). Their summary Fig. 4. suggests increasing dry area coverage for the southwest U.S. but not not over five other regions of CONUS. The past drying trend map of Su et al. does not look as troubling for the NW U.S. as shown in Fig. A4.9, but both methods indicate increased drying over the SW U.S. Refs: Berg, A. and J. Sheffield, 2018: Climate change and drought: the soil moisture perspective. Current Climate Change Reports. https://doi.org/10.1007/s40641-018-0095-0 Su, L., Cao, Q., Xiao, M., Mocko, D. M., Barlage, M., Li, D., Peters-Lidard, C. D., & Lettenmaier, D. P. (2021). Drought Variability over the Conterminous United States for the Past Century, Journal of Hydrometeorology, 22(5), 1153-1168. https://journals.ametsoc.org/view/journals/hydr/22/5/JHM-D-20-0158.1.xml	Thank you for the comment. We forwarded it to the Indicators Appendix team who are responsible for figure. Here is their response: "The authors acknowledge the limitations of the SPEI, particularly with respect to soil moisture and have examined the studies referenced by the commenter (Berg and Sheffield 2018 and Su et al., 2021). The authors chose the SPEI (5-year) because it is widely used, the data record is suitable for long-term studies (100+ years), publicly available, and does have some advantages over other commonly used drought metrics such as the Palmer Drought Severity Index (PDSI) and the Drought Monitor. Berg and Sheffield 2018 make important points about the importance of soil moisture and some of the limitations of existing metrics which are certainly valid. The authors recognize that SPEI is heavily influenced by temperature, however, in terms of magnitude and direction of change, the Su et al., Figure 4 is similar to the SPEI (5-year) for most of the sub-regions. As discussed in Su et al. 2021, observational data for soil moisture (as well as important variables wind speed, relative humidity, and solar radiation) are sparsely distributed over time and space and therefore are challenging to incorporate into long-term metrics of drought. The authors also examined Jasinski et al. 2019 as suggested by another commenter which uses NCA-LDAS data based on modeling forcing estimates from remotely sensed satellite data. This is a scientifically valid approach and provides another perspective on drought conditions based on soil moisture conditions, however, the overall temporal record is shorter as it is not based on in situ observations (indicators based on model data are out of scope for this appendix). Therefore, the authors didn't feel the suggested metrics represented a suitable replacement for the SPEI (5-year). Additional information has been added to this section to highlight that there are several definitions of drought as well as other important metrics for characterizing drought and the important variables and conditions that contribute to it. Ideally, the authors would have preferred to provide multiple drought indicators in this section but could not due to chapter length and space constraints. Other drought indicators featured in NCA5 have now been cited in the text."
Thomas	Knutson	Figure	04. Water		12			5	Figure 9: The metric shown apparently does not consider changes in precipitation so the term "climatic water deficit" is a potentially confusing term to use here, and this map could be confusing for readers to interpret. Modeled projections of column soil moisture and/or runoff would be more appropriate. Those metrics are making fewer assumptions and are part of climate models that obey certain energy balance constraints. Perhaps this space could be better used by showing column soil moisture changes for other seasons to expand on the summer-only results shown in Fig. 4.6, seasonal results for runoff in Fig. 4.7, or a map of historical soil moisture drying trends, like Fig. 4 from the Su et al. (2021) paper. Ref: Su, L., Cao, Q., Xiao, M., Mocko, D. M., Barlage, M., Li, D., Peters-Lidard, C. D., & Lettenmaier, D. P. (2021). Drought Variability over the Conterminous United States for the Past Century, Journal of Hydrometeorology, 22(5), 1153-1168. https://journals.ametsoc.org/view/journals/hydr/22/5/JHM-D-20-0158.1.xml	Climatic water deficit (CWD) represents the shortfall in the amount of water necessary to fully supply the physiological needs of vegetation—it is zero if vegetative needs are fully supplied. CWD is calculated as the difference between potential evapotranspiration (PET) and actual evapotranspiration (AET), which are in turn estimated by a land surface model. PET represents the needs of the vegetation while AET represents the amount of evapotranspiration that occurred given any constraint on water supply. The water supply to vegetation comes from precipitation through soil moisture. We believe that this metric is the best way to show changes in the water balance considering evapotranspiration, precipitation and soil moisture. We have updated the figure caption to clarify the meaning of CWD for a general audience.
Sean	Fleming	Figure	04. Water		12	12	11	12	Figure 4.9: please provide a proper literature citation, not just ‚ÄúSource: University of Colorado Boulder,Äù. Also change ‚ÄúData not available for the US Caribbean, Alaska, or Hawaii,Äù to ‚ÄúProjections not available for the US Caribbean, Alaska, or Hawaii,Äù; for most scientists, engineers, and the general public, the term ‚Äúdata,Äù is reserved for observational data, not model projections, so this caption would be misleading - especially in a widely read report like the NCA5.	Please see the revised caption and notice the link to the figure metadata, where you will find all of the source information. The NCA5 strives for consistency across chapters for projection discussions. The information that is plotted is projection data.
Jessica	Evans	Figure	04. Water		12				Please explain or reference why RCP4.5 is shown instead of RCP8.5.vÇ¬†Please explain whether RCP4.5vÇ¬†is seen asvÇ¬†more plausible for planning purposesvÇ¬†vs.vÇ¬†RCP8.5, or if does it not matter when looking at mid-century results.	RCP4.5 was considered for analysis for two primary reasons. First, the choice of a specific emissions scenario (RCP4.5 vs. RCP 8.5) has a very limited influence on climate change response by a mid-21st century time horizon. Second, based on the recent literature, inlcuding the IPCC AR6 WGIII report, the RCP 8.5 represents a highly unlikely scenario and is only useful as a high-end, high risk scenario.
Molly	Woloszyn	Text Region	04. Water		16	16	13	17	The way this is currently written makes it sound like drought could occur in the absence of below-normal precipitation. This is not possible. You must have below-normal precipitation to have drought. The comment about higher temperatures - I would state that higher temps can accelerate drought development. But, it wouldn't be the ONLY driver. You need to have below normal precipitation too.	It is most common for drought to develop with precipitation shortfalls. As our understanding of drought evolves, however, many researchers recognize that drought can develop with near-normal precipitation. This is most obvious in the development of warm snow drought. However the importance of temperature (and other components of evaporative demand) in driving drought is appartent in the utility of the Evaporative Demand Drought Index (EDDI, Hobbins et al. 2016), which is useful in forecasting drought. We also for example, see that the recent SW drought started seven years earlier due to evaporative demand largely driven by temperature (Williams et al. 2022). Udall and Overpeck (2017) make a compelling case that high temperatures combined with near-normal precipitation resulted in flow reductions in the Colorado. A recent NOAA task force indicated that temperature can induce drought (Hoerling, 2018) and a subsequent task force report also used that definition, stating "Drought is caused by low precipitation, high temperatures and its associated vapor pressure deficits or VPD (Box 2), or a combination of the two" (emphasis added, Mankin et al. 2021). Because this is the definition currently espoused by NOAA, we do not plan to change the text.
Jessica	Evans	Text Region	04. Water		17	17	1	2	Please update the text to reflect 1980-2022 because when going to the NCEI website, the dollar amount in text ($291.1 billion) can not be found in the updated source. NCEI website now states, "The distribution of damage from U.S. Billion-dollar disaster events from 1980 to 2022 is dominated by tropical cyclone losses. Tropical cyclones have caused the most damage ($1,333.6 billion, CPI-adjusted) and also have the highest average event cost ($22.2 billion per event, CPI-adjusted). Drought ($327.7 billion, CPI-adjusted), severe storms ($383.7 billion, CPI-adjusted) and inland flooding ($177.9 billion, CPI-adjusted) have also caused considerable damage based on the list of billion-dollar events."	Thank you for the comment. We have updated the text to include 2022.
Jessica	Evans	Text Region	04. Water		17	18	4	11	In the "Disproportionate Impacts" section or elsewhere in the chapter, it would be useful to mention that utilities investment in their water infrastructure often requires ratepayer increases (barring grants or other complete subsidies), which harm low-income customers the most. 20% of U.S. customers pre-pandemic experienced paying water bills that exceeded 4.5% of their income, a target the EPA considers unaffordable. A citation demonstrating this is McKinsey & Company. Exhibit 3. 2021. US water infrastructure: making funding count. https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/us-water-infrastructure-making-funding-count.	This is an excellent comment and an important issue. However, it is not clearly a climate change issue and given our very tight word count limit, we can't address it here, unfortunately.
Jim	Titus	Text Region	04. Water		18			9	Hispanics people are 50% more likely to live in a 500-year floodplain than the general population. See JG Titus, 2003, "Population in floodplains or close to sea level increased in US but declined in some counties,Äîespecially among Black residents" at Figure 6. Environmental Research Letters.	We thank the commenter for this helpful reference (Titus, 2023). We cite it as additional evidence for our statement about flood exposures. We have edited the text to include this information.
Nick	Procopio	Text Region	04. Water		18	18	21	21	Replace ¬¡absent" with ¬¡without", ¬¡Rainfall was estimated to be 8%¬ñ19% heavier than it would have been without human-caused"	We have made this change.
Jessica	Evans	Text Region	04. Water		19	19	11	12	AMWA and WUCA caution against portraying the state of water infrastructure in a tone that instills fears in the public about the safety of drinking water. Instead, AMWA and WUCA recommend rephrasing the sentence to emphasize that aging infrastructure without significant investment increases the risk of delivering affordable drinking water.	We understand the position of the utilities, but the NCA5 messaging is not crafted to align with that of the utilities. The NCA5 can't make funding or policy recommendations.
Jessica	Evans	Figure	04. Water		20				Considering this chapter's word count limit, it seems many words are dedicated to this figure. Is there a way to include the level descriptions in the figure instead of spelled out in the text?	A picture is worth a thousand words, as they say. The words were there to give reviewers an idea of what the figure will look like once it's published, and they didn't count against our word count. We're sorry that you couldn't review the figure itself.
Jim	Titus	Text Region	04. Water		21	21	9	17	This paragraph omits one of the most important planning and management responses to climate change, which is to move people out of harms way and/or limit new development in hazardous areas. That applies to both drought and floodplains, but it is especially advanced in the case of floodplains. And there is substantial literature on both government sponsored and independent disaster-driven emigrations from the hazardous areas.	Thank you for this suggestion. We have added references for both managed retreat and floodplain management best practices.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jessica	Evans	Text Region	04. Water		21	21	12	13	AMWA and WUCA suggest adding another reference to the "water conservation and reuse" management topic. While Chang et al. 2018 supports the increased uncertainty, SNWA 2019 provides specific conservation tactics to address greater uncertainty between supply availability and demand. This reference is a useful resource for water managers looking for tools to increase conservation. https://www.snwa.com/assets/pdf/reports-conservation-plan-2019.pdf . Alternatively, you could consider referencing EPA's best management practices, https://www.epa.gov/watersense/best-management-practices.	Thank you for this reference. We have added it to our text and our bibliography.
Sean	Fleming	Text Region	04. Water		21	21	14	14	The literature citations around streamflow forecasts on chapter 4's page 21, line 14 are a bit weak and don‚Äôt give the reader an adequate sense of the current state of the field. I suggest adding references to some recent advances around operational river forecasting and the data needed to support it. Two very high-profile examples are (1) the new machine learning-based seasonal river volume forecasting (M4) system being adopted by the USDA for nearly 600 forecast points across the western US and Alaska, which will be the largest roll-out of AI into operational hydrology to date, represents the largest stand-alone operational forecast system operated by a practical service-delivery organization in the US West, and guides the practical management of billions to trillions of dollars of water value every year (Fleming et al., 2021, Assessing the new Natural Resources Conservation Service water supply forecast model for the American West: a challenging test of explainable, automated, ensemble artificial intelligence, Journal of Hydrology, 602, 126782) and (2) the commercialization and operationalization of the NASA-developed Airborne Snow Observatory (ASO), which combines airborne remote sensing and physics-based modeling to provide the highest-resolution operational tracking of mountain snow conditions available so far, with rapid adoption by water managers across the western US (Painter et al., 2016, The Airborne Snow Observatory: fusion of scanning lidar, imaging spectrometer, and physically-based modeling for mapping snow water equivalent and snow albedo, Remote Sensing of the Environment, 184, 139-152.)	Thank you for this suggestion and these references. We have added the Fleming et al. paper. The chapter already had a reference to Painter in the data section at the end of the chapter.
Jessica	Evans	Text Region	04. Water		21	21	17	17	AMWA and WUCA suggest adding another reference to the "adaptation guidance" topic. Utilities and municipalities across the country are considering how to update their planning and design practices with actionable climate change science and information. A good example of this (and one which may be a helpful resource for other water and utility managers) is the Philadelphia Water Department Climate-Resilient Planning & Design Guidance document (January 2022), accessible here:vÇ¬†https://water.phila.gov/pool/files/climate-resilient-guidance.pdf	Thank you for the reference. We have added it to the text.
Reid	Sherman	Whole Page	04. Water		21				Surprised to not see watershed-wide management approaches listed in this section. Citing more holistic, integrated models would also help address disproportionate impacts on the vulnerable people, communities, and places discussed throughout, especially the previous Key Message.	Thank you for the recommendation. We have added a reference (Anderson et al. 2019) that addresses watershed-wide management in the context of ecosystems and social/cultural connections.
Jessica	Evans	Text Region	04. Water		23	23	1	9	The authors should include citations to substantiate the claim that "progress is difficult, in part because regulations, codes, and standards involve competing interests and often span multiple jurisdictions." It is difficult to know which regulations are included. Additionally, later parts of the chapter allude to the water rights regime in the Western United States hindering progress and adaptation, but there is no explicit discussion of this or citations demonstrating how the regime hinder adaptation.	We have added three references that substantiate the phrase: Mulroy, Patricia, ed. The Water Problem: Climate Change and Water Policy in the United States. Washington, D.C: Brookings Institution Press, 2017. Brekke, Levi D., Julie E. Kiang, J. Rolf Olsen, Roger S. Pulwarty, David A. Raff, D. Phil Turnipseed, Robert S. Webb, and Kathleen D. White. Climate Change and Water Resources Management: A Federal Perspective. Circular 1331. Reston, Va: U.S. Geological Survey, 2009. Olmstead, Sheila M. “Climate Change Adaptation and Water Resource Management: A Review of the Literature.” Energy Economics 46 (November 2014): 500–509. https://doi.org/10.1016/j.eneco.2013.09.005.
Sean	Fleming	Figure	04. Water		24	24	1	8	The maps in the top part of Figure 4.19 make a basic terminology error. They don‚Äôt actually show streamflow variability (and changes in it) as they purport to. These are raster images that appear to reflect local net water balances in the local grid cells of a spatially fully distributed land surface model with no routing procedure, whereas river flows only happen in river channels, and these accumulate water from the entire upstream basin area. Any competent water resource scientist, engineer, or manager, or freshwater ecologist, will tell you this is a fundamental and crucially important point. An image like this can be easily misread by a naVØve reader (and remember the NCA5 will be read by a very broad, in many cases scientifically untrained, readership). For example, the value this map shows for a pixel (corresponding to a LSM grid cell) on the lower Colorado River doesn‚Äôt actually reflect Colorado River flow variability at that location, which is determined instead by the interaction of all upstream pixels (LSM grid cells) in the Colorado Basin. You can only make inferences about river flow from a LSM if it uses a routing routine, which apparently wasn‚Äôt used here because ‚Äústreamflow‚Äù is being distributed across the landscape instead of being assigned to river channels or their corresponding upstream watershed areas. But this is an easily fixed nomenclature issue. Please rename the quantity in the maps as ‚Äúlocal runoff generation potential‚Äù or ‚Äúlocal net water balance‚Äù or ‚Äúlocal runoff production‚Äù and include a note in the caption explaining that the streamflow (and streamflow variability) experienced at a downstream point on a river is not represented solely by the pixel at that location but instead reflects the integration of all upstream cells.	Streams integrate runoff across the landscape and unrouted runoff changes are often used as a surrogate for changes in streamflow. That is the intention of this figure. We have changed the figure title and caption to better communicate its content and purpose, while striving to stay within the chapter word count.
George	Rhee	Whole Page	04. Water		24				My comments below are intended to be constructive even if they are critical. I have actually computed error bars (feel free to get in touch gfrhee@gmail.com if you are curious about this work). Comments: I am concerned by the lack of error bars in the graph for the natural flow at lees ferry 1906 - 2016. It would also be good to update the graph to water year 2021. The error bars are critical because they enable one to evaluate the risk. The fact that we apparently do not know the uncertainties associated with the yearly natural flow of the Colorado river is a major problem and magnifies the risks. There is a vital difference between precision and accuracy. They are different measures of data. The narrative that the high river flows led to high allocations in the river compact is misleading because it ignores the known uncertainties in the long term flow of the river back in the 1920s estimates varied between 15 and 18 MAF/year. Simple model fitting based on ~ten years a gauged data would yield an uncertainty of 5MAF (3 sigma) meaning the long term flows were known lie somewhere between 12 and 23 MAF/year. What was known in 1922 was that the long term river flows were not known. It is important to recognize past mistakes in order to avoid repeating them. All of the plans (river compact, interim guidelines, drought contingency plan, 500+ plan) have failed because of the point made above. On a positive note at the webinar of Jan 12 it was encouraging that the representative from USGS thought I had a point. It is disconcerting that it has taken this long to recognize this.	The inclusion of error bars on traces of estimated natural flow, and estimates of error on estimates of long-term average natural flow, make an important contribution to planning and policy development. Researchers have been offering ranges for long-term natural flow for several decades, but planners at Reclamation only began addressing this range publicly in studies supporting the Interim Shortage Guidelines of 2007. For a complete discussion about how confirmation bias led to the over-allocation of Colorado River water supplies, we cited Kuhn and Fleck, 2019. Science Be Dammed: How Ignoring Inconvenient Science Drained the Colorado River. Tucson: The University of Arizona Press. However, it is not the purpose of the NCA to address past policy shortcomings and suggestions for policy are explicitly forbidden in the NCA. Further, inclusion of error bars in Figure 4.19 are not necessary and would detract from the principal purpose of the figure, which is to illustrate the variability of estimates of natural flow over space and time and to illustrate how natural variability affects decision making. We included this figure, and the citation to Fleck, John, and Anne Castle. 2022. “Green Light for Adaptive Policies on the Colorado River.” Water 14 (1): 2. doi:10.3390/w14010002, to mitigate against the return of exuberance when conditions inevitably get wetter again. The wet/dry cycles are illustrated by a single trace and are not affected by estimation error. For an illustration of the coherence of droughts/pluvials across different paleo reconstructions, see Gangopadhyay, S., B. L. Harding, B. Rajagopalan, J. J. Lukas, and T. J. Fulp (2009), “A nonparametric approach for paleohydrologic reconstruction of annual streamflow ensembles”, Water Resour. Res., 45, W06417, doi:10.1029/2008WR007201, particularly Figures 3 and 4.
Jessica	Evans	Figure	04. Water		24				Here are some suggestions to improve clarity on this figure: Although this chapter is nation-wide, for the purpose of the figure clarity, the authors could clip the US maps either to the western states or to the Colorado River basin that is outline. As is, it's hard to see the basin outline in the 1915-1924 left map. Also, the reconstructed flows (bottom) graph have 3 distinct peaks in flow from 1906-2016, but it appears that they are not captured in the zoomed in (upper) graph.	Thank you for these suggestions. The point of this figure is to show the effect of natural variability over space and time. The national context was chosen for that purpose. We have made the basin boundary clearer in both images. The reconstructed flows are based on a statistical model of the relationship between an index based on the widths of tree rings and as such is not perfect—many tree-ring reconstructions over-predict the wet period in the 1940s. See Gangopadhyay, S., B. L. Harding, B. Rajagopalan, J. J. Lukas, and T. J. Fulp (2009), “A nonparametric approach for paleohydrologic reconstruction of annual streamflow ensembles”, Water Resour. Res., 45, W06417, doi:10.1029/2008WR007201, particularly Figure 4. This imperfection is well-understood by those who routinely use the reconstructed flows, but we agree can be confusing to those who are not so familiar with these reconstructions.
Jessica	Evans	Text Region	04. Water		25	25	17	35	It would be worth mentioning there is no central national or regional clearinghouse of publicly available climate and hydrology data available for planners in the water sector.	We feeel that data can be accessed through existing sources. There are national repositories of hydrology (USGS) and climate (NOAA) data. Climate.gov (which is designed to support the NCA process) is one location that includes a great deal of relevant data, a number of tools for planners, and links to other relevant datasets and tools. There are also sites that try to bring together the most relevant data for different sectors. For example, EPA's Creating Resilient Water Utilities (CRWU) provides some more specific tools for the water sector.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jessica	Evans	Text Region	04. Water		25	25	24	35	In water stressed regions, a significant data gap is actual consumptive water use information, whether estimated using diversions or water orders, or via metering for municipalities, which is not mentioned by the authors in this chapter. Additionally, implementing updated water use information in planning models is also behind. See Ch 3 in Lukas, Jeff, and Elizabeth Payton, eds. 2020. Colorado River Basin Climate and Hydrology: State of the Science. Western Water Assessment, University of Colorado Boulder. DOI: https://doi.org/10.25810/3hcv-w477.	Thank you for the comment. We have made a small revision to the section to address water use data gaps.
Thomas	Knutson	Text Region	04. Water		28	28	23	25	"Based on current trends and climate model projections, there is high confidence that warming temperatures will very likely cause soils to dry, increasing the demand for surface and groundwater for crops and human use." This needs more specificity. Is this referring to the top level soil moisture or column soil moisture? Annual mean or summer only? Past century reconstructed trends in dry area coverage suggest annual column soil moisture drying has occurred mainly in the southwest US but not other CONUS regions (Su et al. 2021), despite warmer surface temperatures. This seems to contradict the draft conclusion above, or at least the above statement is too limited in scope and specificity. Ref: Su, L., Cao, Q., Xiao, M., Mocko, D. M., Barlage, M., Li, D., Peters-Lidard, C. D., & Lettenmaier, D. P. (2021). Drought Variability over the Conterminous United States for the Past Century, Journal of Hydrometeorology, 22(5), 1153-1168. https://journals.ametsoc.org/view/journals/hydr/22/5/JHM-D-20-0158.1.xml	Thank you for this comment. In fact, the soil moisture term references total column soil moisture. Regional summer soil moisture projections are provided in the map figures. The data source for our map figures can be found by clicking on the metadata icon. We have revised the soil moisture discussion to be more regionally specific while minimizing jargon that lay readers might find confusing. Please see the Traceable Accounts for more information.
Michael	Jasinski	Text Region	04. Water		36		9		Please add in References: Jasinski, M.F., Borak, J.S., Kumar, S.V., Mocko, D.M., Peters-Lidard, C.D., Rodell, M., Rui, H., Beaudoing, H.K., Vollmer, B.E., Arsenault, K.R. and Li, B., 2019. NCA-LDAS: overview and analysis of hydrologic trends for the national climate assessment. Journal of hydrometeorology, 20(8), 1595-1617. http://doi.org/10.1175/JHM-D-17-0234.1 Date Submitted: 01/27/2023 - 8:02	Thank you for this reference. It will inform our discussions of trends for the hydrologic variables in KM4.1. We have added your findings to our text where appropriate, and will add the reference to our bibliography.
Ferhat	Yilmaz	Whole Chapter	04. Water						As there is no specific covid section in 04 Water Chapter, it is important to consider Covid-19 and Water issues, which shows us how extra pressures like the pandemic on water resources are dangerous for environmental pollution, low reservoir levels, water supply, water quality etc. It would be good to have a section covid related water issues under climate change. We found that Water use increased by up to 21% in some places, Delayed morning peak water consumption from 0700 to 0900, and Local water crisis driven by extreme weather in the USA. Therefore, it would be better if unforeseen circumstances section including further pandemic etc is included in the water chapter. Climate change and public health issues may compound one another, and so we used a DPSIR Framework (no previous use to examine the actual and potential impacts of Covid-19 and climate change on water consumption and resources) to scope the main factors that may interact to affect water use and resources (in the form of reservoirs) using evidence from Istanbul, Turkiye, with some discussion of the comparative situation in elsewhere. The ongoing increase in water use and change in the pattern of use in emergency situations could cause local water shortages in future due to either infrastructure failure or capacity limitations. We have taken the summary findings from our study of the Covid 19 period in Istanbul and elsewhere and used these in the enhanced DPSIR framework to set out at the next level of detail the factors that may be affected by both climate change and the pandemic. See details at: Ferhat Yilmaz, Dan Osborn and Michel Tsamados. The influence of Covid-19 Pandemic and Climate Change on Water Use and Supply: Experience of Istanbul, Turkiye. UCL Open: Environment Preprint. DOI: 10.14324/111.444/000087.v3 https://ucl.scienceopen.com/document/read?id=0222f6b5-e209-410e-8d76-c92b9e7a0ac9	Thank you for this observation. Though the Water chapter does not address COVID, please see the Cross-cutting Box, "Focus on COVID-19 and Climate Change" for a discussion of the importance of access to clean water on COVID-19 and pandemics in general.
James	Smith	Whole Chapter	04. Water						It seems the Water Chapter still is trying to overcome false information about the climate crisis, and to convince the public and representatives of the climate crisis. May I suggest climate crisis mitigation and prevention solutions be included.	The Water chapter is not laying out the case for accepting the science of climate change. That case is thoroughly made in other chapters, particularly Chapters 2 & 3. Regarding the suggestion, we don't have the word count to address climate change prevention, but we do have a Key Message about adaption to climate change impacts to water resources. Please see the NCA5 chapters devoted to mitigation (Chapter 32) and adaptation (Chapter 31).
Dan	Dostie	Whole Chapter	04. Water						Consider using the definition of water availability from USGS in the beginning of the chapter and then using its four elements of quantity, timing, use, and quality as appropriate throughout the chapter. The new USGS version of the water cycle uses this statement that may work ‚ÄúThe amount of water that is available depends on how much water is in each pool (water quantity). It also depends on when and how fast water moves (water timing), how much water we use (water use), and how clean the water is (water quality). Thank you for the consideration. This concept is being used by NRCS to guide investments for addressing water-related issues across the western US.	Thanks for this idea -- while we did not choose to rework the entire chapter around this definition of water availability, we did add this description as part of the section related to our first key message.
Emma	Conrad-Rooney	Whole Chapter	04. Water						Key messages 2 and 3 should be revised to follow the Risk-Based Framework	The chapter is organized according to the risk-based framework to the extent possible with limited space. KM 4.1 establishes the context by describing the range of physical trends and projections in hydrologic variables, followed by KM 4.2, which identifies existing vulnerabililties and impacts and future risks to communities, followed by KM 4.3, which discusses adaptation activities to reduce risk.
Richard	Sigler	Whole Chapter	04. Water						The southwest region of the United States is in a 26 year drought, despite the fact that 2022 and the first part of 2023 have seen a seasonal amount of rainfall. The Colorado River, which supplies water to lake Mead and lake Powel, which in turn supply water to 40 million people, is drying up. Due to climate change, this drought is not going to end anytime soon. The people will have to adapt, by strict conservation measures, including water usage for agriculture.	Due to word count limits, the Water chapter is limited in how much text it can devote to a single region or river. Please see Chapter 28, the Southwest chapter, for a detailed discussion of long-term drought on the Colorado River, the implications for Lakes Powell and Mead, and the impacts to water users that rely on them. We have pointed readers to Ch 28 in our text about the Colorado River for readers who want to learn more.
Molly	Woloszyn	Whole Chapter	04. Water						For flash drought, the most recent "state of the science" is presented in this BAMS article: https://journals.ametsoc.org/view/journals/bams/103/10/BAMS-D-21-0288.1.xml; and would be the best one to reference.	Thank you for highlighting this new paper. We have updated the citation.
Reid	Sherman	Whole Chapter	04. Water						It's hard to sort out implications for the built environment versus ecological impacts throughout the narrative. I know that's a difficult line to walk, but I do think most readers will fall into the bins of natural or built water resource management in this space, so I am sharing that feedback for consideration.	Thank you for this comment. We agree that we haven't segregated impacts along these lines and that it may be difficult for readers who are looking for separate sections. However, the NCA5 has a Built Environment chapter (Ch. 12) and an Ecosystems chapter (Ch. 8) that address climate change impacts to those sectors.
Reid	Sherman	Whole Chapter	04. Water						This is one of the better chapters for addressing effects on marginalized communities.	Thank you!
Rachel	Licker	Text Region	05. Energy		3	3	2	3	Suggest adding "clean" to "reliable and affordable energy", which is important for a high quality of life, public health, and reducing emissions.	Thank you for you comment. We will adopt your suggestion. The sentence now reads "Reliable and affordable clean energy is important for quality of life, econoimnce competitieveness, and national security."
Rachel	Licker	Text Region	05. Energy		3	3	9	10	Suggest adding "..that's lowering heat-trapping emissions..." after "shifts in the generation mix" and electrification in industry, along with buildings and transportation.	Thank you for the comment. We modified the language. to read: Societal changes are altering vulnerabilities of energy systems and communities to climate change. A changing risk profile results from: shifts in the energy generation mix that lower greenhouse gas emissions;; increased electrification in buildings and transportation; technological innovation leading to new demands for energy; greater susceptibility of energy system components to domestic and international supply chain disruptions; and an increasingly automated, interconnected system susceptible to cyberattacks.
Rachel	Licker	Text Region	05. Energy		3	5	16	18	Recommend adding "energy market design and governance structures" to the list of areas where energy system innovations can help ith decarbonization.	Agree with this suggestion. The following statement "Innovative energy market designs are also being proposed and advanced that seek to accelerate decarbonization of the energy sector." has been included in the relevant decarbonization section of the chapter.
Emma	Conrad-Rooney	Text Region	05. Energy		3	3	20	26	To follow the Risk-Based Framework, Key Message 1 should include what can be done about these highlighted problems.	To follow the Risk-Based Framework, Key Message 1 should include what can be done about these highlighted problems.
Rachel	Licker	Text Region	05. Energy		6	6	6	6	Suggest explicitly mentioning that high winds can cause trees to fall on power lines, which is a major source of power outages. Would also suggest adding somewhere in this paragraph that substations are vulnerable to damage from coastal flooding due to sea live rise and storm surge and from high winds and debris that can also result in widespread power outages.	Thank you for the comment. We made the point about trees damaging power lines more explicit, adding a reference. We added "usually resulting from falling vegetation" following "susceptible to damage from high winds." We also added, "D'Amico et al. 2019). Power lines are also susceptible to damage from" after the Cerai reference. We added the suggested point about coastal flooding, sea level rise, and storm surge: "Furthermore, coastal power substations and associated power are at risk from storm surges exacerbated by sea-level rise (de Bruijns et al. 2019, Khanam et al. 2021)."

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Licker	Text Region	05. Energy		7	7	9	13	Suggest adding a reference to NREL's Electrification Future's study, which also includes projections for increases in electricity demand through 2050. Electricity demand is also projected to increase due to the need for more air conditioning and cooling as temperatures increase. This is mentioned in the next section, but should also be briefly mentioned here.	In response to this suggestion, the chapter will include these references as well as the data used in the figure : Khan et al. 2023
Rachel	Licker	Text Region	05. Energy		8	8	26	35	Suggest adding a reference to Evolved Energy Research's Annual Decarbonization Perspsective (ADP) report from August 2022. It includes projections for electricity demand by sector, hydrogen production, and other approaches to achieve at least a 50% reduction in emissions by 2030, and net zero emissions by 2050.	The ADP report investigates long-term deep decarbonization pathways for the US, specifically focusing on achieving carbon neutrality by 2050. As stated in the report, "this analysis addresses the questions "what are the infrastructure, spending, and natural resources requirements needed to decarbonize the U.S. economy by mid-century?" While the ADP report does provide projections for electricity demand and economy-wide emissions levels, both of which are shown graphically for 2030, the primary intent of the study appears focused on an evaluation of pathways to net-zero by 2050, so we do not deem it appropriate to cite here. However, the authors agree that references to multiple studies would be beneficial, so the chapter text has been revised to reference a model intercomparison study of potential actions to reach the US target of at least 50% GHG reductions by 2030 (Bistline et al 2022).
Gabrielle	Dreyfus	Text Region	05. Energy		8	8	31	32	vc¬Ã¬úOther electrification opportunities include space and water heating in buildings and waste heat recovery in industry (Rightor et al. 2020; NASEM 2021).vc¬Ã¬ú COMMENT: Consider adding a sentence here or in other electrification discussions highlighting the broader mitigation opportunity for heat pumps when electrifying heating. Replacing older air conditioning equipment with reversible heat pumps offers the potential to improve energy efficiency and accelerate the transition to lower GWP refrigerants. Implementing a Lifecycle refrigerant management approach would further reduce leaks of high-GWP HCFC and HFC refrigerants and reclaim or destroy banks in existing equipment. The EPA estimates that less than 2% of HFCs in use are reclaimed annually. CITE: Theodoridi C., Hillbrand A., Starr C., Mahapatra A., & Taddonio K. (2022) THE 90 BILLION TON OPPORTUNITY: LIFECYCLE REFRIGERANT MANAGEMENT (LRM) - HOW MINIMIZING LEAKS AND MAXIMIZING RECLAIM CAN AVOID UP TO 91 BILLION METRIC TONS CO2-EQ EMISSIONS, 40 https://www.igsd.org/wp-content/uploads/2022/10/Refrigerant-Lifecycle-FullReport-5SinglePages-PRESS.pdf. See also U.S. EPA (2022) Draft Report vc¬Ã¬i Analysis of the U.S. Hydrofluorocarbon Reclamation Market: Stakeholders, Drivers, and Practices, https://www.epa.gov/system/files/documents/2022-10/Draft_HFC-Reclamation-Report_10-13-22%20sxf%20v3.pdf	"Other electrification opportunities include space and water heating in buildings and waste heat recovery in industry (Rightor et al. 2020; NASEM 2021)." COMMENT: Consider adding a sentence here or in other electrification discussions highlighting the broader mitigation opportunity for heat pumps when electrifying heating. Replacing older air conditioning equipment with reversible heat pumps offers the potential to improve energy efficiency and accelerate the transition to lower GWP refrigerants. Implementing a Lifecycle refrigerant management approach would further reduce leaks of high-GWP HCFC and HFC refrigerants and reclaim or destroy banks in existing equipment. The EPA estimates that less than 2% of HFCs in use are reclaimed annually. CITE: Theodoridi C., Hillbrand A., Starr C., Mahapatra A., & Taddonio K. (2022) THE 90 BILLION TON OPPORTUNITY: LIFECYCLE REFRIGERANT MANAGEMENT (LRM) - HOW MINIMIZING LEAKS AND MAXIMIZING RECLAIM CAN AVOID UP TO 91 BILLION METRIC TONS CO2-EQ EMISSIONS, 40 https://www.igsd.org/wp-content/uploads/2022/10/Refrigerant-Lifecycle-FullReport-5SinglePages-PRESS.pdf. See also U.S. EPA (2022) Draft Report ÃcÂ€Â" Analysis of the U.S. Hydrofluorocarbon Reclamation Market: Stakeholders, Drivers, and Practices, https://www.epa.gov/system/files/documents/2022-10/Draft_HFC-Reclamation-Report_10-13-22%20sxf%20v3.pdf
Rachel	Licker	Text Region	05. Energy		8	8	33	34	How is "clean hydrogen" being defined? Recommend specifying .	We thank the reviewer for their comment that we define "clean hydrogen." The proposed target clean hydrogen standard is currently 4.0 kgCO2e/kgH2. We have added the following: Clean hydrogen (DOE 2022) "that is produced through electrolysis using electricity from renewable sources rather than traditional hydrocarbon reforming pathway as well as fossil systems with high rates of carbon capture" and a citation to the following document that includes definitions of terms used to describe hydrogen production: https://www.energy.gov/eere/fuelcells/articles/clean-hydrogen-production-standard.
Rachel	Licker	Text Region	05. Energy		9	9	14	19	Suggest adding a reference to the NREL/DOE Solar Futures Study, which includes an extended discussion of these integrated land-use strategies for solar.	In response to this suggestion, the chapter will include this reference.
Nick	Procopio	Text Region	05. Energy		9	9	20	30	Cybersecurity is indeed a threat to the power grid, but this is not related to or influenced by climate change. Consider removing this statement or explaining the connection in more detail.	Cybersecurity is indeed a threat to the power grid, but this is not related to or influenced by climate change. Consider removing this statement or explaining the connection in more detail.
Tom	Ellison	Text Region	05. Energy		9	9	21	30	This cyber risk dynamic should be included or expanded upon in the national security section. For example, how might the growing cyber exposure of increasingly interconnected energy grids provide opportunities for adversarial states or non-state actors to asymmetrically hold the US energy system at risk for political, military, or criminal purposes?	This cyber risk dynamic should be included or expanded upon in the national security section. For example, how might the growing cyber exposure of increasingly interconnected energy grids provide opportunities for adversarial states or non-state actors to asymmetrically hold the US energy system at risk for political, military, or criminal purposes?
Rachel	Licker	Text Region	05. Energy		10	10	3	9	Suggest mention that outdoor workers are also especially susceptible to the health effects of extreme heat, which includes significant migrant, minority, and low income populations; and including a reference to this 2021 UCS reports, Too Hot to Work: Assessing the Threats Climate Changes Poses to Outdoor Workers (https://www.ucsusa.org/resources/too-hot-to-work) and this 2019 UCS report, Killer Heat in the United States: Climate Choices and the Future of Dangerously Hot Days (https://www.ucsusa.org/resources/killer-heat-united-states-0)	This comment about outdoor worker health is more appropriate for the Human Health chapter to discuss than the Energy chapter. So, authors have shared this reference with the Health chapter author team.
Matthew	Eisenson	Text Region	05. Energy		12	14	1	5	The summary of "Key Message 5.3" concludes that "[i]nvestments are being made to increase the resilience of the energy system, and opportunities exist to build upon these efforts (likely, high confidence)." The summary and following subsections note that a wide variety of actions can be taken to enhance energy system resilience. While some such actions require "investments," there are also a range of non-capital-intensive actions, such as operational changes, planning updates, and/or design modifications that can have important resilience benefits. Pursuing these approaches can have significant benefits for end-consumers, enabling resilience measures to be implemented more quickly and at lower cost. See e.g., Alison Silverstein et al., A Customer-focused Framework for Electric System Resilience (2018), https://media.rff.org/documents/RFF20R20Street20Resilience20Workshop20Silverstein20Slides.pdf. This should be noted in Chapter 5. Effective planning is essential to ensure that actions to enhance resilience are pursued in the most cost effective and efficient manner. The subsection on ‚ÄúPlanning for Energy System Resilience‚Äù notes that "[m]odeling advances are improving understanding of climate change impacts" on the energy system. Energy industry participants increasingly have access to datasets, tools, and other resources that can be used in planning for the impacts of climate change on their systems. There are, for example, a number of publicly accessible repositories of downscaled probabilistic data on key climate parameters relevant to electric system planning (e.g., temperature and precipitation). See e.g., Climate Mapping for Resilience and Adaptation, https://resilience.climate.gov/; Regional Climate Change Viewer, https://www.usgs.gov/tools/national-climate-change-viewer-nccv; Cal-Adapt, https://cal-adapt.org/; Great Lakes Regional Climate Change Maps, https://glisa.umich.edu/great-lakes-regional-climate-change-maps/. Notwithstanding the above, many in the energy industry are still not using available datasets and other resources and tools to plan for the impacts of climate change. Consider the electric sector, for example. The Department of Energy and others have recommended that electric utilities engage in a process of climate resilience planning. This is a two-step process involving: (1) a climate vulnerability assessment	The summary of "Key Message 5.3" concludes that "[i]nvestments are being made to increase the resilience of the energy system, and opportunities exist to build upon these efforts (likely, high confidence)." The summary and following subsections note that a wide variety of actions can be taken to enhance energy system resilience. While some such actions require "investments," there are also a range of non-capital-intensive actions, such as operational changes, planning updates, and/or design modifications that can have important resilience benefits. Pursuing these approaches can have significant benefits for end-consumers, enabling resilience measures to be implemented more quickly and at lower cost. See e.g., Alison Silverstein et al., A Customer-focused Framework for Electric System Resilience (2018), https://media.rff.org/documents/RFF20R20Street20Resilience20Workshop20Silverstein20Slides.pdf. This should be noted in Chapter 5. Effective planning is essential to ensure that actions to enhance resilience are pursued in the most cost effective and efficient manner. The subsection on "Planning for Energy System Resilience" notes that "[m]odeling advances are improving understanding of climate change impacts" on the energy system. Energy industry participants increasingly have access to datasets, tools, and other resources that can be used in planning for the impacts of climate change on their systems. There are, for example, a number of publicly accessible repositories of downscaled probabilistic data on key climate parameters relevant to electric system planning (e.g., temperature and precipitation). See e.g., Climate Mapping for Resilience and Adaptation, https://resilience.climate.gov/; Regional Climate Change Viewer, https://www.usgs.gov/tools/national-climate-change-viewer-nccv; Cal-Adapt, https://cal-adapt.org/; Great Lakes Regional Climate Change Maps, https://glisa.umich.edu/great-lakes-regional-climate-change-maps/. Notwithstanding the above, many in the energy industry are still not using available datasets and other resources and tools to plan for the impacts of climate change. Consider the electric sector, for example. The Department of Energy and others have recommended that electric utilities engage in a process of climate resilience planning. This is a two-step process involving: (1) a climate vulnerability assessment which uses forward-looking climate projections to assess where and under what conditions utility assets and operations are at risk from climate change, and (2) development of a climate resilience plan which evaluates measures to mitigate the risk to vulnerable assets. See generally, U.S. Department of Energy, Climate Change and the Electricity Sector: Guide for Climate Resilience Planning (2016), https://toolkit.climate.gov/sites/default/files/Climate%20Change%20and%20the%20Electricity%20Sector%20Guide%20for%20Cl
Rachel	Licker	Text Region	05. Energy		12	12	3	7	Suggest adding clean energy microgrids to the list as a win-win solution for providing power to critical infrastructure with the centralized grid goes down and for reducing emissions by replacing fossil fuels with clean energy (both during power outages and when there aren't outages).	We added a sentence "and clean energy microgrids that provide power to vulnerable communities due to wildfire induced grid power outages (Perera et al. 2023)".
Rachel	Licker	Text Region	05. Energy		12	12	12	12	vegetation management is also important for reducing outages from trees falling on power lines during extreme weather events with high winds.	Thank you. We have added this point, along with a reference. We have added "and risk of trees falling on power lines (Taylor et al. 2022)." The reference is: Taylor et al. 2022. Dynamic modeling of the effects of vegetation management on weather-related power outages. Electric Power Systems Research 207:107840
Rachel	Licker	Text Region	05. Energy		12	12	26	28	Suggest adding a reference to this 2015 UCS report, Lights Out: Storm Surge, Blackouts, and How Clean Energy Can Help (https://www.ucsusa.org/resources/lights-out) which looks at the vulnerability of power plants, substations and electricity supplies from storm surge and coastal flooding from hurricanes in 5 locations on the East and Gulf coasts.	Thank you very much for your review and comments. We intended to include more recent references for most updated information as well as only representative reference(s) to fit within the word limit of the Chapter. In addition, the major points in your suggested reference is already in a reference used: Dumas and Cunliff, 2019.
Rachel	Licker	Text Region	05. Energy		15	15	5	14	Should also mention heat pumps for heating, cooling, and water heating as another key decarbonization solution that can also save money.	Thanks for the comment. One sentence, as suggested, was added, "Heat pumps for heating, cooling, and water heating as another key decarbonization solution can also save money"
Rachel	Licker	Text Region	05. Energy		16	16	1	3	Would add that electrification can also reduce emissions and lower energy bills. While it's most efficient to use renewable electricity directly, many decarbonization studies show that it can be used to produce green hydrogen for use in other sectors like industry and transportation, while reducing curtailment.	The text has been revised to say, "In addition to reducing energy-related emissions via electrification, electricity may serve as a more efficient and economical alternative to other energy sources..." The hydrogen box is now crossreferenced. The sentence reads:Clean hydrogen (DOE, 2022) that is produced through electrolysis using electricity from renewable sources rather than traditional hydrocarbon reforming pathways as well as fossil systems with high rates of carbon capture can also play a role in decarbonizing several sectors, including transportation and industry (Oliveira et al. 2021; Thombs 2019; Cheng et al. 2018; Chapter 32)

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Licker	Text Region	05. Energy		16	16	15	17	While almost every deep decarbonization study for the US shows we need a high level of renewable energy (80-90% of US electricity generation by 2050 or sooner) and existing nuclear, several studies show we do not necessarily need new nuclear or CCS in the power sector (but they do include CCS in the industrial sector) because it's too expensive and can't operate enough hours during the year to recover it's high capital costs with a high penetration of low cost wind and solar. The Princeton Net Zero study you reference shows this as does other economy wide decarbonization studies by Evolved Energy Research, University of Maryland, UCS, NRDC, and others. Would suggest adding a sentence or footnote acknowledging this.	Thank you for your comment. Most studies, including the latest IPCC Sixth Assessment report, show a role for both nuclear and CCS alongside renewable generation allowing for a smoother and lower cost transition. However the text was revised as follows: Meeting both goals require electrification of transportation, buildings, and industry and some production of low-carbon electricity from sources such as nuclear and fossil fuel energy with carbon capture (NASEM 2021; Larson et al. 2021; IPCC 2022).
Rachel	Licker	Text Region	05. Energy		17	17	11	14	This is not consistent with NuScale's recently announced price increase for their SMR project in Utah from $58/MWh to $100/MWh (https://www.utilitydive.com/news/nuscale-nuclear-reactor-smr-uamps-rising-steel-prices-interest-rates/636619/). This should be mentioned to provide more balance. The industry is saying they can lower costs but haven't built any projects to prove it, and historically the industry has a really poor track record in delivering projects on time and budget.	We removed the phrase that was specific to nuscale. The comment is correct, nuscale has increased its outlook cost but the statement we make is still true in that modular manufacturing is used to achieve reduction in costs. The nuscale cost is on a FOAK plant and we believe costs will be demonstrated to decrease as nth of a kind is achieved. To address this comment we modified the sentence that indicated that Nuscale has benefited from improved economics through modularity since that has not been demonstrated at this time. "The first advanced small modular reactor, which will benefit from improved economics from modular construction, obtained design approval from the US Nuclear Regulatory Commission in 2020 (NRC 2022). "
Nick	Procopio	Figure	05. Energy		17				Shows US renewable electricity generation, but the graph includes coal. Coal is not a renewable energy source.	Shows US renewable electricity generation, but the graph includes coal. Coal is not a renewable energy source.
Rachel	Licker	Figure	05. Energy	7	17				Suggest replacing this EIA figure with a figure from another study that includes the effects of the IRA. This could come from NREL's 2022 Standard Scenarios or Rhodium analysis in NEMS or Princeton modeling from August 2022.	Thank you for your comment. The authors have replaced the figure with updated informaton from the 2023 Annual Energy Outlook. The analysis includes IRA initiatives. The text has also been expanded to include affecIt of IRA and other factors on changing electric power demand and the energy sources. Growth in electric power demand is projected due to increasing electrification and ongoing economic growth. Declining capital costs and government subsidies, including IRA initiatives, are projected to drive increasing renewable energy generation from solar and wind by about 325% and 138% respectively, as compared with 2022 (AEO 2023). Increased electrification of end-use sectors is projected with more heat pumps, and electric vehicles as well as electric arc furnaces in the iron and steel industry.
Rachel	Licker	Text Region	05. Energy		18	18	6	8	It should be explicitly acknowledged that some decarbonization technologies, such coal and gas with CCS or producing hydrogen with fossil fuels, could lead to increases in air emissions in local communities. This is especially true with CCS, because of additional energy that's needed to power the carbon capture process, which results in more fuel being needed to produce the same amount of electricty and an increase in upstream emissions and other fuel cycle impacts.	Thank you for your comments. A full life cycle analysis of decarbonization technologies is beyond the scope of this chapter and also represents an area where more research would be beneficial. In response to the comment, we have added text regarding the challenges associated with decarbonization technologies, including lowering their costs and addressing environmental impacts: "Many decarbonization technologies are expected to decrease environmental impacts such as air pollution (Shindell et al. 2018; Vandyck et al. 2018; Markandya et al. 2018; Gallagher and Holloway 2020; KM14.5; KM32.4), which can be particularly beneficial to overburdened communities that disproportionately experience pollution from roadways, refineries, and power plants (Rowangould 2013; Carpenter and Wagner 2019; Elliott and Kittner 2022). However, impacts of some decarbonization technologies can include land use changes that conflict with other uses, particularly in biomass applications, and shifts in the magnitude, location, and type of pollution can occur, potentially exacerbating local impactsi (Gonzalez-Salazar et al. 2018; Ou et al., 2018; Luderer et al. 2019; Babaee et al., 2020; Fig. 14.9; KM32.4). Regulations play an important role in addressing environmental impacts, requiring pollution controls on many sources and restricting siting through permitting. ."
Nick	Procopio	Text Region	05. Energy		23	23	33	34	Increased marketing of electric vehicles is listed as evidence of progress in reducing carbon through electrification. Marketing alone is weak evidence, but increased sales would be stronger.	Increased marketing of electric vehicles is listed as evidence of progress in reducing carbon through electrification. Marketing alone is weak evidence, but increased sales would be stronger.
Steve	Wolff	Whole Chapter	05. Energy						The goal to fully implement electric vehicles in the US relies on many multiple parts coming together and working, from vehicle design to battery manufacturing to raw material mining all the way to charging station and electrical generation infrastructure (which is already under stress in certain areas of the country, including California, when the temperature rises). If a medium term goal is a 50%+ drop in vehicle emissions, a more practical multi-step process might be worth considering, along the following lines Step 1 (e.g. 5 years): ban the manufacture and sale of passenger vehicles (cars and trucks) that rely solely on gas engines in favor of at minimum, hybrid, plug-in hybrid and electric vehicles. Hybrid vehicles currently are capable of 50% mileage of conventional gas engines. Step 2 (e.g. 10 years) ban the manufacture and sale of anything less than plug-in hybrid (and perhaps set a larger minimum range for the electric portion of the drive train). This will allow battery / charging / generation capacity to ramp up Step 3 (e.g. 20 years) allow only the sale of new vehicles that are fully electric or green-hydrogen-powered once battery / charging / generation capacity can meet the demand of all-electric fleets. This multi-step process would allow the gradual build-up of necessary infrastructure throughout the system, which should dramatically reduce the US's carbon emissions at a faster rate than waiting for the all-electric "moon shot", with its inherent risks.	The goal to fully implement electric vehicles in the US relies on many multiple parts coming together and working, from vehicle design to battery manufacturing to raw material mining all the way to charging station and electrical generation infrastructure (which is already under stress in certain areas of the country, including California, when the temperature rises). If a medium term goal is a 50%+ drop in vehicle emissions, a more practical multi-step process might be worth considering, along the following lines Step 1 (e.g. 5 years): ban the manufacture and sale of passenger vehicles (cars and trucks) that rely solely on gas engines in favor of at minimum, hybrid, plug-in hybrid and electric vehicles. Hybrid vehicles currently are capable of 50% mileage of conventional gas engines. Step 2 (e.g. 10 years) ban the manufacture and sale of anything less than plug-in hybrid (and perhaps set a larger minimum range for the electric portion of the drive train). This will allow battery / charging / generation capacity to ramp up Step 3 (e.g. 20 years) allow only the sale of new vehicles that are fully electric or green-hydrogen-powered once battery / charging / generation capacity can meet the demand of all-electric fleets. This multi-step process would allow the gradual build-up of necessary infrastructure throughout the system, which should dramatically reduce the US's carbon emissions at a faster rate than waiting for the all-electric "moon shot", with its inherent risks.
Emma	Conrad-Rooney	Whole Chapter	05. Energy						Key messages 2 and 3 should be revised to follow the Risk-Based Framework.	Key messages 2 and 3 should be revised to follow the Risk-Based Framework.
Sam	Davis	Whole Chapter	05. Energy						Mentioned briefly, the technology "bioenergy with carbon capture and storage" is only advanced as a potential solution without any discussions of its major drawbacks: - no to-scale projects yet to-date, and yet, many climate plans are relying on the technology - the scale of land use required to produce enough feedstock has been flagged by the IPCC as unreasonable and would compete with land for food and people - burning bioenergy, especially from woody biomass, is not decreasing in costs at all, especially when compared to other technologies like wind and solar. Carbon stored in trees could continue to be safely stored there for centuries, well beyond the scope of our need to act on climate change. Researchers are finding that many older trees will continue to absorb carbon. While critics point out that the rate of absorption may in some cases be slightly less than the carbon uptake rate of seedlings, they fail to mention that the total amount of carbon absorbed by a single mature tree is still much greater than a single seedling (or scaling up to an acre of each).	Mentioned briefly, the technology "bioenergy with carbon capture and storage" is only advanced as a potential solution without any discussions of its major drawbacks: - no to-scale projects yet to-date, and yet, many climate plans are relying on the technology - the scale of land use required to produce enough feedstock has been flagged by the IPCC as unreasonable and would compete with land for food and people - burning bioenergy, especially from woody biomass, is not decreasing in costs at all, especially when compared to other technologies like wind and solar. Carbon stored in trees could continue to be safely stored there for centuries, well beyond the scope of our need to act on climate change. Researchers are finding that many older trees will continue to absorb carbon. While critics point out that the rate of absorption may in some cases be slightly less than the carbon uptake rate of seedlings, they fail to mention that the total amount of carbon absorbed by a single mature tree is still much greater than a single seedling (or scaling up to an acre of each).
Richard	Sigler	Whole Chapter	05. Energy						With renewable energy now cheaper than fossil fuel sources of energy, our entire energy infrastructure will need to change. Charging stations for electric vehicles will need to be built across the country. This will incentivize the adoption of EV's, which will in turn increase their range and efficiency, which will again increase greater adoption of EV's. The production of electricity, to power our buildings, cars, and industry, will also require new infrastructure development to meet this demand. Solar and Wind farms, as well as technologies that harness the power of the ocean, will need to be built. This will lead to a large increase in jobs in the renewable energy sector, which will in turn be a boon for the economy.	With renewable energy now cheaper than fossil fuel sources of energy, our entire energy infrastructure will need to change. Charging stations for electric vehicles will need to be built across the country. This will incentivize the adoption of EV's, which will in turn increase their range and efficiency, which will again increase greater adoption of EV's. The production of electricity, to power our buildings, cars, and industry, will also require new infrastructure development to meet this demand. Solar and Wind farms, as well as technologies that harness the power of the ocean, will need to be built. This will lead to a large increase in jobs in the renewable energy sector, which will in turn be a boon for the economy.
Joseph	Sollod	Whole Chapter	05. Energy						Building codes are an essential tool to advancing resilience against climate change,Ăîincluding within the energy sector. We commend the authors for recognizing the important role codes play. Where practical, we recommend providing reference to other sections of the assessment that cover building codes in more detail including in Chapters 12, 31 and 32.	Building codes are an essential tool to advancing resilience against climate change--including within the energy sector. We commend the authors for recognizing the important role codes play. Where practical, we recommend providing reference to other sections of the assessment that cover building codes in more detail including in Chapters 12, 31 and 32.
Reid	Sherman	Whole Chapter	05. Energy						This chapter uses mitigation, adaptation, and resilience throughout chapter. Make sure the usages of these terms are consistent with other chapters in the report.	This chapter uses mitigation, adaptation, and resilience throughout chapter. Make sure the usages of these terms are consistent with other chapters in the report.
Reid	Sherman	Whole Chapter	05. Energy						This chapter has provided significant work on integrating energy impacts from climate change and the corresponding impacts for overburdened communities. This chapter covers content that could be cited by Oceans (shipping and changes in the Arctic); coastal storm surge and flooding (numerous locations); water (use for cooling of energy infrastructure); land use (subsidence affecting pipelines) and more.	This chapter has provided significant work on integrating energy impacts from climate change and the corresponding impacts for overburdened communities. This chapter covers content that could be cited by Oceans (shipping and changes in the Arctic); coastal storm surge and flooding (numerous locations); water (use for cooling of energy infrastructure); land use (subsidence affecting pipelines) and more.
Jesse	Freeman	Text Region	06. Land Cover and Land-Use Change		5	5	9	2	commenting	Ignored - comment seems to be a placeholder

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Emma	Conrad-Rooney	Figure	06. Land Cover and Land-Use Change		5				As a reader, it is unclear what the "number of transitions" legend is referring to. It would be helpful if the caption described what types of land use categories are considered for the transitions. As a reader I wondered if the land use transitions were between the land cover types from Figure 6.1 or whether these figures were not connected.	This has been clarified by changing the previous use of "transition" to "conversion". The figure caption is modified to include a detailed explanation of the number of conversions. New text is "A conversion is defined as a change between years from one primary land cover category to a different category. The categories considered are: developed, cropland, grass/shrub, tree cover, water, wetland, ice/snow, and barren."
Emma	Conrad-Rooney	Figure	06. Land Cover and Land-Use Change		6				It would be helpful to include a scale bar for the maps in this figure.	The figure is being updated to include scale bars.
Cathy	Day	Text Region	06. Land Cover and Land-Use Change		7	10	1	12	Discussion of climate change impacts on ‚Äúland systems goods and services‚Äù includes loss of forest-sequestered C through wildfire and loss of soil moisture due to higher temperatures, but misses the two key ways that climate change can undermine soil health: accelerated oxidation of SOC by the higher temperatures, and increased soil erosion by intensified rainfall (erosion selectively ‚Äústeals‚Äù SOC which becomes CO2 or CH4 depending on whether eroded soil becomes dust or submerged mud).	We now include text and references about how wildfire can affect soil carbon stocks through oxidation and erosion and they can be found at the end of the first paragraph after the Interactions with the Land System section header.
Nick	Procopio	Text Region	06. Land Cover and Land-Use Change		7	11	8	15	The role of forests as carbon sinks is discussed thoroughly in this section. However, other natural lands (e.g., woodlands, salt marshes, wetlands, seagrass, agriculture, etc.) are also large carbon sinks and could provide important mitigation against greenhouse gases.	We agree it is important to include reference to carbon sinks in other biomes. The literature is more conclusive for forests in general and for Northern Hemisphere forests in particular, but we have added mention of several other systems with some representative references. New text added just before Figure 6.6: "Other ecosystems, such as grasslands (Bai and Cotrufo 2022), wetlands (Bao et al. 2023), and some agricultural systems (USEPA 2022; KM11.1), also contribute to the carbon sink, with complex and uncertain interactions with management actions. "
Emma	Conrad-Rooney	Text Region	06. Land Cover and Land-Use Change		7	11	8	15	As a reader, this key message seems redundant, since much of the information in this key message is already covered in greater detail in the Coastal, Built Environment, Human Health, Agriculture, Forests, Ecosystems, and Indigenous Peoples chapters. It would be helpful to shorten the repetitive sections in this key message by referencing the above-mentioned chapters to leave room for key messages 2 and 3 which are more unique to the Land chapter.	We have added references to the other chapters where relevant. Since goods and services are a critical aspect of the value we place on land cover and land use, and since there are so many associated climate change risks, it seems necessary to retain in this chapter, where a broad scope of values and risks can be addressed. This helps to strengthen the message from other chapters, and it also forms an important foundation for KM6.2 and KM6.3, which address the resilience of land systems, and future choices for land systems.References to other chapters, including Forests, Agriculture, Human Health, and Built Environment have been added.
Thomas	Knutson	Text Region	06. Land Cover and Land-Use Change		7	7	9	10	I don't think there is high confidence that climate change has increased the frequency of drought. Such a high confidence assessment is not supported by the text in earlier chapters. Compare to Key Message 2.2: "Drought risk has been increasing in the Southwest over the past century (very high confidence) and decreasing elsewhere (medium confidence)." Compare to p. 3-32, lines 2-13. (Note this is referring to amplifying drought severity (which has been seen so far in some western regions), but not necessarily changing drought frequency, and that there are additional uncertainties around future drought changes.) Note that Key Message 3.12 as written can be easily misinterpreted (which is a separate issue I have commented on for CH. 3).	This has been clarified in the KM text by saying "climate change has increased regional intensity and frequency..."
Cathy	Day	Text Region	06. Land Cover and Land-Use Change		9	9	3	5	We appreciate the authors' mention of the value of soil biological crusts and the damage that occurs to them as the result of higher temperatures.	We greatly appreciate the reviewer's comment.
Cathy	Day	Text Region	06. Land Cover and Land-Use Change		9	9	20	23	We appreciate the inclusion of discussion of agroforestry benefits including increased soil water infiltration and reduced erosion, resulting in protection from impacts of warming, drought, and extreme rainfall events. The evidence is strong that agroforestry is one of the high quality agricultural practices for carbon sequestration and greenhouse gas emissions reduction. We appreciate the discussion of its further resilience benefits.	We greatly appreciate the reviewer's comment.
Cathy	Day	Text Region	06. Land Cover and Land-Use Change		9	9	24	25	The warning about net carbon loss when converting native forest to bioenergy production is important, and could be worded more strongly. It is important to highlight in part because the ecological risks of such practices extend well beyond carbon loss to decreased soil resilience and water quality, among others.	We appreciate this comment, and in response we have expanded "net carbon losses" to "net losses of carbon, habitat, soil quality, or other ecosystem services" and added another citation (Lark et al 2020) to support the point.
Cathy	Day	Text Region	06. Land Cover and Land-Use Change		9	10	27	12	Discussion on carbon sinks on pages 9-10 make no mention of soil organic carbon sequestration,Äîseems like an omission here and an important one to remedy given the rapid development of agricultural carbon markets and related agricultural solutions.	We have expanded the text in this section to be more comprehensive of other land-based carbon sequestration opportunities, and added a reference to the Agriculture chapter in particular, which discusses this topic in some detail: "Other ecosystems, such as grasslands (Bai and Cotrufo 2022), wetlands (Bao et al. 2023), and some agricultural systems (USEPA 2022; see also Ch. 11: Agriculture, Food Systems, and Rural Communities), also contribute to the carbon sink, with complex and uncertain interactions with management actions."
Chuxuan	Li	Text Region	06. Land Cover and Land-Use Change		12	12	13	23	When talking about the interactions between wildfire and land systems, it may be important to mention the impacts of wildfires on the soil. Specifically, wildfires can induce physical-chemical property changes in the soils which include hydrophobicity. The soil-water repellency due to hydrophobicity decreases soil infiltration rates and increases post-fire debris flow susceptibility. It may also be important to mention the geomorphological changes that are resulted from post-fire debris flows which may reshape the terrains, change the original soil type, and remove vegetation along their run-out paths.	We agree that these factors are all important, and some of it is covered in the cross-cutting box on Western Wildfires. We have edited the Wildfire box and added "water-repellent" in the description there of what fire does to soils that makes them more susceptible to debris flows. We have also added a reference to this cross cutting box at this location within our chapter.
Emma	Conrad-Rooney	Text Region	06. Land Cover and Land-Use Change		12	12	25	32	This paragraph should reference Chapter 07, the Forests chapter.	We have added a reference to KM7.1, which includes additional details on the connections between climate change and forest resilience and mortality.
Emma	Conrad-Rooney	Text Region	06. Land Cover and Land-Use Change		12	12	34	35	As a reader, it would be helpful to elaborate on what kind of ecosystems experienced net warming because of forest loss.	Details have been added to elaborate
Ariela	Zycherman	Text Region	06. Land Cover and Land-Use Change		13	13	3	5	This paragraph is only 1 sentence. It seems like there should be more to say here, perhaps giving more examples of mitigation or adaptation? What are the opportunities and limitations?	Additional material discussion opportunities and limitations has been added here, together with cross-references to forests and agriculture chapters.
Cathy	Day	Text Region	06. Land Cover and Land-Use Change		13	14	12	19	In this section, concerns about urban resilience are raised, but nothing is said about urban farming, especially urban community gardens, etc., that integrate trees and herbaceous crops. Urban tree planting of all kinds is a vital resilience and carbon sequestration strategy.	A paragraph has been added to KM6.2 in the subsection titled "Increasing Development"
Emma	Conrad-Rooney	Figure	06. Land Cover and Land-Use Change		13				As a reader, this figure is complicated and confusing. It would be helpful if the caption could describe in more detail what exactly is changing in the land-cover changes category and what is the meaning of all of the arrows.	This figure is under revision, in collaboration with TSU. The changes are expected to address this comment.
Ariela	Zycherman	Figure	06. Land Cover and Land-Use Change		13				The placement of urban here implies that there are no ecosystem services in urban areas.	The figure has been revised to link urban to ecosystem services; a new paragraph has been added about urban ecosystem service
Emma	Conrad-Rooney	Text Region	06. Land Cover and Land-Use Change		14	14	5	6	At the end of this sentence, "A resilient urban infrastructure... from extreme storms", Chapter 12, the Built Environment chapter, should be referenced.	We have added a reference to KM 12.2, dealing with risks to urban environments.
Emma	Conrad-Rooney	Text Region	06. Land Cover and Land-Use Change		14	14	12	19	As a reader, this paragraph, "Increasing energy demand...interactions with climate change" seems to discuss rather vaguely the consequences of these technologies on "ecosystem resilience, biodiversity and the land carbon sink" as well as the "interactions with climate change." These seem to be important details that would be helpful to elaborate on.	We made this paragraph less vague by changing "consequences" to "reductions". We also specified that renewable energy interactions with climate change will depend on the energy type and location, and cited the key messages from Chapter 5 (Energy). This is an active area of research with many research gaps, and this issue has now been added to trhe traceable accounts to reflect this.
Ariela	Zycherman	Text Region	06. Land Cover and Land-Use Change		14	14	12	19	If the intent is to include land transformations to meet energy demands of urban areas, what about solar or wind farms?	We agree that solar and wind farms will be an increasingly large driver of land use in the future in virtually all mitigation scenarios. We have included some context around this in Key Message 6.3 and the associated text.
Emma	Conrad-Rooney	Text Region	06. Land Cover and Land-Use Change		14	15	20	2	This section should reference Chapter 11, the Agriculture chapter.	Reference has been added to KM 11.1, related to success in the conservation programs, and to greenhouse gas emissions from conversion of land to ag production.
Cathy	Day	Text Region	06. Land Cover and Land-Use Change		14	14	30	32	Soil organic carbon recovery after ‚Äúagricultural abandonment‚Äù is described as ‚Äúslow.‚Äù It seems worth mentioning ways in which it can be accelerated, as through deliberate revegetation with woody and herbaceous perennials as in the Conservation Reserve Program (CRP). This program has been cited as sequestering substantial carbon.	We now highlight the Conservation Reserve Program and the carbon storage it has initated and we ahve include text and a reference highlighting how acceleration of soil carbon storage (and other soil services) can be accelerated through the active planting of perennials. This can be found as the last two sentences in the first paragraph following the header "Changes in agriculture"
Emma	Conrad-Rooney	Text Region	06. Land Cover and Land-Use Change		14	14	34	35	As a reader the sentence "Agricultural extensification...where grassland is replaced" is confusingly worded, and it would be helpful if it could be revised.	This has been revised with more details to clarify
Nick	Procopio	Text Region	06. Land Cover and Land-Use Change		15	20	3	3	Decarbonation efforts will also require expansion of offshore wind farms. Has land-use change in the coastal zone been considered? The cables installed through the coastal zone may impact carbon sinks including seagrass beds.	The scope for this chapter includes only land systems, and does not extend to the coastal waters where offshore wind production would be a relevant impact. The details of offshore wind development are not currently being covered by other chapters in suficient depth to be able to refer this point to another chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Cathy	Day	Text Region	06. Land Cover and Land-Use Change		15	15	9	12	Reforestation and biomass crop cultivation are mentioned in the same phrase,Äîyet they are very different and possibly opposite in their impacts on carbon sequestration. They should be treated as separate topics. Biomass crop cultivation is likely, for example, to remove large amounts of organic matter from the agricultural/forest system, resulting in loss of soil health and soil carbon emissions. The opposite is expected with reforestation.	Based on this and other related comments, we have edited KM6.3 to better differentiate between natural climate solutions and biomass/bioenergy measures for achieving land-based mitigation: "Decarbonization... may involve large land-use changes toward land-based mitigation measures including reforestation, other natural climate solutions, and biomass crop cultivation." We note that the soil carbon outcomes of cultivating dedicated bioenergy crops depend on previous land use. Qin et al. 2016 [GCB Bioenergy, 8(1), 66–80] showed that a variety of perennial bioenergy crops result in increased soil carbon when cultivated on land previous under annual crops. We have added new text providing context around dedicated energy crops and associated soil carbon outcomes: "Future bioenergy expansion may rely on dedicated cellulosic biomass crops cultivated on low-value land in order to minimize conflicts with existing agricultural production (White House 2016; Khanna et al. 2021), with positive or negative effects on ecosystem carbon storage depending on previous land use (Qin et al. 2016)."
Cathy	Day	Figure	06. Land Cover and Land-Use Change		16	16	1	1	Figure 6.8 includes bioenergy with carbon capture and storage (BECCS) as a solution with high mitigation value. To our knowledge, none of the research has yet resulted in a system that effectively produces fuel that even approximates net zero emissions, and carbon capture and storage continues to be a highly uncertain proposition in terms of permanence of storage. It is unclear to us why the authors would place this solution in a location suggesting high likely mitigation value. Riparian buffers have a far higher likelihood of offering effective mitigation value, yet they are placed low in mitigation value on the graphic.	We had initially placed BECCS high on the mitigation axis because of its prominence in the integrated assessment scenario literature, and its representation in CMIP. We acknowledge that this figure would be strengthened by making it semi-quantitative, tying the position of the different labels to assessment data. We have initiated this figure editing process with the Technical Support Unit, and where possible we will align the mitigation axis with data from Text Box 32.2 on Carbon Dioxide Removal. We have also added text and a reference to the recent State of Carbon Dioxide Removal report, to add context around the challenges and uncertainties in this area: "Most of the limited CDR achieved to date has come from forest restoration and management, though globally there is a gap between the amount of CDR proposed in nationally determined contributions versus what is included in many mitigation scenarios (Smith et al. 2023)"
Steven	Richter	Text Region	06. Land Cover and Land-Use Change		16	16	8	9	In regards to the sentence "Future land-use is likely to involve substantial departures from historic trends", Richter (2020) supports this claim, having compared previous forecasts of developed land cover against actual change, showing significant divergence between the two. There was a sharp decline in expansion of development while several forecasts and econometric models showed an increasing rate. Further, Richter (2022) examines how the determinants of growth in developed lands vary across space and have shifted over time, with demographics (the emerging prominence of the baby boomer and millennial cohorts) playing a key role. However, the transition of millennials into family formation will likely stimulate increases in the rate of development, which Figure 6-4 shows may already have begun (this has yet to be confirmed empirically though). So while the statement is certainly true, it is suggested that some additional (and brief) detail about why it is true would be beneficial. Perhaps a brief statement pointing out how drivers of change vary over time and across space due to shifting patterns in social and ecological determinants. It may also be worth mentioning (though I'm not certain where would be most appropriate) that there is a high likelihood that the decline in the rate of development is likely to reverse as the demographic drivers of decline shift toward expansion as the millennial cohort matures. This shift as already begun and is likely to continue (medium confidence). Thank you for your time. Richter, S. M. (2020). Revisiting urban expansion in the continental United States. Landscape and Urban Planning, 204, 103911. https://doi.org/10.1016/j.landurbplan.2020.103911 Richter, S. M., & Bixler, R. P. (2022). Complexifying urban expansion: An exploratory, gradient-based approach. Buildings and Cities, 3(1), Article 1. https://doi.org/10.5334/bc.226	We have included the reviewer's suggestion to include a statement that future departures from historical trends are going to vary spatially and with time based on the underlying patterns of demographic and ecological changes. We have cited Richter et al. 2022 as an example of this. We did not directly mention the reviewer's comments about a recent decline in developed land expansion since this is not present to the same extent in the LCMAP data already included in this chapter (we chose to focus on the LCMAP dataset since it provides a consistent timeseries of land-cover, annully, over a long time period 1985-2000).
Cathy	Day	Text Region	06. Land Cover and Land-Use Change		16	17	12	3	The positive mention here of biofuels leaves us skeptical. It is unclear to us that any biofuel research has yet demonstrated anything near net zero emissions, nor even substantial improvements over use of petroleum-based fuels.	This text is meant to express a straightforward observation (that many existing mitigation scenarios include a large scale-up of biomass crop cultivation), rather than a critical review of the efficacy of bioenergy-based carbon dioxide removal (CDR). We recognize that there is controversy about the effectiveness and practicality of different CDR methods; see also the response to comment 176234. Additionally, note that we acknowledge and explore the uncertainties around the effectiveness of various land-based mitigation measures—including conventional biofuel production—in the main text ("existing experience with land-based mitigation measures is limited, and the efficacy of forest carbon offsets, agricultural soil carbon enhancement, and first-generation biofuel programs remains controversial") and Traceable Accounts ("The efficacy of existing land-based mitigation measures is often debated... this ambiguity contributes to the debate around the viability and desirability of wide-scale land-based mitigation and carbon dioxide removal measures in future decarbonization scenarios"). This uncertainty notwithstanding, bioenergy is prominently included in the integrated assessment literature and CMIP modeling scenarios on which this chapter is based (see Traceable Accounts), and thus we feel it is most appropriate for it to be included prominently here as well.
Emma	Conrad-Rooney	Figure	06. Land Cover and Land-Use Change		16				It would be helpful to clarify in the caption how the local, regional, and global response scales are defined.	This figure and caption are being revised, in collaboration with TSU. The comment will be addressed in the revision.
Reid	Sherman	Figure	06. Land Cover and Land-Use Change		16				This would be improved with including links in the text from these land use choices to the relevant chapters (e.g., coastal-9)	The Fig. 6.8 caption has been edited to cite text boxes elsewhere in the report that provide more information and context around the specific land-use choices shown in the figure.
Ariela	Zycherman	Figure	06. Land Cover and Land-Use Change		17				I don't know if SSPs and RCPs are going to be described in the overall report frontmatter, but I think it would be helpful here to explain generally what the range of SSPs here might be and how they may be influencing the spread that we see here.	We have added a reference to the SSP definitions in the Front Matter, Table 3. In addition, we have added the following description of the range of land-use within the SSPs: "Land-use representation within the range of SSPs includes differences in land-use regulation, land productivity, trade, land-based mitigation, and food/diet choices, along with a corresponding range of land-use trends that result from these drivers (Figure 6.9)."
Ariela	Zycherman	Figure	06. Land Cover and Land-Use Change		17				The figure description text should clarify that this is for CONUS (I'm assuming)	The figure includes the 50 States (incl Alaska and Hawaii). That information is now reflected in the figure caption and in the figure metadata.
Chuxuan	Li	Text Region	06. Land Cover and Land-Use Change		21	21	3	4	Many chapters touch on wildfires and their cascading impacts on increasing post-fire debris flow hazards. The need to better forecast post-fire debris flows cannot be overemphasized. Following Oakley (2021), it is also worth mentioning the recent progress in model and/or method developments toward better forecasting of post-fire debris flows. The following two are using empirical approaches: 1) The USGS provides Emergency Assessment of Post-Fire Debris-Flow Hazard that includes probability and volume estimates immediately following wildfires since 2013 (USGS). 2) Using the rainfall intensity-duration (ID) threshold has been the fastest and the most economic method to predict postfire debris flow occurrence. The ID threshold is still constantly updated and improved using new data like satellite precipitation (Orland et al. 2022) In contrast, Li et al. (2022) augmented the processed-based hydrologic core of the National Water Model to map postfire debris flow susceptibility at regional scales, which exhibits the potential of the process-based model to be used in operational forecasting mode. References: [1] USGS. Emergency Assessment of Post-Fire Debris-Flow Hazard. https://landslides.usgs.gov/hazards/postfire_debrisflow/ [2] Orland, E., Kirschbaum, D., & Stanley, T. (2022). A scalable framework for post fire debris flow hazard assessment using satellite precipitation data. Geophysical Research Letters, 49, e2022GL099850. https://doi.org/10.1029/2022GL099850 [3] Li et al. (2022). Augmentation of WRF-Hydro to simulate overland-flow- and streamflow-generated debris flow susceptibility in burn scars. Natural Hazards and Earth System Sciences. https://doi.org/10.5194/nhess-22-2317-2022	We have added mention in the main text that "the U.S. Geological Survey (2023) provides emergency assessment of debris-flow hazard after major fires" and added the reference to the list for their main website (which gets updated frequently): https://landslides.usgs.gov/hazards/postfire_debrisflow/ We also expanded the sentence in Traceable Accounts that deals with this, now writing, "The link between climate and slope-failure hazards, including the characteristics of rainfall, terrain, and burn severity that contribute to post-fire debris flows..." Adding the Orland et al. or Li et al. references to the Traceable Accounts would mean we would also need to cite them in the main text, which we feel is too much technical detail for this report. Intensity-Duration thresholds are indeed the main focus of operational forecasting for debris flows but ID thresholds are not well constrained (actually they are almost not at all constrained) for anywhere except a relatively small area of southern California. Discussing this would be excessively technical for the NCA5 report.
Thomas	Knutson	Text Region	06. Land Cover and Land-Use Change		21	22	34	2	This assessment seems inconsistent/stronger/more confident than earlier chapters with regards to drought frequency. Compare to Key Message 2.2: "Drought risk has been increasing in the Southwest over the past century (very high confidence) and decreasing elsewhere (medium confidence)." Compare to p. 3-32, lines 2-13 (Note this is referring to amplifying drought severity (which has been seen so far in some western regions), but not necessarily changing drought frequency, and that there are additional uncertainties around future drought changes.) Note that Key Message 3.12 can be easily misinterpreted as written (which is a different issue that needs addressing in CH. 3.	We agree, and this has been addressed by qualifying the statement in the traceable accounts to say "...climate change is increasing the regional intensity and frequency of extreme events..."

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Emma	Conrad-Rooney	Whole Chapter	06. Land Cover and Land-Use Change						All key messages should be revised to follow the Risk-Based Framework	The Key Messages and supporting text are fundamentally informed by the risk-based framework.
Emma	Conrad-Rooney	Whole Chapter	06. Land Cover and Land-Use Change						Many portions in this chapter seem to repeat information that is covered in other National Topics chapter, but the other chapters go into more detail since that is the focus of those chapter. To make better use of space in this chapter, it would be helpful to take advantage of referencing these other chapters (e.g. agriculture, forests, built environment) and minimize repetitive material, so this chapter can focus on the aspects unique to this chapter.	Extensive cross-referencing to other chapters has been added, allowing for removal of some text related to repeated themes.
Emma	Conrad-Rooney	Whole Chapter	06. Land Cover and Land-Use Change						There were no mentions of the effects of fungi, bacteria, and microbes on ecosystems. Microbial and microscopic life, especially bacteria and fungi, play critical roles in supporting life on Earth. Microorganisms are extremely abundant--there is more than 40x the biomass of microorganisms on earth than that of animals (Bar-On et al. 2017)--and their functions have enormous impacts on every ecosystem. Fungi and bacteria are responsible for much of the movement of nutrients through ecosystems. They perform decomposition, through which dead matter is broken down, and nutrients in organic matter are transformed back into usable forms, recycling infinitely. Without decomposing microorganisms, our planet would be covered in dead matter and life on Earth would cease. Thus, the many factors that impact the composition and activity of decomposer microorganisms (such as climatic, edaphic, and biotic factors) should be of critical interest, especially as these factors, along with microbial diversity and distributions, are changing rapidly with global change. Fungi are also responsible for most of the nutrient transfer to vegetation. 80% of all plants and nearly every tree species on earth form associations with mycorrhizal fungi (Wang and Qiu 2006), which are responsible for providing nutrients from the soil to the plants in return for sugars from photosynthesis (Smith and Read 2008). Like soil decomposers, the composition and activity of mycorrhizal fungi are strongly dependent on factors that are changing rapidly with global change, which will affect plant productivity, soil carbon storage, and nutrient cycling. There seems to be a lack of expertise among the authors to address information about microbial communities and functions in ecosystems. We suggest adding information on these topics, perhaps by adding one or more technical contributors who have expertise in how fungi and bacteria impact ecosystems. Suggestions include Drs. Jennifer Bhatnagar at Boston University, Serita Frey at the University of New Hampshire, V. Bala Chaudhary at Dartmouth College, Ashish Malik at the University of Aberdeen, Mark Anthony at WSL Umweltforschung, and Peter Kennedy at the University of Minnesota. Citations: Bar-On, Y. M., R. Phillips, and R. Milo. 2018. The biomass distribution on Earth. Proceedings of the National Academy of Sciences 115:6506--6511. Smith, S. E., and D. J. Read. 2008. Mycorrhizal Symbiosis. Elsevier. Wang, B., and Y.-L. Qiu. 2006. Phylogenetic distribution and evolution of mycorrhizas in land plants. Mycorrhiza 16:299--363.	This content is out of scope for the chapter, but a cross-reference to KM 8.1 has been added in the current section on LCLUC relationship to carbon sinks in supporting text for KM 6.1.
Matthew	Eisenson	Whole Chapter	06. Land Cover and Land-Use Change						The summary of "Key Message 6.3. Future Land-Use Options" states that "[d]ecarbonization will require a large expansion of solar and wind energy generation and transmission infrastructure (high confidence) and may involve large land-use changes toward reforestation or biomass crop cultivation (low confidence)." (See page 15 at lines 3-12.) The evidence supports your assessment that a large expansion of renewables is more likely needed than an expansion of biomass crop cultivation. To further support this point, please consider noting the following: (1) solar and wind energy projects use very little agricultural land compared to growing biomass for the production of biofuels; and (2) photovoltaic (PV) solar delivers far more energy per acre than corn ethanol. With respect to point (1), approximately 40 million acres of agricultural land is currently being used to grow corn for ethanol, an area the size of Florida. According to the U.S. Department of Agriculture (USDA), 90 million acres of agricultural land in the U.S. are used to grow corn, and 45% of that corn is used for ethanol production. See Claire Hutchins, Feedgrains at a Glance, USDA Economic Research Service (last updated October 3, 2022), https://www.ers.usda.gov/topics/crops/corn-and-other-feedgrains/feedgrains-sector-at-a-glance/. By comparison, solar installations on all types of land (both agricultural and non-agricultural) occupy only 0.5 million acres, while wind turbines occupy only 0.07 million acres. See Dave Merrill, ‚ÀúThe U.S. Will Need a Lot of Land for a Zero-Carbon Economy‚Äù Bloomberg (last updated June 3, 2021), https://www.bloomberg.com/graphics/2021-energy-land-use-economy/. To achieve complete decarbonization of the grid and electrification of end uses, the U.S. Department of Energy estimates that approximately 10 million acres of land will be needed for solar PV by 2050, still far less than the amount of land currently being used to grow corn for ethanol production. See U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, Solar Futures Study (Sep. 2021) at 180, https://www.energy.gov/sites/default/files/2021-09/Solar%20Futures%20Study.pdf. The 10 million acres of solar PV needed for full decarbonization and electrification in 2050 account for just 0.5% of all land in the contiguous U.S., whereas 43% of that land will continue to be used for agricultural production. Id. With respect to point (2), please note that solar PV produces approximately 40 times more energy than	We agree that a large fraction of current-day US cropland is devoted to growing corn used primarily for ethanol production, and that photovoltaics are more efficient in terms of energy production per unit of land occupied. However, second-generation cellulosic bioenergy is increasingly invoked in integrated assessment model scenarios to provide either liquid fuels for difficult-to-decarbonize sectors (e.g., aviation, shipping) and/or carbon dioxide removal, energy services that are not easily met via renewable electricity. In response to this comment, we have added new text and refences to highlight the lower per-area energy efficiency of bioenergy from dedicated energy crops, and more context around the intended role and land use envisioned for bioenergy in future decarbonization scenarios: "Bioenergy is the most land-intensive form of renewable energy (Lovering et al. 2022), though it is valued in integrated assessment models for providing fuels for long-haul aviation and freight transport in addition to CDR (KM32.3). Future bioenergy expansion may rely on dedicated cellulosic biomass crops cultivated on low-value land in order to minimize conflicts with existing agricultural production (White House 2016; Khanna et al. 2021)."
Ariela	Zycherman	Whole Chapter	06. Land Cover and Land-Use Change						While this chapter does a good job describing the impacts of climate change to people in general terms, there is no mention anywhere of equity and justice concerns with respect to current and potential future land cover and land use.	The chapter has been modified to include reference to equity and justice concerns within the supporting text for each KM, with cross-referencing to other chapters where relevant.
Ariela	Zycherman	Whole Chapter	06. Land Cover and Land-Use Change						There are many instances in this chapter where linkages should be made to other chapters in NCA (e.g., agrigulture, forests, etc.). I assume these will be added later?	Extensive cross-referencing to other chapters has been added.
Reid	Sherman	Whole Chapter	06. Land Cover and Land-Use Change						Overall this chapter has more discussion of resilience than adaptation. And includes figures that have resilience and adaptation. The adaptation chapter notes the distinction between the two and chooses to focus that chapter on adaptation. Make sure that the usages align with that chapter and others.	We have checked the glossary and our use of these terms is consistent with the definitions in the glossary.
Reid	Sherman	Whole Chapter	06. Land Cover and Land-Use Change						Expected to see more comments on other land surface instabilities such as sink holes, subsidence in low lying coastal areas, etc.	The chapter includes a section on climate interactions with built environment, referencing increases in erosion, shoreline retreat, permafrost thaw, slope failure, fire, and flooding. We highlight these topics as the most relevant in terms of changes in land cover or land use, and space limitations prevent going into further details.
David	Cleaves	Text Region	07. Forests		3	3	9	14	The forest land area of 766 million acres at first glance compared with NCA4 figure of 896 suggests a massive loss of forest inconsistent with the relative stability pointed out in the text. But the NCA4 contains about 130 million acres in urban forests so the numbers are ok, just the need to explain the urban forest influence in the accounting.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion and the reference has been replaced to include the latest report using methods for area estimation that are consistent with those used in NCA4.
Theodore	Weber	Text Region	07. Forests		5	5	5	8	Yearly wildfire extent quadrupled in the U.S. between 1983 and 2021 (R2 = 0.47; data from National Interagency Fire Center, 2022)	We appreciate the suggestion and have reviewed the source of information. Reporting mechanisms have changed over this time period and thus we feel our sentence (which conveys a similar trend) is more appropriate. The text has been left unchanged.
David	Cleaves	Text Region	07. Forests		5	5	8	10	The reference on the proliferation of forest management actions could be bolstered with some of the numbers of acres planned for treatment under the new infrastructure, inflation reduction laws and the interagency wildfire strategy. There is a need for more quantitative evidence of changes in levels of adaptive action and their linkages back to in part climate impacts reduction.	We thank the reviewer for this comment. We have edited the sentence to focus on adaptation and added several citations to support the statement. We also added information to the traceable account about the evidence base. Although the work being done under the infrastructure bill is notable, it is mainly focused on fire risk reduction and not necessarily on climate change adaptation.
Emma	Conrad-Rooney	Text Region	07. Forests		5	5	18	23	To follow the Risk-Based Framework, Key Message 1 should include what can be done about these highlighted problems.	We thank the reviewer for the comment. This is addressed in KM 7.3. The text has been left unchanged.
David	Cleaves	Text Region	07. Forests		5	5	24	24	Include the mechanisms for driving forest change, including mortality, loss in growth, and challenges in recovering from disturbances. There are different but intersecting pathways for disturbance events vs. slower and longer-term stressors such as drought.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Emma	Conrad-Rooney	Text Region	07. Forests		6	6	14	17	Chapter 28, the southwest chapter, also discusses wildfire severity the Southwest, particularly in Key Message 28.5. I would recommend referencing this here.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
David	Cleaves	Text Region	07. Forests		7	7	12	20	This section could reference back to and update the graphic and text introductions of stressor complexes and interactions in NCA4 Forests chapter. This is a productive conceptual framework for helping readers understand compound climate risks and avoid oversimplifying climate change's role as a driver and coupler in disturbance systems.	We thank the reviewer for the comment. We have edited the text and cited Figure 6-1 in Vose et al. (2018).
George	Xian	Text Region	07. Forests		7	7	12	12	The map (figure 7.1) shows forest extents in the Northeast extend to the most of region. They are not small extents.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Theodore	Weber	Text Region	07. Forests		7	7	12	18	Warming temperatures allow cold-sensitive invasive species like kudzu to move further north and become more successful there (Hickman and Lerdau 2013). Vines are significantly stimulated by increased CO2 (Sasek and Strain 1990, Vaughn and Bowling 2011, Anderson?Teixeira 2013), and can choke out trees and other plants (Matthews et al. 2016). References: Anderson?Teixeira, K.J., Miller, A.D., Mohan, J.E., Hudiburg, T.W., Duval, B.D. and DeLucia, E.H., 2013. Altered dynamics of forest recovery under a changing climate. Global Change Biology 19(7):2001-2021. Hickman, J. E., and M. T. Lerdau. 2013. Biogeochemical impacts of the northward expansion of kudzu under climate change: the importance of ecological context. Ecosphere 4(10):121. http://dx.doi.org/10.1890/ES13-00142.1 Matthews, E. R., J. P. Schmit, and J. P. Campbell. 2016. Climbing vines and forest edges affect tree growth and mortality in temperate forests of the U.S. Mid-Atlantic States. Forest Ecology and Management 374:166-173. Sasek TW, Strain BR (1990) Implications of atmospheric CO2 enrichment and climatic change for the geographical distribution of two introduced vines in the U.S.A. Climatic Change 16:31--51. Vaughn, K.C. and Bowling, A.J. 2011. Biology and physiology of vines. Horticultural Reviews 38:1-21.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Three references have been added.
David	Breshears	Text Region	07. Forests		7		14		Missing here or elsewhere in the chapter is a clear, solid supported statement that warming with drought is a strong driver of tree mortality, regardless of the presence of bark beetles or other pests and pathogens (the first column in Fig. 7.1 might imply this point but based on the supporting text in the body this point is not explicitly made). Most significantly , published since NCA 4, this point has been shown solidly for trees die-off events globally in Hammond et al. 2022: Hammond, W.M., Williams, A.P., Abatzoglou, J.T. et al. Global field observations of tree die-off reveal hotter-drought fingerprint for Earth‚Äôs forests. Nat Commun 13, 1761 (2022). https://doi.org/10.1038/s41467-022-29289-2	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. The reference has been addded.
Don	Falk	Text Region	07. Forests		7	7	15	15	Add literature citation: "...21st centuries due partly to climate change (Box 7.1; O'Connor et al. 2015)." O‚ÄôConnor CD, AM Lynch, DA Falk, and TW Swetnam. 2015. Post-fire forest dynamics and climate variability affect spatial and temporal properties of spruce beetle outbreaks on a Sky Island mountain range. Forest Ecology and Management 336: 148-162. http://dx.doi.org/10.1016/j.foreco.2014.10.021	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. The reference has been addded.
Don	Falk	Text Region	07. Forests		8	8	6	7	Add literature citation: "conversion to non-forest ecosystems (e.g., Stanke et al. 2021; Falk et al. 2022). Falk DA, PJ van Mantgem, JE Keeley, RM Gregg, CH Guiterman, AJ Tepley, DJN Young, and LA Marshall. 2022. Mechanisms of forest resilience. Forest Ecology & Management Tamm Review 515: 120129. https://doi.org/10.1016/j.foreco.2022.120129 .	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. The reference has been addded.
Don	Falk	Text Region	07. Forests		8	8	10	11	Add literature citation: "...further reduced postfire regeneration (Davis et al. 2019a; Keeley et al. 2019)." Keeley JE, P van Mantgem, and DA Falk. 2019. Fire, climate and changing forests. Nature Plants 5 (8): 774-775. https://doi.org/10.1038/s41477-019-0485-x	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. The reference has been addded.
David	Cleaves	Text Region	07. Forests		8	8	14	15	Is Fig 7.5 referencing US forests or the global forest resource in general terms. Are there separate versions of Fig. 7.5 for different regional or forest system profiles as might be suggested by the discussion that follows? This could be a useful template for comparing situations across forest types and regions.	We thank the reviewer for the comment. The figure title states the information presented is for US forests.
Don	Falk	Text Region	07. Forests		9	9	14	15	Add literature citation: "...adapted to infrequent wildfire (O'Connor et al. 2020; Hagmann et al. 2022)." O‚ÄôConnor CD, DA Falk, and GM Garfin. 2020. Projected climate-fire interactions drive forest to shrubland transition on an Arizona Sky Island. Frontiers in Earth Science 8: Article 137. https://doi.org/10.3389/fenvs.2020.00137	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. The reference has been addded.
Don	Falk	Text Region	07. Forests		9	9	20	21	Add literature reference: "...offer little resistance to colonization (Bentz et al. 2010; O'Connor et al. 2015; Kolb et al. 2016)." O‚ÄôConnor CD, AM Lynch, DA Falk, and TW Swetnam. 2015. Post-fire forest dynamics and climate variability affect spatial and temporal properties of spruce beetle outbreaks on a Sky Island mountain range. Forest Ecology and Management 336: 148-162. http://dx.doi.org/10.1016/j.foreco.2014.10.021	We thank the reviewer for the comment. We feel the sentence is better substantiated woth other references. The text has been left unchanged.
David	Cleaves	Text Region	07. Forests		9		24		The phrase "warming and drought killed.." may be misleading especially when attribution in the same sentence gives the final macabre credit to the beetles. Can we say reframe to say warming through drought contributed or some other framing to show a stressor complex at work?	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Nick	Procopio	Text Region	07. Forests		9	9	26	26	The word ¬ialthough" seems out of place, suggest changing to ¬iwith model simulations suggesting".	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
David	Cleaves	Text Region	07. Forests		9		35		Somewhere here and elsewhere there is an opportunity to trace many of these interactions back to the response prospects of managing vegetation density. The return to density management is multi-faceted and synergistic yet we in user world get stuck on one note (e.g. fire or bugs) at a time and fail to capture the benefits and costs as science is showing them to us.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. A reference has been added.
Emma	Conrad-Rooney	Text Region	07. Forests		10	16	7	8	Key Message 2 could have a stronger emphasis on ecosystem services. While this chapter talks about the goods and services provided by ecosystems, ecosystems services is a more universal term and is what is emphasized in the Ecosystems chapter. To connect more across chapters, increasing usage of the term ecosystem services in this chapter would be beneficial.	We thank the reviewer for the comment. We have revised the text using the term "ecosystem services" which now appears linked to the glossary as is defined there by IPCC.
Emma	Conrad-Rooney	Text Region	07. Forests		10	10	9	16	To follow the Risk-Based Framework, Key Message 2 should include what can be done about these highlighted problems.	We thank the reviewer for the comment. This is addressed in KM 7.3. The text has been left unchanged.
David	Cleaves	Text Region	07. Forests		10	10	22	25	Timber production is mentioned only lightly here but could be fleshed out a little to describe how. On the demand side, rebuilding and resilience-based construction demands could increase demand while on the supply side, operation and transportation susceptibilities to climate-related harvesting and transportation constraints and costs could tug the other direction.	We thank the reviewer for these comments. We have revised the chapter by inserting new text describing the forest products sector effects of climate change. We also added one citation reflecting how forest managers may respond to climate change, affecting timber product outputs and carbon. New citation added: Cruetzburg, M.K., R.M. Scheller, M.S. Lucash, S.D. LeDuc, and M.G. Johnson, 2017: Forest management scenarios in a changing climate: trade-offs between carbon, timber, and old forest. Ecological Applications, 27(2), 503-518. https://doi.org/10.1002/eap.1460

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Emma	Conrad-Rooney	Text Region	07. Forests		11	11	1	7	There were minimal mentions of fungi (only about food and medicine), and no mentions of the effects of bacteria or microbes on ecosystems in this chapter. Microbial and microscopic life, especially bacteria and fungi, play critical roles in supporting life on Earth. Microorganisms are extremely abundant--there is more than 40x the biomass of microorganisms on earth than that of animals (Bar-On et al. 2017)-- and their functions have enormous impacts on every ecosystem. Fungi and bacteria are responsible for much of the movement of nutrients through ecosystems. They perform decomposition, through which dead matter is broken down, and nutrients in organic matter are transformed back into usable forms, recycling infinitely. Without decomposing microorganisms, our planet would be covered in dead matter and life on Earth would cease. Thus, the many factors that impact the composition and activity of decomposer microorganisms (such as climatic, edaphic, and biotic factors) should be of critical interest, especially as these factors, along with microbial diversity and distributions, are changing rapidly with global change. Fungi are also responsible for most of the nutrient transfer to vegetation. 80% of all plants and nearly every tree species on earth form associations with mycorrhizal fungi (Wang and Qiu 2006), which are responsible for providing nutrients from the soil to the plants in return for sugars from photosynthesis (Smith and Read 2008). Like soil decomposers, the composition and activity of mycorrhizal fungi are strongly dependent on factors that are changing rapidly with global change, which will affect plant productivity, soil carbon storage, and nutrient cycling. There seems to be a lack of expertise among the authors to address information about microbial communities and functions in ecosystems. We suggest adding information on these topics, perhaps by adding one or more technical contributors who have expertise in how fungi and bacteria impact ecosystems. Suggestions include Drs. Jennifer Bhatnagar at Boston University, Serita Frey at the University of New Hampshire, V. Bala Chaudhary at Dartmouth College, Ashish Malik at the University of Aberdeen, Mark Anthony at WSL Umweltforschung, and Peter Kennedy at the University of Minnesota. Citations: Bar-On, Y. M., R. Phillips, and R. Milo. 2018. The biomass distribution on Earth. Proceedings of the National Academy of Sciences 115:6506--6511. Smith, S. E., and D. J. Read. 2008. Mycorrhizal Symbiosis. Elsevier. Wang, B., and Y.-L. Qiu. 2006. Phylogenetic distribution and evolution of mycorrhizas in land plants. Mycorrhiza 16:299--363	We appreciate the suggestion, but space is limited. The author team has deliberated on this and has prioritized the allocation of text to other foci. The text has been left unchanged.
Emma	Conrad-Rooney	Text Region	07. Forests		11	11	1	7	For the sentence vÇ¬Â¬úReduced snow depthvÇ¬Â¬¶ exposure to frosts" I recommend the following revisions to include the effects of reduced snow depth on soil microbes: vÇ¬Â¬úReduced snow depth, for example, can increase plant injury and mortality,vÇ¬†through increased tissue exposure tovÇ¬†soil frost (Comerford et al. 2012;vÇ¬†Sanders-DeMott et al. 2019; Slatyer et al. 2022),vÇ¬†as well as reduced microbial biomass and activity (Sorensen et al. 2016; 2018)." For this, I suggest adding the following 3 citations: 1) Comerford DP, PG Schaberg, PH Templer, AM Socci, JL Campbell, KF Wallin. 2012. Influence of experimental snow removal on root and canopy physiology of sugar maple trees in a northern hardwood forest. Oecologia 171:261-269. 2) Sorensen PO, AC Finzi, M Giasson, AB Reinmann, R Sanders-DeMott, PH Templer. 2018. Winter soil freeze-thaw cycles lead to reductions in soil microbial biomass and activity not compensated for by soil warming. Soil Biology and Biochemistry 116:39-47. 3) Sorensen PO, PH Templer & AC Finzi, 2016. Contrasting effects of winter snowpack and soil frost on growing season microbial biomass and enzyme activity in two mixed-hardwood forests.vÇ¬†BiogeochemistryvÇ¬†128:141vÇ¬Â¬ì154.	We thank the reviewer fr the comment. The text has been revised to "Reduced snow depth, for example, can increase plant injury and mortality through increased tissue exposure to frosts (Comerford et al. 2012; Sanders-DeMott et al. 2019; Slatyer et al. 2022) as well as reduced microbial biomass and activity (Sorensen et al. 2016, 2018)." and three references have been added.
David	Cleaves	Text Region	07. Forests		11		15		The STACCs report has some useful information on climate impacts and responses to culturally important values. Status of Tribes and Climate Change Working Group (STACCWG). (2021). Status of Tribes and Climate Change Report, Institute for Tribal Environmental Professionals Northern Arizona University, Flagstaff, AZ. [Marks-Marino, D. (ed.)]http://nau.edu/stacc2021W	We thank the reviewer for their comment. We have updated this paragraph to include a reference to the STACCWG report.
Theodore	Weber	Text Region	07. Forests		11	11	24	24	Using our forests for biomass energy is a losing strategy, especially considering that we need to store carbon now, not release it into the atmosphere by burning it. We can't wait decades for the forests to regrow and resequester that carbon.	The text has been revised to clarify the point of this sentence "Chemicals mobilized into the environment from burning structures and other infrastructure differ from those emitted from burning forest fuels...".
David	Cleaves	Text Region	07. Forests		12		7		Graphic is not yet ready, but the link between tree morality and home and timber values is not clear. Maybe a little more on this relationship would help understand the graphic when it is ready.	We thank the reviewer for this comment. We have edited the text under item e to be more specific about the relationship.
Theodore	Weber	Text Region	07. Forests		13	13	4	6	Major hurricanes (category 3 and higher) have increased in the North Atlantic Ocean since the 1970s (data from National Hurricane Center). As hurricane intensity increases, more forests in these areas could be knocked back to earlier successional stages. Rising sea temperatures are increasing the intensity and rainfall of tropical cyclones (USGCRP 2017, Ch. 9). In 2017, Hurricane Harvey dumped a record 60.6 inches of rain onto Southeast Texas, inundating hundreds of thousands of homes. Trenberth et al. (2018) showed that record high ocean heat values, the result of warming temperatures, intensified Harvey and increased its rainfall. Also, in 2017, Hurricane Maria produced record?breaking rainfall over Puerto Rico, which caused unprecedented flooding and landslides. Keellings and Hernv"ndez Ayala (2019) showed that the trend of increasing air and sea surface temperatures significantly increased the likelihood of extreme precipitation events like Hurricane Maria. Reed et al. (2020) showed that human-induced climate change increased the amount of rainfall of Hurricane Florence in 2018. Models project that hurricane intensities and precipitation will continue to increase as the climate warms. The frequency of the most intense storms is also projected to increase (USGCRP 2017, Ch. 9). Citations: Keellings D, Hernv"ndez Ayala JJ. 2019. Extreme rainfall associated with Hurricane Maria over Puerto Rico and its connections to climate variability and change. Geophysical Research Letters 46(5):2964--2973. Reed KA, Stansfield AM, Wehner MF, Zarzycki CM. 2020. Forecasted attribution of the human influence on Hurricane Florence. Science Advances. 6(1):p.eaaw9253. Trenberth KE, Cheng L, Jacobs P, Zhang Y, Fasullo J. 2018. Hurricane Harvey links to ocean heat content and climate change adaptation. Earth's Future. 6(5):730--744. USGCRP (U.S. Global Change Research Program). 2017. Climate science special report: Fourth National Climate Assessment, Volume I. Wuebbles DJ, Fahey DW, Hibbard KA, Dokken DJ, Stewart BC, Maycock TK, editors. Washington (DC): U.S. Global Change Research Program. 470 p.	We thank the reviewer for this comment. We have edited the text to respond to your comment. New citations added: Trenberth K.E., L. Cheng, P. Jacobs, Y. Zhang, and J. Fasullo, 2018: Hurricane Harvey links to ocean heat content and climate change adaptation. Earth's Future, 6 (5), 730-744. https://doi.org/10.1029/2018EF000825 and Reed, K.A., A.M. Stansfield, M.F. Wehner, and C.M. Zarzycki, 2020: Forecasted attribution of the human influence on Hurricane Florence. Science Advances, 6 (1), eaaw9253. https://doi.org/10.1126/sciadv.aaw9253

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Shaye	Wolf	Text Region	07. Forests		13	13	10	24	The Section on Forests and Carbon must acknowledge that logging/thinning forests is the dominant driver of carbon loss from U.S. forests, and relatedly that protecting existing forests from degradation and deforestation, and allowing them to grow intact to their ecological potential termed proforestation, maximizes forest biological carbon sequestration, increases forest ecosystem resilience, and is critical for limiting global warming to 1.5~∞C. Carbon losses from logging and thinning U.S. forests are much larger than the losses associated with wildfire, bark beetles, or drought. For example, Berner et al. (2017) reported that logging was the largest cause of tree mortality (~50%) in western US forests between 2003 and 2012, followed by bark beetles (32%) and wildfires (18%) (Berner, Logan T. et al., Tree mortality from fires, bark beetles, and timber harvest during a hot and dry decade in the western United States (2003-2012), 12 Environmental Research Letters 065005 (2017)). A Forest Service study by Harris et al. (2016) found that logging during 2006,Äì2010 nationwide released up to 10 times more carbon emissions than wildfire and insects combined (Harris, N.L. et al., Attribution of net carbon change by disturbance type across forest lands of the conterminous United States, 11 Carbon Balance and Management 24 (2016)). Hudiberg et al. (2019) estimated that carbon losses from logging were three times higher than from wildfire across Washington, Oregon and California forests during 2001-2016 (Hudiburg, Tara W. et al., Meeting GHG reduction targets requires accounting for all forest sector emissions, 14 Environmental Research Letters 095005 (2019), https://doi.org/10.1088/1748-9326/ab28bb). Protecting existing forests from logging/thinning and allowing logged forests to continue to grow and reach their full biological carbon sequestration potential is a highly and immediately effective, low-cost approach to removing carbon dioxide from the atmosphere. Numerous studies have concluded that growing existing forests intact to their ecological potential,Äîtermed proforestation,Äîmaximizes forest biological carbon sequestration and is critical for limiting global warming to 1.5~∞C (Moomaw, William R. et al., Intact forests in the United States: Proforestation mitigates climate change and serves the greatest good, 2 Frontiers in Forests and Global Change (2019),	We thank the reviewer for the comment. The chapter text has been expanded to incorporate the suggestion. Multiple references have been added.
Shaye	Wolf	Text Region	07. Forests		13	13	10	24	The Section on Forests and Carbon should acknowledge the extensive science documenting that broad-scale thinning to reduce fire risk or severity leads to more carbon emissions than it prevents from being released in a wildfire. Numerous studies, including a recent review of the science by forest carbon experts Beverly Law, William Moomaw, Tara Hudiburg, William Schlesinger, John Sterman, and George Woodwell, have concluded that ‚Äú[b]road-scale thinning to reduce fire severity results in more carbon emissions than would be released by fire, creating a multi-decade carbon deficit that conflicts with climate goals,Äù and that ‚Äúthe amount of carbon removed by thinning is much larger than the amount that might be saved from being burned in a fire, and far more area is harvested than would actually burn.‚Äù (Law, Beverly E. at al., Creating strategic reserves to protect forest carbon and reduce biodiversity losses in the United States, 11 Land 721 (2022), https://doi.org/10.3390/land11050721.) See also: Campbell, J.L. et al., Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? 10 Frontiers in Ecology and Environment 83 (2012), https://doi.org/10.1890/110057; Hudiburg, Tara W. et al., Meeting GHG reduction targets requires accounting for all forest sector emissions, 14 Environmental Research Letters 095005 (2019), https://doi.org/10.1088/1748-9326/ab28bb; Bartowitz, Kristina J. et al., Forest carbon emission sources are not equal: putting fire, harvest, and fossil fuel emissions in context, 5 Frontiers in Forests and Global Change 867112 (2022), https://doi.org/10.3389/ffgc.2022.867112; Hanson, C., Cumulative severity of thinned and unthinned forests in a large California wildfire, 11 Land (2022), https://doi.org/10.3390/land11030373; Baker, B.C., and C.T. Hanson. 2022. Cumulative tree mortality from commercial thinning and a large wildfire in the Sierra Nevada, California. Land 11: Article 995.	We thank the reviewer for the comment. The chapter text has been expanded to include the role silviculture in managing for multiple objectives, including carbon sequesteration and storage.
Theodore	Weber	Text Region	07. Forests		13	13	14	14	Harvested wood products are not one of the top forest carbon storage pools. In fact, they are the lowest. 2021 data: Soil (Mineral and Organic): 32,816 MMT C (54% of total) Aboveground Biomass: 15,688 MMT C (26% of total) Litter: 3,810 6% Belowground Biomass: 3,106 5% Dead Wood: 2,896 5% Total Harvested Wood Products: 2,718 4% Harvested Wood Products in Use: 1,536 3% Harvested Wood Products in Disposal: 1,182 2% Data from EPA, 2022, Table 6-10 in Chapter 6, ¬ìLand Use, Land-Use Change, and Forestry," U.S. National Greenhouse Gas Inventory. https://www.epa.gov/system/files/documents/2022-04/us-ghg-inventory-2022-chapter-6-land-use-land-use-change-and-forestry.pdf	We thank the reviewer for the comment. The text was not intended to indicate that harvested wood products are "one of the top forest carbon storage pools." Harvested wood products were included in this sentence for completeness in addition to forest ecosystem pools. The chapter text has been revised to better reflect this separation.
David	Cleaves	Text Region	07. Forests		13		15		The statement from the Domke et al. paper presents forest uptake, usually defined as a negative stock change in forest ecosystem carbon, yet the net forest forest sink which accounts for the 11% offset includes uptake and emission in ecosystems+net increases to harvested wood products+urban trees. Should recheck the use of the term uptake and if only ecosystem carbon relate it to C02 only.	We thank the reviewer for the comment. The estimate reported only included uptake from forest land remaining forest land and land converted to forest land. It did not include net increases from HWPs or urban trees in the estimates. That said, we have revised the text to be more explicit on what was included and report equivalence in terms of CO2.
David	Cleaves	Whole Page	07. Forests		13				This is a very important result and consistent with the trendline reported and forecasted in the NCA4 chapter. Policy expectations will be reshaped by the fact that the forest sink is becoming weaker and that the hopes for actually expanding the level of carbon replacement and emission offset may not be well-placed. It is a prompt to reevaluate our national porfolio of nature-based solutions to address the most influential and manageable in our practices tool kit.	We thank the reviewer for the comment.
Theodore	Weber	Text Region	07. Forests		15	15	13	14	Worth mentioning here: Maximizing riparian forest buffers also reduces erosion, sedimentation, and pollutant runoff, as well as providing essential wildlife habitat and other benefits.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Theodore	Weber	Text Region	07. Forests		15	15	14	16	This may be true in fire-prone upland forests, but thinning and clearing riparian forest could be harmful rather than helpful.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Shaye	Wolf	Text Region	07. Forests		15	15	14	16	The Section on ‚ÄúClimate Change Impacts to Forest Water Resources‚Äù states that ‚ÄúThinning and surface-fuel reduction lessen the risk of high-severity wildfires and associated effects on water resources (Rust et al. 2019).‚Äù However, the scientific evidence does not support the claim that thinning lessens the risk of high-severity wildfires and the citation to Rust et al. (2019) does not support this claim. This sentence should be removed. For example, a recent review by Law et al. (2022) concluded that thinning is not effective for reducing fire severity: "As to the effectiveness and likelihood that thinning might have an impact on fire behavior, the area thinned at broad scales to reduce fuels has been found to have little relationship to area burned, which is mostly driven by wind, drought, and warming. A multi-year study of forest treatments such as thinning and prescribed fire across the western U.S. showed that about 1% of U.S. Forest Service treatments experience wildfire each year. The potential effectiveness of treatments lasts only 10‚Äì20 years, diminishing annually. Thus, the preemptive actions to reduce fire risk or severity across regions have been largely ineffective." (Law, Beverly E. at al., Creating strategic reserves to protect forest carbon and reduce biodiversity losses in the United States, 11 Land 721 (2022)) See also: Bradley, C.M. C.T. Hanson, and D.A. DellaSala. 2016. Does increased forest protection correspond to higher fire severity in frequent-fire forests of the western USA? Ecosphere 7: article e01492; DellaSala, D.A., B.C. Baker, C.T. Hanson, L. Ruediger, and W.L. Baker. 2022. Have western USA fire suppression and megafire active management approaches become a contemporary Sisyphus? Biological Conservation 268: Article 109499; Bartowitz, K.J., et al. 2022. Forest Carbon Emission Sources Are Not Equal: Putting Fire, Harvest, and Fossil Fuel Emissions in Context. Front. For. Glob. Change 5: Article 867112.	We thank the reviewer for the comment. The sentence has been revised to clarify the text and incorporate the suggestion. Two references have been added.
David	Cleaves	Text Region	07. Forests		16	16	11	15	Is there any or any increases in the evidence base for the development of assessments and plans or the levels of adoption of forest adaptation practices? Is there a greater emphasis on use of vulnerability in agency or private sector adaptation planning? Is there a wider variety of approaches to conducting and using climate vulnerability in planning? This needs a little more support, perhaps in the Traceable Accounts section.	We thank the reviewer for the comment. We have revised the text to add additional examples . We have also revised the confidence level of the key message statement around development and implementation of vulnerability assessments and adaptation to medium (from high) and added additional information to the traceable account.
Emma	Conrad-Rooney	Text Region	07. Forests		16	16	11	17	To follow the Risk-Based Framework, Key Message 3 should include what is projected to change in the future.	We thank the reviewer for the comment. This is addressed in KM 7.1 and 7.2. The text has been left unchanged.
Ariela	Zycherman	Text Region	07. Forests		16	16	12	13	The sentence "Forest landowners and managers are preparing...." brings to mind an image of a private landowner or Weyerhauser employee. It doesn't bring to mind community forests, indigenous rights holders, and others who are involved with forest management. If there is evidence available, suggest including a longer list of 'who' is doing this work.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Emma	Conrad-Rooney	Text Region	07. Forests		19	19	11	14	Key Message 16.3, in the Indigenous Peoples chapter, should be referenced at the end of this sentence. This key message covers Indigenous people's forest management practices including prescribed burning and their management responses to climate change.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Ariela	Zycherman	Text Region	07. Forests		19	19	19	25	Thanks for including the paragraph "opportunities to better integrate social considerations..." The paragaph reads really generally, though, and I'm not sure eactly what "social considerations" refers to. It does have an example but even that is a little vague, mentioning "socioeconomic haracteristics" twice. Maybe it could be tightened up to leave space for an example on natural resource-dependent communities, or another example that complements the discussion of Indigenous forest relations in the next paragraph.	We thank the reviewer for the comment. We added more detail to the paragraph, including specific examples of socioeconomic characteristics and examples of applications of an environmental justice framework.
Emma	Conrad-Rooney	Text Region	07. Forests		19	19	26	27	Key Message 16.3, in the Indigenous Peoples chapter, should be referenced at the end of this sentence. This key message covers indigenous people's forest management practices including prescribed burning and their management responses to climate change.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
David	Cleaves	Whole Page	07. Forests		19				Very helpful discussion of different approaches and the variety of different climate-driven risk situations. The ties to social and cultural values in the adaptation planning domains are quite welcome and create an opportunity to describe regional climate adaptation challenges and prospects within cultural contexts. The examples could be extended to include vignettes from the eastern temperate, coastal Pacific, and Southeast forest type/cultural response combinations.	We thank the reviewer for the comment. We worked to provide a diversity of adaptation examples from a variety of forest ecosystems across regions and have linked to regional chapters to bolster this content and provide additional context.
David	Cleaves	Text Region	07. Forests		20	29	25	29	The development of markets - compliance and voluntary - for carbon and ecosystem service flows has developed steadily in the last decade but is usually associated with the mitigation side of climate response. Is there any new evidence on the potential of markets and payments for ecosystem services focused on practices to reduce vulnerability or assist transformation beyond the historical emphasis on commodifying carbon. Many adaptation measures involve temporary up-front reductions in standing carbon and costs and the temporal returns in adaptation and mitigation play out in different time frames.	We thank the reviewer for the comment. We searched the literature for emerging markets as suggested and did not find evidence of such systems to consider in the chpt.
David	Cleaves	Text Region	07. Forests		21	25	20	30	These paragraphs have lots of good information but are dense with material from different regions. Are there ways to link some of these references to regional chapters without sacrificing the strength they provide in clocks under the key messages?	We thank the reviewer for the comment. We have revised the text and linked the text to several others chapters.
Don	Falk	Text Region	07. Forests		21	21	23	23	"severity of some disturbances that drive forest change (Coop et al. 2020; Hagmann et al. 2021; Guiterman et al. 2022)." Coop JD, SA Parks, CS Stevens-Rumann, S Crausbay, PE Higuera, MD Hurteau, A Tepley, E Whitman, T Assal, BM Collins, KT Davis, S Dobrowski, DA Falk, PJ Fornwalt, PZ FulvÍ©, BJ Harvey, VR Kane, CE Littlefield, EQ Margolis, M North, M-A Parisien, S Prichard, KC Rodman. 2020. Wildfire-driven forest conversion in western North American landscapes. BioScience 70 (8): 659‚Äì673. https://doi.org/10.1093/biosci/biaa061 Hagmann K, P Hessburg, S Prichard, N Povak, PM Brown, PZ FulvÍ©, R Keane, E Knapp, JM Lydersen, K Metlen, M Reilly, A SvÍnchez Meador, S Stephens, J Stevens, AH Taylor, LY Yocom, M Battaglia, D Churchill, L Daniels, DA Falk, M Krawchuk, J Johnston, C Levine, G Meigs, A Merschel, M North, H Safford, TW Swetnam, and A Waltz. 2021. Evidence for Widespread Changes in the Structure, Composition, and Fire Regimes of Western North American Forests. Ecological Applications 31(8): e02431. http://dx.doi.org/10.1002/eap.2431 Guiterman, C.H., R.M. Gregg, L.A.E. Marshall, J.J. Beckmann, P. van Mantgem, D.A. Falk, et al. 2022. Vegetation type conversion in the US Southwest: Field observations and perspectives from fire and ecosystem managers. Fire Ecology 18: 6. https://doi.org/10.1186/s42408-022-00131-w	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Three references have been added.
Don	Falk	Text Region	07. Forests		21	21	33	33	Add reference: "...eventually limit increases in area burned (Kitzberger et al. 2017)." Kitzberger T, DA Falk, AL Westerling, and TW Swetnam. 2017. Direct and indirect climate controls predict heterogeneous early-mid 21st century wildfire burned area across western and boreal North America. PLoS One 12(12): e0188486. https://doi.org/10.1371/journal.pone.0188486 .	We thank the reviewer for the comment. The reference has been added.
David	Cleaves	Whole Page	07. Forests		21				Did any of the components of the key messages stand out with substantive changes in confidence (lower or higher) than they were characterized in NCA4. There is value in understanding the trends in scientific agreement across NCA's for among other purposes, deciding what research to favor and whether the science bases for individual strategies or practices are getting stronger or weaker.	We thank the reviewer for the comment. We have revised the text to included a few comparisons with NCA4. The confidence language has been revised as well.
Theodore	Weber	Text Region	07. Forests		22	22	21	21	Both windthrow and landslides are of increasing concern as the climate changes. Wind patterns are changing, and more intense rainfall events can increase landslides.	We thank the reviewer for their comment. We agree but feel this is well repreented by the text. The text has been left unchanged.
David	Cleaves	Text Region	07. Forests		22	22	22	25	Good description of research gaps. Much more work is needed to develop usable estimates of management action efficacy and good measures of resilience and key ecosystem outcomes. There are good opportunities here to work toward a framework for framework for developing consistent expectations for elements of resilience for different practices in different forest ecosystem types.	We greatly appreciate the reviewer's kind comment.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Nick	Procopio	Text Region	07. Forests		24	24	6	7	The following statement seems out of place in the Forests chapter, ¬iSea level rise, while virtually certain to continue, has so far unquantified effects on recreational fisheries and the values they generate."	We thank the reviewer for the comment. The sentence has been deleted.
Theodore	Weber	Text Region	07. Forests		25	25	5	9	This applies primarily to fire-prone forests and is probably unnecessary in mesic and wetland forests. The studies you cited were of ponderosa pine, drought-stressed mixed-conifer, planted Scots pine in Germany, and planted oak in Germany. It is an extreme stretch to extrapolate from these studies to "most forest types" in the U.S. Logging is also a form of disturbance, to plants, wildlife, and soils, and should not be considered a catch-all solution for every forest type in America. In fact, in moist old forests, maintaining the cool damp microclimate under the canopy is best to reduce fire risk.	We thank the reviewer for the comment. The sentences have been revised to clarify the text and incorporate the suggestion. Five references have been added.
David	Cleaves	Whole Chapter	07. Forests						Are there any ways to more clearly pull out what we have learned in the NCA5 period that we didn't know before or could not report out as confidently as we did in NCA4 and earlier?	We thank the reviewer for the comment. We have specifically focused on literature and advances since NCA4 in the chapter and, where possible, have included the estimates of status and trends which build on and are consistent with previous assessments.
Emma	Conrad-Rooney	Whole Chapter	07. Forests						This chapter has a large bias towards plants and animals, with little mention of soil microbes, which play a critical role in regulating nutrients and ecosystem processes. It would be beneficial to incorporate more information about microbes throughout.	We thank the review for the comment. We appreciate this suggestion, but space is limited. The author team has deliberated and prioritized text toward other foci.
Sam	Davis	Whole Chapter	07. Forests						I'm disappointed to see no citations of recent papers from Nancy Harris and others (including Grant Domke!) on carbon flux in forests. While wildfires, insects, and droughts are all taking carbon stores from forests and influencing resilience, the elephant in the room (forestry practices) is not mentioned at all. I advise reading and including within the discussion of threats and solutions the following papers: Harris et al. (2016) Attribution of net carbon change by disturbance type across forest lands of the conterminous United States. Carbon Balance and Mgmt 11:24. Curtis et al. (2018) Classifying drivers of global forest loss. Science 361(6407) Hansen et al. (2013) High-resolution global maps of 21st-century forest cover change. Science 342(6160)	We thank the reviewer for the comment. There is an entire Key Message devoted to solutions in the chapter and we have revised the text in other areas to incorporate the suggestions and appropriate citations.
Theodore	Weber	Whole Chapter	07. Forests						The chapter on Forests does not discuss the need to protect major carbon storages from commercial logging and other extractive industries. It is especially important to protect mature and old-growth forest and manage them for long-term persistence and resilience. They provide not only carbon sequestration, but other ecosystem services like wildlife and biodiversity habitat, aquifer recharge, watershed protection, recreation, and others.	We thank the reviewer for the comment. We have added text in the chpt to describe how timber havesting alters carbon sequesteration and storage and can result in transfers to the the atmosphere.
Theodore	Weber	Whole Chapter	07. Forests						Mgmt/Policy Recommendation: Invest in protection against fire, drought, disease, pests, and invasive species. Both research and large-scale field application are needed.	We thank the reviewer for the comment. The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Discussion of policy options is beyond its defined scope.
Theodore	Weber	Whole Chapter	07. Forests						Mgmt/Policy Recommendation: Be strategic with restoration, considering landscape and watershed contexts; e.g. creating wildlife and climate corridors, buffering streams and allowing groundwater recharge. But keep local forest ecology in mind.	We thank the reviewer for the comment. The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Discussion of policy options is beyond its defined scope.
Theodore	Weber	Whole Chapter	07. Forests						Mgmt/Policy Recommendation: Many opportunities exist for synergistic approaches to the climate and biodiversity crises, such as protecting ecosystems that both sequester carbon and harbor important habitats, as well as provide climate change and fire refugia and climate corridors.	We thank the reviewer for the comment.
Theodore	Weber	Whole Chapter	07. Forests						Mgmt/Policy Recommendation: For protection of communities from wildfire, USDA/USFS could purchase conservation easements along the borders of national forests, and especially inholdings, like the military does around bases (e.g., Army Compatible Use Buffer). Also minimize encroachment in fire-prone areas. USFS could also work with local governments to reduce encroachment in firesheds.	We thank the reviewer for the comment. The points raised are beyond the scope of this chapter/report. The text has been left unchanged..
Theodore	Weber	Whole Chapter	07. Forests						Mgmt/Policy Recommendation: USFS should provide more overall guidance for forest plans, making sure that climate resilience and biodiversity protection are included.	We thank the reviewer for the comment. The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Discussion of policy options is beyond its defined scope.
Theodore	Weber	Whole Chapter	07. Forests						Mgmt/Policy Recommendation: The Forest Service has put a lot of emphasis on a concept of restoration that mostly emphasizes structure and tree species composition, and not enough on the broader ecological system, including understory vegetation and other species. Forest planning can also utilize indicator focal species, using both coarse and fine filters, as well as considering viability and ecological integrity.	We thank the reviewer for the comment.
Theodore	Weber	Whole Chapter	07. Forests						Mgmt/Policy Recommendation: Use national forest and grassland planning processes to protect climate refugia, wildlife corridors, high biodiversity areas and high carbon areas with management prescriptions and land and water designations.	We thank the reviewer for the comment. The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Discussion of policy options is beyond its defined scope.
Theodore	Weber	Whole Chapter	07. Forests						Mgmt/Policy Recommendation: Revitalize existing tools and resources such as the climate vulnerability and adaptation strategies presented in Strategic Framework for Responding to Climate Change, National Roadmap for Responding to Climate Change, Climate Change Scorecard, "Responding to Climate Change in National Forests: Guidebook for Developing Adaptation Options," and multi-agency adaptation partnerships.	We thank the reviewer for the comment.
Theodore	Weber	Whole Chapter	07. Forests						Mgmt/Policy Recommendation: Conduct biodiversity and carbon vulnerability assessments on national forests and grasslands. Some assessments of ecological integrity and baseline carbon stocks have been conducted for forest planning, and vulnerability assessments exist for many national forest units, but there is an urgent need for uniform ecological assessments across NFS lands to inform policy development, analysis and decision-making.	We thank the reviewer for the comment.
Theodore	Weber	Whole Chapter	07. Forests						Mgmt/Policy Recommendation: Couple restoration actions with imperiled species recovery, conservation and monitoring to address the biodiversity crisis and add the response of species populations to restoration projects as an index to evaluate trends toward ecological integrity.	We thank the reviewer for the comment.
Theodore	Weber	Whole Chapter	07. Forests						Mgmt/Policy Recommendation: Pause old forest logging and pursue rulemakings or programmatic plan amendments to protect areas that have high ecological integrity and adaptive capacity on NFS lands -- including older forests -- consistent with President Biden's 30x30 goal. These rules (including objective parameters for conducting ecological restoration in a manner that sustains ecological integrity and conservation values) would be a key tool to assure national forests' continued value for: (1) carbon storage; (2) biodiversity protection and species recovery; and (3) climate adaptation, including designation of climate refugia and connecting landscapes. Such rulemaking should also set in these areas.	We thank the reviewer for the comment. The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Discussion of policy options is beyond its defined scope.
Theodore	Weber	Whole Chapter	07. Forests						Deer, feral hogs, and other ungulates have increased above carrying capacity in many areas. In such large numbers, they decimate seedlings, planted trees, and natural understory vegetation, which is then often replaced by invasive alien species. Reintroducing predators like wolves and mountain lions (in natural areas big enough to support them), as well as encouraging hunting, could bring deer and feral hog populations back down to less destructive levels. (Ideally, the population of exotic species like hogs should be zero within U.S. forests).	We thank the review for the comment. The points raised are beyond the scope of this chapter/report. The text has been left unchanged.
Theodore	Weber	Whole Chapter	07. Forests						Mgmt/Policy Recommendation: Prohibit the selling of invasive plants by nurseries and other outlets.	We thank the review for the comment. The points raised are beyond the scope of this chapter/report. The text has been left unchanged.
Nick	Procopio	Text Region	08. Ecosystems		4	7	1	22	The introduction does an excellent job of emphasizing the connection between human well-being and nature.	We greatly appreciate the reviewer's comment about the report/chapter and hope that the content is useful.
Gabriel	Oppler	Figure	08. Ecosystems		4	4	7	8	We suggest adding 'maintain and restore climate-wise corridors' to the Biodiversity Adaptation box. For reference, please see this paper on modeling corridors to allow species range shifts: Keeley, Annika TH, et al. "New concepts, models, and assessments of climate-wise connectivity." Environmental Research Letters 13.7 (2018): 073002.	Thank you for this comment. We believe that the figure is sufficient with regard to the concept of connectivity as it is already mentioned there, but we have added additional text on connectivity in KM2 in a new box on species adaptations, and have cited the Keeley paper there.
Reid	Sherman	Figure	08. Ecosystems		4				Figure 8.1. Adaptation is a key element of this figure with no defintion of adaptation in the chapter or reference to Chapter 31. Adaptation	Thank for this comment. However, we have noted that Ch 31 does not have much material on ecosystem or species adaptation, as they are primarily focused on human adaptation. Therefore, we do not believe it is not necessary to refer within the figure to Ch 31, although we have added additional text referenes elsewhere in the chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Emma	Conrad-Rooney	Figure	08. Ecosystems		5				It would be helpful for the figure caption to explain what is in the table. As a reader, it is unclear if the types of species, ecosystem, and ecosystem services change listed are the most important, most changed for that region, or just clear examples to show the framework of the multiple scales of change in figure 1. It could also be helpful if the examples were connected across the rows rather than seeming like three separate examples for each region.	The figure has been revised to include a table as the caption, with additional descriptions of the changes listed, and the caption now notes that these are selected as examples of unique changes for the region, but are not necessarily the most important or most changed.
Emma	Conrad-Rooney	Figure	08. Ecosystems		6				It is confusing why some of the bars go to 5 degrees C and others only go to 4 degrees C. It would be helpful to make all of the bars go to a uniform height or explain the difference in the figure caption.	The heights of the bars differ because maximum risk/impact is reached below 4 deg C of warming in some cases, and between 4–5 deg C in others. As this is a figure from IPCC and not one designed by the authors, we have declined to alter the heights of the bars and instead have addressed the commenters question in the caption.
Ned	Ende	Figure	08. Ecosystems		6				I reached out to the Department of Natural Resources Kelp Work Group noticing that figure 8.3 appears not correctly representing the temperature risk for kelp. Please contact BERRY, HELEN (DNR) HELEN.BERRY at dnr.wa.gov and Brook Weigel, blweigel at uw.edu. Brook is leading a study that explores thermal thresholds for several life cycle stages of bull kelp in Puget Sound, with publications in development. A 4 degree increase would approach or exceed the thermal thresholds.	We thank the reviewer for this perspective, but believe the figure does represent the temperature risks to kelp correctly since it refers to multiple species, not just Nereocystis.
Reid	Sherman	Text Region	08. Ecosystems		7	7	4	4	Important statement with no explanation: "There are limits to adaptation..." Can this provide more detail or link to other chapters, given that the average reader likely won't follow the citations to IPCC reports?	We have added examples in a sentence following reference to the IPCC report: "For example, adaptation is of limited value in the face of rising sea levels that increasingly submerge coastal communities and ecosystems, or extreme heat that is intolerable to humans or other organisms."
Emma	Conrad-Rooney	Text Region	08. Ecosystems		7	7	7	13	Key message 8.1 should be revised to follow a Risk-Based Framework.	KM1 has been revised to follow a risk-based framework.
Emma	Conrad-Rooney	Text Region	08. Ecosystems		7	13	7	21	Early warning indicators are mentioned in Key Message 8.1 but are not revisited much in the text. It would be helpful if the text more clearly explained what the gap in knowledge is. As a reader it is unclear whether scientists need to monitor to identify what the indicators even are or whether the indicators are known and just need to be monitored to detect changes.	We have removed reference to early warning indicators in KM 8.1. The text now refers to the roles monitoring can play, rather than specifying indicators per se.
Don	Falk	Text Region	08. Ecosystems		8	8	13	13	Add literature reference: "...return path to the original state may be drastically different (Hillebrand et al. 2020; Chazdon et al. 2021; Falk et al. 2022)." Chazdon, R, DA Falk, L Banin, M Wagner, S Wilson, RC Grabowski, and KN Suding. 2021. The intervention continuum in restoration ecology: rethinking the active-passive dichotomy. Restoration Ecology https://doi.org/10.1111/rec.13535 Falk DA, PJ van Mantgem, JE Keeley, RM Gregg, CH Guiterman, AJ Tepley, DJN Young, and LA Marshall. 2022. Mechanisms of forest resilience. Forest Ecology & Management Tamm Review 515: 120129. https://doi.org/10.1016/j.foreco.2022.120129 .	Thank you for these references. The Falk was added as it particularly related to this sentence, while the Chazdon article, while important, is less focused on tipping points, which was the focus of this sentence.
Don	Falk	Text Region	08. Ecosystems		9	9	7	7	Add literature reference: "...ecosystem characteristics and key species (Marshall and Falk 2020)." Marshall LA and DA Falk. 2020. Demographic trends in community functional tolerance reflect tree responses to climate and altered fire regimes. Ecological Applications e02197. https://doi.org/10.1002/eap.2197	Thank you for the reference. It has been added.
Don	Falk	Text Region	08. Ecosystems		9	9	10	11	Add literature reference: "...followed by abrupt shifts (Malhi et al. 2020; O'Connor et al. 2020)." O‚ÄôConnor CD, DA Falk, and GM Garfin. 2020. Projected climate-fire interactions drive forest to shrubland transition on an Arizona Sky Island. Frontiers in Earth Science 8: Article 137. https://doi.org/10.3389/fenvs.2020.00137	Thank you for the reference, but it did not seem to us to fit the point being made in this sentence as well as the existing, broader reference.
Emma	Conrad-Rooney	Figure	08. Ecosystems		13				For figure 8.9 panel b, it is unclear if the reddish orange colors in the arrow are supposed to differ between the two decision pathways. It would be helpful if the colors in the arrows were either the same or clearly different.	Thank you for your attention to detail. They were intended to be the same. We have corrected so both the color and the size and placement of the arrows are the same between upper and lower.
Theodore	Weber	Text Region	08. Ecosystems		15	15	16	17	The sentence on phenological mismatches could use an example; e.g., the timing of food availability no longer matching an organism's demand for food.	Thank you for this suggestion and the text has been modified. The sentence has been changed to read: "Phenological mismatches emerge when the timing of activity in interacting species changes in different ways, such as food availability shifting to no longer match a dependent organism's need for food "
Tiffany	Turner	Figure	08. Ecosystems		16		1		While the previous section noted that terrestrial range shifts were less than marine, the figure would benefit from more relatable species and/or language. Also, Alaska listing only "herbaceous plants and shrubs" is a miss and should display game shifts of caribou and/or moose. Though precipitated by the range shift or changes of plant availability (e.g., permafrost thaw making flora available when they weren't before), the range shift of these animals is documented and causing deep harm to native peoples' lifestyles, traditions, and livelihoods that should be recognized.	Thank you for this suggestion. We have added an icon depicting a moose to Figure 8.11 and the following supporting reference: Tape, K. D., Gustine, D. D., Ruess, R. W., Adams, L. G., & Clark, J. A. (2016). Range expansion of moose in Arctic Alaska linked to warming and increased shrub habitat. PloS one, 11(4), e0152636.
Theodore	Weber	Text Region	08. Ecosystems		16	18	8	15	The definition of climate refugia in the text is not quite correct. More importantly, there is no mention of climate corridors. Wildlife (and plant propagules) cannot successfully migrate to more suitable habitat if they are blocked by highways or urban development. Climate refugia are areas where species, natural communities, or ecosystems can persist within a larger area that has been rendered inhospitable by climate change. Such areas are relatively buffered from changes in regional environmental conditions, and allow organisms to persist as long as local conditions remain tolerable (Keppel and Wardell-Johnson 2012, Morelli et al. 2016). Climate change refugia may only be temporary for a given species (Morelli et al. 2020), but can delay ecosystem transitions for decades or longer (Krawchuk et al. 2020). They can serve as a ¬islow lane," protecting native species and ecosystems from negative effects of climate change in the short term, providing longer-term havens for overall biodiversity and ecosystem function, and reducing the risk of extinction (Morelli et al. 2020). Climate corridors are relatively climate-stable areas that can facilitate long-distance dispersal movement to more suitable habitat if rising temperatures and other changing conditions exceed an organism¬is tolerance (Stralberg et al., 2020) Citations: Keppel, G., and Wardell-Johnson, G. W. (2012). Refugia: Keys to climate change management. Global Change Biology, 18(8), 2389¬ñ2391. https://doi.org/10.1111/j.1365-2486.2012.02729.x Krawchuk, M. A., G. W. Meigs, J. M. Cartwright, J. D. Coop, R. Davis, A. Holz, C. Kolden, and AJH Meddens. (2020). Disturbance refugia within mosaics of forest fire, drought, and insect outbreaks. Frontiers in Ecology and the Environment, 18(5), 235¬ñ244. Morelli, T. L., C. Daly, S. Z. Dobrowski, D.M. Dulen, J. L. Ebersole, and S. T. Jackson, et al. (2016). Managing climate change refugia for climate adaptation. PLoS ONE, 11(8), e0159909. Morelli, T. L., C. W Barrows, A. R. Ramirez, J. M. Cartwright, D. D. Ackerly, T. D. Eaves, J. L. Ebersole, et al. (2020). Climate-change refugia: biodiversity in the slow lane. Front Ecol Environ, 18(5), 228¬ñ234. Stralberg, D., C. Carroll, and S. E. Nielsen. (2020b). Toward a climate-informed North American protected areas network: Incorporating climate-change refugia and corridors in conservation planning. Conservation	The text has been revised to incorporate this suggestion. The reference to physiological state has been removed and replaced by reference to difference between the refugia and the regional environmental patterns. Specific reference is now made to corridors and connection through larval dispersal, and additional references added to the text.
Emma	Conrad-Rooney	Figure	08. Ecosystems		16				As a reader, the "Regional advancement" category in the legend is unclear. It is unclear how does it differs from "latitudinal shift." Also, the image for regional advancement in the legend looks slightly different that the image in the map.	We modified the use of the regional advancement image and matched the images in the map and legend. We also explained the term regional advancement in the caption.See modified text below: Many plant and animal species are shifting their ranges to higher elevations, to more northern latitudes, or in multiple directions (e.g., regional advancement).
Emma	Conrad-Rooney	Figure	08. Ecosystems		18				As a reader, some of the details of this figure are confusing. It is unclear if there is a specific reason why the bees and butterflies are placed in different areas in the landscape diagram. If so, it would be helpful if this could be explained more clearly in the caption, including a description of the ecosystem types in the figure. If the bees and birds are not intentionally placed on certain locations in the landscape, then as a reader, it is unclear what is the point of the detailed landscape. Also, for the individual range maps for each species, it would be helpful to clarify if the range shown refers to the current or past range. It would also be helpful for the legend to include titles for the population (colored circles) and range (colored arrows) columns.	The captions for this figure was expanded to explain the differing responses of bees and butterflies to changing climatic conditions. Given the complexity of those responses, bees were separated out from butterflies and the relative positions on the landscape associated with the habitat uses. The landscape was meant to highlight those different types of landuse and habitat shifts that these organisms are responding to. The figure has been revised to expand out the icons and indicate linkages between specific habitats, and shifts in where the organisms are occuring.
Emma	Conrad-Rooney	Figure	08. Ecosystems		18				It would be helpful to clarify what time frame is the population decrease and increase occurring as well as the time frame for range contraction and expansion is depicted in the figure.	The figure was adjusted to reflect range shifts over the last ten years of peer reviewed literature. The range shift maps were moved to the side and reflect current shifts or contractions of the species based on recent literature. Range contractions are noted from documented species of concern that are proposed for listing status.
Reid	Sherman	Text Region	08. Ecosystems		19	19	1	1	Box 8.2. This should include a link to the Oceans chapter	This reference to the Oceans chapter KM10.1 has been added to the text of the box.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Emma	Conrad-Rooney	Table	08. Ecosystems		20				As a reader, it is confusing that there the images for type of pathogen and vector or intermediate host for some but not all types. This table seems very detailed, compared to the scope of the rest of this chapter, so it could be removed if there is need for more space.	We have removed the icons and reverted to words per the reviewer's request. Given that the material is not presented in any other chapter of the NCA, we have retained the detail, but provided some reorganization.
Nick	Procopio	Text Region	08. Ecosystems		23	23	9	10	Increasing connectivity and decreasing fragmentation should be emphasized more.	We have added additional texts on both of these topics - connectivity with examples in KM2 and decreasing fragementation in KM1 and protected areas expansion in KM2
Nick	Procopio	Text Region	08. Ecosystems		24	24	1	2	This sentence could be more clearly expressed. Without reviewing the citations, I am not certain whether this is emphasizing human-wildlife conflicts or human-human conflict (or both) in the phrase ¬iThe effect of climate change on human conflicts is complex".	Thank you for the helpful suggestion. We have now revised the sentence to clarify our focus on both human-wildlife conflicts and human-human conflicts.
Emma	Conrad-Rooney	Text Region	08. Ecosystems		24	24	11	17	To follow the Risk-Based Framework, Key Message 3 should include what is projected to change in the future.	We have revised for more closely follow risk-based framings, but because ecosystem services vary in terms of their projected climate impacts as well as among regional changes, there are difficulties in projecting what trends will be across all ES.
Theodore	Weber	Text Region	08. Ecosystems		24	24	18	19	Maybe include flood protection among direct material benefits, as it is economically one of the most important ecosystem services.	We agree with this comment, and have added flood protection to the list of direct material benefits.
Emma	Conrad-Rooney	Figure	08. Ecosystems		25				As a reader, some of the details of this figure are confusing. It is unclear whether the items in the two concentric rings are placed in specific order or just randomly exist within each ring. For the categories including non-material contributions, material contributions, etc., it would be helpful to cut the diagram into clear pie slices for each of these contributions.	This figure is drawn from a published paper, and is meant to convey broad categories of different ES. We feel dividing into firm categories (e.g slicing the pie) would create more confusion than clarity by implying firm categories and divisions between ES, when in fact these categories are meant to be fluid.
Emma	Conrad-Rooney	Figure	08. Ecosystems		25				Water quantity and quality is listed in the caption but does not appear in the figure. It is unclear why that is the case, and it would be helpful to clarify that. Also, in the figure it is unclear whether the outer labels refer to certain items in the green circle. For example, it is unclear if "maintenance of options" is considered "regulating contributions."	We have changed the caption to refer to a material contribution (energy) that is in the figure. The categories are meant to be somewhat fluid and potentially overlapping; e.g. some services might fall between material and regulating contributions. This has been clarified in the caption.
Nick	Procopio	Text Region	08. Ecosystems		26	26	6	7	Add ¬ito" to the phrase ¬iInsufficient attention to these existing inequities, likely to be further exacerbated by climate change, will¬Ò"	The sentence has been corrected.
Theodore	Weber	Text Region	08. Ecosystems		26	26	10	10	The section on climate impacts to ecosystem services is much too short. Here is some material from the draft National Fish, Wildlife and Plants Climate Adaptation Strategy update that might inform a more complete section: Climate change impacts such as more frequent extreme events (heat waves, droughts, powerful storms), or simply ecosystem changes driven by steady changes in climatic conditions (e.g., sea level rise) can hinder the ability of ecosystems to provide services to humans. For example, climate-related disturbances like increased drought, fires, storms, and the spread of pests, diseases, and invasive species can alter the distribution, productivity, and health of forests. This will impact carbon storage and sequestration, the forest products industry, flood control and erosion, aquifer recharge, water quality, air quality, recreation, and many other essential services. Some benefits provided by well-functioning inland water and coastal ecosystems will also change or be lost due to climate change impacts, especially when compounded with other stressors such as land-use change and population growth. For example, there may be fewer salmon for commercial and recreational harvest, as well as for traditional ceremonial and cultural practices of indigenous peoples. Coastal marshes and mangroves provide clean water, groundwater recharge, and act as natural buffers against storms (Costanza et al. 2008), absorbing floodwaters and providing erosion control with vegetation that stabilizes shorelines and absorbs wave energy. As sea levels rise, coastal marshes are disappearing (NCA4, Vol. I, p. 379). The loss of coastal wetlands means adjacent inland communities may experience more direct storm energy and flooding (NC NERR 2007). Tidal marshes and submerged aquatic plant beds are also important spawning, nursery, and shelter areas for fish and shellfish (e.g., commercially important species like blue crab), serve as nesting habitat for birds, and provide invertebrate food for shorebirds. At least 50 percent of commercially valuable fish and shellfish depend upon estuaries and nearshore coastal waters in at least one life history stage (Lellis-Dibble et al. 2008); others reported estuarine dependency for approximately 85 percent of commercially valuable fish and shellfish (NRC 1997). In marine systems, large scale changes to biogeochemical processes, ocean currents, and the increased	We have added material to the table 8.2, and included additional examples of general climate impacts on ecosystem services in "Climate Impacts" section of Key Message 3, as well as location-specific examples of climate-induced ES changes and impacts of equitable distribution of and access to those services in Table 8.2. Many of the impacts mentioned are also covered in KM1. We are unable to specifically refer to the draft document mentioned by commenter since it is not yet published.
Nick	Procopio	Table	08. Ecosystems		26				Column for type of pathogen would be more easily interpreted with words (e.g., fungal, bacterial) instead of pictures, particularly with the table being so long.	We have removed the icons and reverted to words per the reviewer's request.
Theodore	Weber	Table	08. Ecosystems		26				Table 8.2 only contains a small fraction of ecosystem services. Please see Berhanu Zawude Bakure et al. 2022. IOP Conf. Ser.: Earth Environ. Sci. 1016 012055 (online: https://iopscience.iop.org/article/10.1088/1755-1315/1016/1/012055/pdf)	We have added material to the table 8.2, but we have not added this reference because it is not empirical literature related to new research on climate impacts on ES. We did not feel it added new primary data that was useable.
Theodore	Weber	Text Region	08. Ecosystems		27	27	25	25	You might want to add sea level rise as a threat to NBS's; e.g., "...also vulnerable to rising temperatures, sea level rise, and other climate impacts."	Thank you for this suggestion, which has been incorporated
Emma	Conrad-Rooney	Figure	08. Ecosystems		29				It would be helpful to clarify what kind of error bars are on this figure. As a reader, it is unclear what the maximum climate mitigation cost means exactly. It would be helpful if the maximum climate mitigation cost was in the same units as the rest of the climate mitigation cost categories, which are per unit CO2 equivalents per year.	The figure is based on a review by Fargione et al. (2018). The errors bars are represented by the black lines, indicating the 95% confidence interval (CI) or reported range, which we now note in the caption. Details are available in the supplementary materials https://www.science.org/doi/suppl/10.1126/sciadv.aat1869/suppl_file/aat1869_sm.pdf. Per Fargione et al., the figure refers to mitigation potential, not costs. The maximum potential considers additional mitigation potential for natural climate solutions (NCS) in the year 2025, i.e. mitigation due to human actions taken beyond business-as-usual (BAU) activities, as expected to occur in 2025. The year 2025 as a reference year for three reasons: 1) its policy relevance to the United States Nationally; determined Contribution under the Paris Agreement, 2) it is distant enough to envision a scaling up of activities by that year, but also 3) soon enough to contribute meaningfully to the urgent need for mitigation of climate change.
Theodore	Weber	Figure	08. Ecosystems		29				Carbon sequestration is only part of the climate consideration. Maintaining existing stored carbon (e.g., not cutting down mature forests) is necessary to keep the carbon from re-entering the atmosphere.	The figure already refers to "avoid forest conversion" which is in agreement with the commenter about not cutting down trees.
Don	Falk	Text Region	08. Ecosystems		30	30	23	23	Add literature reference: "...grassland or woodland following increased wildfires (Guiterman et al. 2018; van Mantgem et al. 2020; O'Connor et al. 2020)." Guiterman CH, EQ Margolis, CD Allen, DA Falk, and TW Swetnam. 2018. Long-term persistence and frequent fire suggest future increased landscape dominance of shrubfields in northern New Mexico. Ecosystems 21(5): 943-959. http://DOI:10.1007/s10021-017-0192-2 van Mantgem PJ, DA Falk, EC Williams, AJ Das, and NL Stephenson. 2020. Intermediate- and long-term growth predict post-fire tree mortality for common conifers in western U.S. parks. International Journal of Wildland Fire 29(6) 513-518. https://doi.org/10.1071/WF19020 O,ÃôConnor CD, DA Falk, and GM Garfin. 2020. Projected climate-fire interactions drive forest to shrubland transition on an Arizona Sky Island. Frontiers in Earth Science 8: Article 137. https://doi.org/10.3389/fenvs.2020.00137	Thank you for these references, which have been added.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Theodore	Weber	Text Region	08. Ecosystems		31	31	8	14	Warming temperatures also allow cold-sensitive invasive species like kudzu to move further north and become more successful there (Hickman and Lerdau 2013). Vines are especially stimulated by increased CO2 (Sasek and Strain 1990, Vaughn and Bowling 2011, Anderson?Teixeira 2013), and can choke out trees and other plants (Matthews et al. 2016). References: Anderson?Teixeira, K.J., Miller, A.D., Mohan, J.E., Hudiburg, T.W., Duval, B.D. and DeLucia, E.H., 2013. Altered dynamics of forest recovery under a changing climate. Global Change Biology 19(7):2001-2021. Hickman, J. E., and M. T. Lerdau. 2013. Biogeochemical impacts of the northward expansion of kudzu under climate change: the importance of ecological context. Ecosphere 4(10):121. http://dx.doi.org/10.1890/ES13-00142.1 Matthews, E. R., J. P. Schmit, and J. P. Campbell. 2016. Climbing vines and forest edges affect tree growth and mortality in temperate forests of the U.S. Mid-Atlantic States. Forest Ecology and Management 374:166-173. Sasek TW, Strain BR (1990) Implications of atmospheric CO2 enrichment and climatic change for the geographical distribution of two introduced vines in the U.S.A. Climatic Change 16:31--51. Vaughn, K.C. and Bowling, A.J. 2011. Biology and physiology of vines. Horticultural Reviews 38:1-21.	Thank you for these suggestions. Additional text was added on kudzu to the section on invasive species, while an additional sentence on Co2 stimulated growth of vines was also added. The references suggested were also added.
Theodore	Weber	Text Region	08. Ecosystems		31	31	25	25	You could add citizen observations like iNaturalist.	We added a reference to iNaturalist in refering to the roles of citizen science in monitoring.
Theodore	Weber	Text Region	08. Ecosystems		31	31	29	30	Adaptive management is also important for conserving, managing, and restoring ecosystems and species populations.	We have added this phrasing to the discussion of adaptive management.
Theodore	Weber	Text Region	08. Ecosystems		32	32	14	22	Perhaps worth pointing out: Terrestrial and especially freshwater species cannot always shift their ranges due to natural and anthropogenic barriers or limited movement capability compared to the speed of climate change. In some cases, human intervention is needed to prevent extinction.	Thank you for your comment. We have added this to the text.
Theodore	Weber	Text Region	08. Ecosystems		34	34	22	27	Household wealth and income also affect the degree of impact.	It is true that wealth and income can affect the degree of impact in some cases. We have added a citation and additional sentence to include income and wealth as part of this relationship.
Reid	Sherman	Text Region	08. Ecosystems		35	35	25	25	Check for underlining.	Underlining has been removed.
Don	Falk	Text Region	08. Ecosystems		36	36	7	7	Add literature reference: "...will be observed (Chazdon et al. 2021; Opperman and Galloway 2022)..." Chazdon, R, DA Falk, L Banin, M Wagner, S Wilson, RC Grabowski, and KN Suding. 2021. The intervention continuum in restoration ecology: rethinking the active-passive dichotomy. Restoration Ecology https://doi.org/10.1111/rec.13535	Thank you for the reference which has been added.
Emma	Conrad-Rooney	Whole Chapter	08. Ecosystems						There was minimal mentions of fungi and bacterial (only about diseases), and no mentions of the effect of microbes on ecosystems in this chapter. Microbial and microscopic life, especially bacteria and fungi, play critical roles in supporting life on Earth. Microorganisms are extremely abundant--there is more than 40x the biomass of microorganisms on earth than that of animals (Bar-On et al. 2017)--and their functions have enormous impacts on every ecosystem. Fungi and bacteria are responsible for much of the movement of nutrients through ecosystems. They perform decomposition, through which dead matter is broken down, and nutrients in organic matter are transformed back into usable forms, recycling infinitely. Without decomposing microorganisms, our planet would be covered in dead matter and life on Earth would cease. Thus, the many factors that impact the composition and activity of decomposer microorganisms (such as climatic, edaphic, and biotic factors) should be of critical interest, especially as these factors, along with microbial diversity and distributions, are changing rapidly with global change. Fungi are also responsible for most of the nutrient transfer to vegetation. 80% of all plants and nearly every tree species on earth form associations with mycorrhizal fungi (Wang and Qiu 2006), which are responsible for providing nutrients from the soil to the plants in return for sugars from photosynthesis (Smith and Read 2008). Like soil decomposers, the composition and activity of mycorrhizal fungi are strongly dependent on factors that are changing rapidly with global change, which will affect plant productivity, soil carbon storage, and nutrient cycling. There seems to be a lack of expertise among the authors to address information about microbial communities and functions in ecosystems. We suggest adding information on these topics, perhaps by adding one or more technical contributors who have expertise in how fungi and bacteria impact ecosystems. Suggestions include Drs. Jennifer Bhatnagar at Boston University, Serita Frey at the University of New Hampshire, V. Bala Chaudhary at Dartmouth College, Ashish Malik at the University of Aberdeen, Mark Anthony at WSL Umweltforschung, and Peter Kennedy at the University of Minnesota. Citations: Bar-On, Y. M., R. Phillips, and R. Milo. 2018. The biomass distribution on Earth. Proceedings of the National Academy of Sciences 115:6506--6511. Smith, S. E., and D. J. Read. 2008. Mycorrhizal Symbiosis. Elsevier. Wang, B., and Y.-L. Qiu. 2006. Phylogenetic distribution and evolution of mycorrhizas in land plants. Mycorrhiza 16:299--363	Thank you for this comment. We have added a sentence in KM1 on microbes, and slightly edited the rest of the paragraph to help it fit in. The high level of detail provided by the commenter is not feasible given word count restrictions for the chapter, and many of the suggested references are fairly old, so have not been included.
George	Kling	Whole Chapter	08. Ecosystems						There appears to be no mention of a topic that has gained attention recently, which is the issue of disease mobilization due to permafrost thaw and subsequent impact to people in the Arctic.	Mention of disease mobilization has been added to the caption for figure 8.5 with appropriate references.
George	Kling	Whole Chapter	08. Ecosystems						Overall the text about ecosystem restoration and nature-based solutions appears to be mostly academic, and it is fairly clear that few if any actual practitioners participated in the development of this text.	Thank you for your comment. We have added examples to the table 8.2 with examples of ES and their management and equity implications. We have also added a box on ecological restoration drawing form tribal forestry practioners.
Theodore	Weber	Whole Chapter	08. Ecosystems						Chapter 8 mentions impacts on biodiversity from climate change, but does not mention the converse: that preserving biodiversity can help mitigate climate change. For example, higher plant diversity can increase carbon storage and sequestration (Chen et al. 2018, Liu et al. 2018, Pastore et al. 2021) and increase ecosystem resilience to carbon-releasing disturbances like drought, diseases, or pest outbreaks (Hutchison et al. 2018, Roberts et al. 2020). Each species contains unique adaptations, yet interacts with other species in a web of dependencies. When species disappear from an ecosystem, those that depend on them for food, pollination or other needs also begin to disappear. This can decrease overall productivity and resilience. At a certain point, it becomes a "Jenga effect" - pull out too many pieces, and eventually the structure collapses. Examples include forest turning to grassland and coral reefs becoming expanses of sand. Such ecosystem collapses accelerate climate change and worsen its effects. Citations: Chen, S., et al. 2018. Plant diversity enhances productivity and soil carbon storage. PNAS 115 (16) 4027-4032. https://doi.org/10.1073/pnas.1700298114 Hutchison, C., Gravel, D., Guichard, F. et al. 2018. Effect of diversity on growth, mortality, and loss of resilience to extreme climate events in a tropical planted forest experiment. Sci Rep 8, 15443. https://doi.org/10.1038/s41598-018-33670-x Liu X et al. 2018. Tree species richness increases ecosystem carbon storage in subtropical forests. Proc. R. Soc. B 285: 20181240. http://dx.doi.org/10.1098/rspb.2018.1240 Pastore, M. A., S. E. Hobbie, P. B. Reich. 2021. Sensitivity of grassland carbon pools to plant diversity, elevated CO2, and soil nitrogen addition over 19 years. PNAS 118 (17) e2016965118. https://doi.org/10.1073/pnas.2016965118 Roberts. M., C. A. Gilligan, A. Kleczkowski, N. Hanley, A. E. Whalley, and J. R. Healey. 2020. The Effect of Forest Management Options on Forest Resilience to Pathogens. Front. For. Glob. Change, Sec. Forest Disturbance, Volume 3. https://doi.org/10.3389/ffgc.2020.00007	Thank you for your comment. We have strenthened the statements in KM1 that biodiversity helps build resilience to climate impacts and helps to mitigate climate change through carbon sink capacity. The whote chapter also conveys this message throughout various pertinent sections. These points are also highlighted in other related NCA5 chapters which we cross-reference in this chapter. Several of these suggested references do not refer to US ecosystems so we have focused on other references for these messages.
Reid	Sherman	Whole Chapter	08. Ecosystems						Adaptive Management is never defined in this chapter and never defined in Adaptation chapter. It is an important concept to present with more clarity.	We have added a sentence in the "Mitigation of Risks and Managing for Change" section that defines adaptive management according to the IPCC.
Reid	Sherman	Whole Chapter	08. Ecosystems						There is only one reference to the Adaptation Chapter in the entire Ecosystems chapter, even though adaptation is discussed quite a bit.	We specifically refer to the Adaptation chapter when discussing ways in which ecosystems can be used to help people and communities adapt (e.g. ecosystem-based adaptation), which is discussed briefly in Ch 31. Other forms of adaptation discussed in this chapter, such as species movements or use of climate refugia, are not discussed in Ch 31, therefore it would be confusing to refer readers to that chapter. Therefore we have kept the existing call-outs.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jim	Titus	Text Region	09. Coastal Effects		3	3	1	26	The introduction is strange. On a broad topic such as the effects of climate change on the coast, we would expect a bit of background on the coastal environment and how that related to climate change; and the first 1 and 1/2 paragraphs do so. But the last half of the introduction should be a bridge between the backgrund and what the rest of the chapter does. Instead, it wanders off on tangents and advocacy of perspectives that leave this reader uncertain whether the intro is simply providing us with the conclusions of the chapter (without telling us) or using the space for a special pleading.	Thank you for the comment. The introduction is intended to briefly frame the scope of the chapter without being an abstract of the KMs. The NACEM review noted that "The chapter introduction offers reasonable context". We have revised the Introduction in response to NACEM comments to provide more regional context, but have not made further revisions in response to this public comment.
Jim	Titus	Text Region	09. Coastal Effects		3	3	7	9	The Strauss et al. 2021 reference does not support the assertion in the sentence that 9.3 million people live in coastal land that will be inundated by 2100. In fact, the paper does not estimate vulnerability through 2100; its focus is on sea level rise centuries hence (though the supplement to the article has 2100 results--but not 20 million). However, a new paper in the same journal does quantify US population close to sea level. It estimates 2.1 (~±0.19) million people below 1 meter (JG Titus 2023, Population in floodplains or close to sea level increased in US but declined in some counties,Äîespecially among Black residents, Environmental Research Letters Section 3.1.) It also estimates 8.1 million below 2m ((Titus 2023 Table S3-C). and 12.8 million below 3 meters (Titus 2023 Figure 4 and Table S3-C).	Thank you for the comment and the paper reference. We have added this citation to the introduction.
Jim	Titus	Text Region	09. Coastal Effects		3	3	7	9	This statement is not supported by the citation. In addition, it has several problems. First, the number of people who currently live below 1 meter has been revised downward from 3.5 million to 2 million by a 2023 paper that uses better data. (Titus. Environmental Research Letters). Second, it is not at all clear that all of the people living in this area would be displaced, since most live in cities where shore protection rather than abandonment is likely and cost-effective at least for the first meter. (Ibid, Table S14). Actually there are three separate issues: how much will the sea rise by 2100, how many people live below various elevations, which land will be protected and which land will be inundated. Studies exist for all three topics--especially along the US Atlantic Coast--and it would be useful for a few paragraphs to put together the three issues based on that research. But if space is too limited, it might be better to simply state population below 1m or 2m, mention that most will require protection, and state the uncetainty as to when the sea will rise 1 or 2m.	Thank you for your comment. We have updated the text to reflect the Titus 2023 paper. Unfortunately, due to space limitations, we cannot accommodate the inclusion of a couple of paragraphs on this topic. We recognize there is great uncertainty on the number of people that could be impacted by future SLR and future storm events.
Jim	Titus	Text Region	09. Coastal Effects		3	3	7	9	The reference to Strauss et al. should include a page or table number. You are citing a detailed result that is not a fundamental conclusion of the paper cited, so it is impractical to expect anyone to find the number asserted when you cite the entire paper.	We appreciate the comment; however, USGCRP guidance does not recommend citing specific page numbers within the citations.
Jeff	Peterson	Text Region	09. Coastal Effects		3	3	7	7	As discussed in comments on Chapter 2, understanding of the acceleration of the sea level rise is critical to effective planning. Page 3; line 7: Add the following sentences: ‚Äúln addition, NOAA reports that the rate of global sea level rise is accelerating: it has more than doubled from 0.06 inches (1.4 millimeters) per year throughout most of the twentieth century to 0.14 inches (3.6 millimeters) per year from 2006‚Äì2015.‚Äù [Note that 3.6mm/year needs to be aligned with the 3.4mm/year reported on p 2-11; see graphic.] Here is source of quotation: https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level	Thank you for your comment. We have edited to reflect this comment and left in terms of global rates between 1900-1990 and 1993-2022 as well as the overall amount of rise along the US coastline during the same periods. We have decided not to highlight the most recent decadal rate, s its comparison to a century-scale rate can be misleading due to inter-decadal variability.
Kelly	Van Baalen	Text Region	09. Coastal Effects		3	3	7	9	The numbers given in these lines do not agree with the numbers reported by the paper cited. Strauss et al. found that the number of people in the US currently living in coastal areas that will be inundated by SLR before 2100 is, with the 66% confidence interval in parentheses, 1.1 (0.88 to 1.4) million in a 1.5C warming scenario, 1.2 (0.94 to 1.6) million in a 2C warming scenario, 1.3 (0.97 to 1.7) million in a 3C warming scenario, and 1.4 (1.1 to 1.9) million in a 4C warming scenario. Please see Table S4 in Strauss et al. 2021 to verify these figures. Strauss et al. also present figures for the number of people in the US currently living in coastal areas that will be inundated by multi century sea level rise in Table S2. The number of people in the US currently living in coastal areas that will be inundated by multi century SLR is, with the 66% confidence interval in parentheses, 8.5 (1.3 to 19) million in a 1.5C warming scenario, 18 (7.5 to 26) million in a 2C warming scenario, 24 (16 to 30) million in a 3C warming scenario, and 30 (25 to 35) million in a 4C warming scenario.	Thank you for your comment. In response to another comment (174407), we updated this section to reference Tigus (2023) and have revised the numbers accordingly.
Ariela	Zycherman	Text Region	09. Coastal Effects		3	3	8	8	the 20 million number is unclear- is that the estimate for 2100?	Thank you for your comment. In response to another comment (174407), we updated this section to reference Tigus (2023) and have revised the numbers accordingly.
Jeff	Peterson	Text Region	09. Coastal Effects		3	3	9	9	The Fourth National Climate Assessment estimated the costs of storms and sea level rise to exceed $3.6 trillion by 2100 in a scenario without adaptation actions and $820 billion in the event that cost-effective adaptation measures are implemented. The scale of damages associated with storms and rising seas is a critical consideration and should be added to the Introduction to the Chapter as it was in NCA4. https://cfpub.epa.gov/si/si_public_record_Report.cfm?Lab=OAP&dirEntryId=335095 Add new sentence at page 3 line 9: ‚ÄúEPA estimates that the costs of cumulative damages to coastal property by sea level rise and storms could exceed $3.6 trillion by 2100 and that these damage costs could be reduced substantially, to under $1 trillion, if cost effective adaptation measures are implemented.‚Äù	Thank you for your comment. We recognize that this information is important to include; however, EPA study may underestimate the damage totals as it does not consider the increasing level of damages incurred across the US since 2017. We have included references to the increasing damage totals using information from NOAA NCEI 2022. We have not included the reference to cumulative damages being reduced to less than 1 billion with well-timed adaptation. Since 2017, storm damage has continued to increase at a steady rate, reaching an all time high in 2020 of 500 billion. Although we agree that adaptation will reduce damage, as a national community, adaptation is not yet keeping pace with the increasing hazards, and "well timed" adaptation is likely too optimistic to include in NCA5.
Ariela	Zycherman	Text Region	09. Coastal Effects		3	3	9	10	I think it's worth noting that flooding from extreme storms impacts coastal communities even where SLR is not acute.	We appreciate the comment. We agree that storms have been impacting coastal years for many decades, and sea level rise is worsening the impacts. We revised this text for clarity.
Jeff	Peterson	Text Region	09. Coastal Effects		3	3	11	11	: It is important to point out that, in addition to sea level rise accelerating, coastal storms are increasing in intensity as a result of climate change and, like sea level rise, are projected to result in increased impacts in decades ahead. These storm changes are documented in Chapter 2; p 2-17 and ‚Äúcompound event risk‚Äù as documented on p 2-24. Page 3; Line 11: Add new sentence recognizing more damaging future storm risk: ‚Äúln addition, warmer air temperatures are projected to result in more destructive coastal storms, as documents in Chapter 2.‚Äù	Thank you for your comment. We have revised this paragraph to reference the increasing number of weather-related disasters and referenced KM 2.2.
Ariela	Zycherman	Text Region	09. Coastal Effects		3	3	11	20	Good to see centering equity and justice concerns in who is affected by coastal impacts. This also could reference Ch20 Social Systems and Justice	Thank you. We added a cross reference to Chapter 20, KM 20.3.
Jeff	Peterson	Text Region	09. Coastal Effects		3	3	20	20	This Chapter documents that more damaging storms and rising sea level will cause damage to ecosystems and infrastructure, but the introduction addresses community impacts without mentioning harm to ecosystems and infrastructure. After addressing storm and sea level rise future impacts on human communities, the text should briefly identify the impacts of more intense storms and rising sea level on coastal ecosystems and major infrastructure assets (i.e., more than just human settlements are at risk). Page 3; following line 20: Add new paragraph: ‚Äúln addition to damage to communities, more damaging storms and rising sea level will cause coastal ecosystems (e.g., wetlands, marshes, beaches, and dunes) to migrate inland and pose a risk of flooding to major infrastructure assets ranging from transportation systems (e.g., highways, railroads, bridges, ports, and airports), water treatment systems, defense facilities, and industrial capacity. Protection structures can reduce risks for existing infrastructure on an interim basis but many major infrastructure assets along the coast will need to relocate to higher ground. Coastal ecosystems require interaction with marine waters and will need to migrate landward as sea levels rise and sustaining these assets will require removal of obstacles to their landward migration.‚Äù	Thank you for the comments. We have included portions of your suggested text in the revised overview along with a reference to vulnerability and impacts on the built envionment in KM12.2. We have also discused revisions in KM9.3 to discuss the inevibility of moving much of this infrastructure inland as part of managed retreat or transormative adaptation in KM9.3.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jim	Titus	Text Region	09. Coastal Effects		3	3	21	22	Leaving aside whether the assertion here is proven in the chapter, the second clause of the sentence does not logically follow, as it implies that science justifies adaptation. Science alone cannot say whether an action is worth taking; it only can help us understand the consequences of the alternatives. In any event, either this statement is proven in the chapter, in which case the chapter sections should be cited rather than some example papers; or the chapter does not prove the case, which would mean this needs to be cut.	Thank you for you comment. This paragraph was revised in response to other comments and the suggested revision is no longer necessary.
Ariela	Zycherman	Text Region	09. Coastal Effects		3	3	23	23	language is a bit unclear - suggest "while transforming coastal communities and environments TO serve all people equitably". Also, transformation focuses on systems, rather than physical environments directly, so consider "while ensuring that coastal communities and environments serve all people equitably."	Thank you for you comment. This paragraph was revised in response to other comments and the suggested revision is no longer necessary.
Ariela	Zycherman	Text Region	09. Coastal Effects		3	3	25	25	Good reference to transformative adaptation but needs a short explanation or definition. Does the adaptation chapter provide a definition?	Thank you for pointing out this opportunity for increased clarity. We have added a short definition from KM 31.1. This definition was moved from the introdction to KM9.3 where transformative adaptation is covered.
Jim	Titus	Text Region	09. Coastal Effects		3	3	27	36	The Key Message 9.1 seems to be almost the same as Key Message 9.2, on the surface. Hazards are a subset of impacts. The actual text suggests that 9.1 is more about the physical effects, so maybe the key message text should be built around the physical effects, which logically would precede the next section on impacts.	Thank you for comment. In response to you comment, as well as additional comments from NACEM, we have revised both KM9.1 and 9.2 for clarity. KM9.1 focuses on the physical processes that are changing in response to climate change, and KM9.2 focuses on the impacts of those changes.
Jeff	Peterson	Text Region	09. Coastal Effects		3	3	27	27	This key message describes coastal hazards primarily in terms of flooding due to storms and rising sea levels. The general reference to ‚ÄúHazards,Äù in the title obscures the essential flood and inundation nature of the risks described in the text of the message. Note that ‚Äúerosion‚Äù is a result of flooding. Although saltwater intrusion is a coastal risk separate from flooding or permanent inundation, it is minor compared to flooding and only briefly addressed on page 9-4. Page 3; Line 27: change title of Key Message to ‚ÄúCoastal Flood Hazards Are Increasing Rapidly‚Äù.	Thank you for the comment. After deliberation within the author team, we have decided not to change the key message language. Hazards beyond flooding are of concern, including erosion, groundwater rise, and saltwater intrusion.
Jim	Titus	Text Region	09. Coastal Effects		3		28		Consider cutting "rapidly": While "likely" etc. are defined by the lexicon, "rapidly" is not. Maybe it should be. But until then, the term is at best subjective since nowhere does the report define the point at which change is rapid as opposed to moderate.	Thank you for the comment. We have removed the word "rapidly" from the text.
Emma	Conrad-Rooney	Text Region	09. Coastal Effects		3	3	28	36	To follow the Risk-Based Framework, Key Message 1 should start by highlighting what we value which is at risk.	Thank you for the comment. The opening paragraph does highlight several aspects that we value along the coast, which are then further discussed in Key Messages 2 and 3. Key Message 1 focuses on changing physical environment.
Jeff	Peterson	Text Region	09. Coastal Effects		3	3	28	28	This key message describes coastal hazards primarily in terms of flooding due to storms and rising sea levels. The general reference to ‚ÄúHazards,Äù in the title obscures the essential flood and inundation nature of the risks described in the text of the message. Note that ‚Äúerosion‚Äù is a result of flooding. Although saltwater intrusion is a coastal risk separate from flooding or permanent inundation, it is minor compared to flooding and only briefly addressed on page 9-4. Page 3; Line 28: change to ‚Äúrisk of coastal flood hazards‚Äù.	Thank you for the comment. After deliberation within the author team, we have decided not to change the key message language. Hazards beyond flooding are of concern, including erosion, groundwater rise, and saltwater intrusion.
Jeff	Peterson	Text Region	09. Coastal Effects		3	3	29	29	It is important to point out that, in addition to sea level rise accelerating, coastal storms are increasing in intensity as a result of climate change and, like sea level rise, are projected to result in increased impacts in decades ahead. These storm changes are documented in Chapter 2; p 2-17 and ‚Äúcompound event risk‚Äù as documented on p 2-24. Page 3; line 29: the term ‚Äúchanging storm patterns,Äù is too vague to describe the clear shift toward more intense storms likely to cause more damage to communities, ecosystems, and infrastructure. Revise to read: ‚Äúmore damaging coastal storms,Äù.	Text has been updated to "more damaging storms". This is accurate as SLR will clearly amplify the impacts of storms, as extreme coastal water levels will be riding on a higher baseline. However, there is not unequivocal evidence that various modes of climate variability (e.g., ENSO, NAO) are increasing in intensity across the board. For example, there are suggestions that ENSO variability will increase (i.e., more intense El Ninos and La Ninas), e.g., Cai, W. et al. Increased ENSO sea surface temperature variability under four IPCC emission scenarios. Nat. Clim. Change 12, 228–231 (2022), whereas other studies suggest a decrease, e.g. Callahan, C. W. et al. Robust decrease in El Niño/Southern Oscillation amplitude under long-term warming. Nat. Clim. Change 11, 752–757 (2021) AND Wengel, C. et al. Future high-resolution El Niño/Southern Oscillation dynamics. Nat. Clim. Change 11, 758–765 (2021). Global and regional wave studies of recent trends and projections for the 21st Century show a poleward shift in mean and extreme wave heights for the Eastern North Pacific; e.g., Erikson, L., Morim, J., Hemer, M. et al. Global ocean wave fields show consistent regional trends between 1980 and 2014 in a multi-product ensemble. Commun Earth Environ 3, 320 (2022). https://doi.org/10.1038/s43247-022-00654-9 AND Erikson, L.H., Hegermiller, C.A., Barnard, P.L., Ruggiero, P. and van Ormondt, M., 2015. Projected wave conditions in the Eastern North Pacific under the influence of two CMIP5 climate scenarios. Ocean Modeling, Volume 96, p. 171-185, http://dx.doi.org/10.1016/j.ocemod.2015.07.004 AND Meucci, A., Young, I.R., Hemer, M., Kirezci, E. and Ranasinghe, R., 2020. Projected 21st century changes in extreme wind-wave events. Science Advances, Volume 6(24), 9 pp., https://www.science.org/doi/10.1126/sciadv.aaz7295. There is evidence for significant increases in tropical cyclone intensity, especially for U.S. coastlines, but the assessment is not unanimous: e.g., Knutson, T. et al., 2020: Tropical Cyclones and Climate Change Assessment. Part II: Projected Response to Anthropogenic Warming. Bull. Amer. Meteorol. Soc., https://doi.org/10.1175/BAMS-D-18-0194.1. A nice discussion on the topic can be found here: https://www.gfdl.noaa.gov/global-warming-and-hurricanes/.
Jim	Titus	Text Region	09. Coastal Effects		3	3	33	34	"significant disruption" needs to be added to the defined lexicon or this term needs to be defined. Otherwise, this sentence seems to merely reflect a personal opinion as to what is significant--and that opinion is not even defined.	Than you for the comment. We have deleted the word significant.
Jeff	Peterson	Text Region	09. Coastal Effects		4	4	7	9	The first paragraph on page 9-4 needs to clarify that sea level rise will result in both more extensive, temporary flooding due to storm surges and gradual, permanent inundation of places that are now dry land and above the current high tide line. This permanent inundation begins as more extensive reach of a regular high tide and gradually changes to permanent inundation during all stages of tide to a growing geographic extent. Page 9-4; Line 7-9: This sentence should be revised to be: ‚ÄúSLR has escalated the geographic extent and severity of large and small temporary flooding events (e.g., impacts from storms) and are most noticeable at times of high tides [HTF]. Rising sea level will increasingly drive these storm event high tides further inland as well as bring permanent inundation to places that are now dry land. This permanent inundation begins as increased extent of high tides and gradually becomes permanent during all stages of the tide.‚Äù Additional edits are needed to the references to ‚Äúfrequency of high tide flooding‚Äù.	Thank you for your comment. We have edited the text to reflect your comment.
Reid	Sherman	Text Region	09. Coastal Effects		4	4	12	12	Recommend replacing East with Atlantic and likewise for West/Pacific for more clarity.	Thank you for this comment. We are using Atlantic, Pacific, and Gulf coasts
Jeff	Peterson	Text Region	09. Coastal Effects		4	4	14	14	Page 4; line 14 estimates average sea level rise along the US coast by 2050 to be 10-12 inches by 2050. But, page 2-27 gives an estimate of 12-20 inches. The estimates should be consistent (i.e., use a 2000 or a 2020 baseline) or a difference in assumptions should be more clearly described. Page 20; line 8 repeats the 10-12 inches by 2050 estimate.	Thank you for the comment. In chapter 9, we now provide a 11 inch rise by 2050 since 2020 with a 9-13 inch likely range based upon trend extrapolation (or trajectory). Ch 2 is providing the entire range based upon the scenarios at 2050 which is not incorrect but is not using the observation trajectory to derive this rise amount.
Reid	Sherman	Text Region	09. Coastal Effects		4	4	16	16	Remove hyphen in ice sheet.	Thank you for the comment. The hyphen was removed.
Jim	Titus	Text Region	09. Coastal Effects		4		17		This statement is misleading and possibly wrong. First, what does "could" mean? It should be replaced with a probability statement from the lexicon. For the statement as written to be accurate, failing to curtail emissions must imply a low scenario of 5.6 feet--if that is the case, then it would be clearer to simply state that sea level will rise 5.6 to ____ feet if emissions are not curtailed. A final problem, is that the text implies that Figure 9.1 supports the sentence, but it does not. It has the numbers, but it does not support any of the words in this sentence.	Thank you for you comment. We have clarified the paragraph to reflect your input and removed the word 'could'.
Jeff	Peterson	Text Region	09. Coastal Effects		4	4	17	17	Page 4; line 17 refers to sea level rise of 3.6-7.1 feet by 2100 compared to 2020 whereas Chapter 2, page 29 refers to 3-6 feet. The estimates should be consistent or a difference in assumptions described.	Thank you for the comment. Ch. 2 is referring to global rise amounts, whereas in Ch. 9 we are referring to CONUS rise under the Intermediate to High sea level scenarios.
Reid	Sherman	Text Region	09. Coastal Effects		4	4	17	17	Edit (1.12.1 m) to insert hyphen (1.1-2.1 m).	Thank you for the comment. The hyphen was inserted.
Jim	Titus	Text Region	09. Coastal Effects		4	4	18	21	This sentence should be moved to chapter 2. The rest of this chapter does not address the effects, impacts, and adaption to these very long-term rates of sea level rise, so it is superfluous here.	Thank you for your comment. We have added a bit more about sea level rise out to year 2150 and based upon agency comments, have decided to leave the multi-millenium sea level rise mention intact.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jim	Titus	Text Region	09. Coastal Effects		4	4	23	29	The third paragraph on page 4: the first sentence strikes me as nonsensical. Or extremely poorly worded. How can sea level rise cause more floods 3 feet above the average high tide? Sea level rise increases both the average high tide and the elevation of the title flooding. So unless there's a really weird bathymetric effect going on, sea level rise should not change the frequency of flood elevations relative to mean Highwater. It certainly could change frequencies of flooding of particular parts of of land, or the frequency of flooding of land that today is 3 feet above high tide--but that's not what the report says. Anyway, if the sea is a few feet higher, then floods that are 1 foot above the future sea level but 3 feet above the 2010 sea level will be considered minor.	Thank you for your comment. We have edited the text to clarify above the average high tide defined by NOAA's current tidal datum epoch.
Jim	Titus	Text Region	09. Coastal Effects		4		34		It seems odd to be citing sectioj 9.2, since that section is built upon this section. Points made in that section do not need to appear here.	Thank you for the comment. We have removed the reference to KM 9.2.
Jim	Titus	Text Region	09. Coastal Effects		5		2		We have an assertion in the very first sentence about what should be considered, when planning for future flood risk. This seems out of place since the chapter has not even discussed planning for future flood risk yet, and more important, the rest of the paragraph does not talk about planning. So this is a poor topic sentence.	We thank the reviewer for their comment. The authors did review the opening sentence and think it is an appropriate summary of the current coastal activities and good introduction to the rest of the chapter.
Ariela	Zycherman	Text Region	09. Coastal Effects		5	5	5	6	In describing the coastal landscape here, there is no mention of the built environment and the forces of development on shaping the coastal landscape.	Thank you for your comment. We have revised the Introduction section to include reference to the impact of human modification in coastal regions.
Jim	Titus	Text Region	09. Coastal Effects		5	5	10	12	It,Äôs not at all clear what is meant where it talks about tripling the estimated number of people exposed to flooding. My guess would be that they do not really mean what they write, because literally, the suggestion seems to be that sea level rise increases the number of people exposed to waves or still water flooding, by three times as much as sea level rise increases the number of people exposed only to stillwater flooding. However, I would not be surprised if all they really mean is that the people exposed to waves or stillwater flooding is three times as much as the increase in people exposed to stillwater flooding, which, if true would tend to mean that sea level rise has a more modest impact on exposure to flooding when one considers the waves. Yet the information is presented in a way to suggest something else. The sentence just needs to be clarified, possible with representative nationwide or site-specific numbers.	That you for your comment. We revised this sentence for clarity. Based on a study in California, the inference is that the population exposure triples when dynamic coastal response (beach change and cliff retreat) + storm water levels are included in flood exposure studies, compared to SLR alone. Yes, this illustrates that while SLR elevates flood exposure, to fully capture future flood risk, coastal change and storms should be considered as well.
Jim	Titus	Text Region	09. Coastal Effects		5		12		The reference to Barnard should include a page or table number. You are citing generality that is not clear from the face of the paper. If that general conclusion about the Pacific Coast is in the paper, it is impractical to expect a reviwer to find that assertion when you cite the entire paper.	We appreciate the comment; however, USGCRP guidance does not recommend citing specific page numbers within the citations.
Thomas	Knutson	Text Region	09. Coastal Effects		5	5	17	19	This statement has the wrong references and needs some modification/elaboration. Here is a suggested revision: "Tropical storms and hurricanes have slowed down over the continental U.S. since 1900 (Kossin 2019) and near-U.S. coastal regions since 1948 (Hall and Kossin 2019), with mixed observed trends reported along the U.S. coast since 1951 (Zhang et al. 2020), although these changes have not been attributed to historical anthropogenic forcing (e.g., Zhang et al. 2020). The few existing modeling projection studies on this subject disagree on whether and where anthropogenic forcing is projected to cause a significant slowing of tropical cyclones over and near the US East Coast (Garner et al. 2021; Zhang et al. 2020; Yin et al. 2020; Gori et al. 2022). Hurricane and major hurricane landfalling frequency over the U.S. has no significant trend since the late 1800s." Refs: Kossin, J.P. Reply to: Moon, I.-J. et al.; Lanzante, J. R.. Nature 570, E16-E22 (2019). https://doi.org/10.1038/s41586-019-1224-1 Hall, T.M., Kossin, J.P. Hurricane stalling along the North American coast and implications for rainfall. npj Clim Atmos Sci 2, 17 (2019). https://doi.org/10.1038/s41612-019-0074-8 Gori, A., N. Lin, D. Xi, and K. Emanuel, 2022: Tropical cyclone climatology change greatly exacerbates U.S. extreme rainfall-surge hazard. Nature Climate Change, 12171-178 Zhang, G., H. Murakami, T. R. Knutson, R. Mizuta, and K. Yoshida, 2020: Tropical cyclone motion in a changing climate. Science Advances, 6(17), eaaz7610, DOI:10.1126/sciadv.aaz7610.	Thank you for your comment. We have revised the text with cross-references to KM 2.2, KM 3.6, and appropriate language therein.
Jim	Titus	Text Region	09. Coastal Effects		5	5	19	21	Figure 9.3 does not support the proposition here thougjh it is provided as support. Moreover, if it really supported the point then it should be printed here.	Thank you for your comment. Figure 9.3 (now Figure 9.4) has been moved in KM9.2. This figure is intended to provide the "existing conidtions" baseline for the future climate impacts (Figure 9.5) and adaptation (Figure 9.6).
Jim	Titus	Text Region	09. Coastal Effects		5		21		Figure 9.3 does not support the proposition stated.	Thank you for your comment. Figure 9.3 (now Figure 9.4) has been moved in KM9.2. This figure is intended to provide the "existing conidtions" baseline for the future climate impacts (Figure 9.5) and adaptation (Figure 9.6).
Ariela	Zycherman	Text Region	09. Coastal Effects		5	5	22	24	What about mentioning the contribution of impervious surfaces to flooding?	Thank you for your comment. In an effort to provide the reader with a broader context within which to understand the evolving risks from coastal flooding, the second sentence in the opening paragraph was revised to state: "Observed changes in sea level and the frequency and intensity of coastal storms, coupled with changes in land use and land cover that tend to magnify flood risk, already have a significant and demonstrable negative impact on people living and working along the coast."
Jeff	Peterson	Text Region	09. Coastal Effects		8	8	7	7	The coastal impacts addressed in this Key Message are primarily flood and inundation. The title should be changed to better identify this risk. Page 8; Line 7: Change title of Key Message to ‚ÁúCoastal Flood Impacts on People and Ecosystems Are Increasing‚Äù.	Thank you for the comment. After deliberation within the author team, we have decided not to change the key message language. Hazards beyond flooding are of concern.
Emma	Conrad-Rooney	Text Region	09. Coastal Effects		8	8	8	15	To follow the Risk-Based Framework, Key Message 2 should highlight what can be done about these highlighted problems.	Thank you for your suggestion. We have rephrased the KM for clarity: "Proactive strategies are necessary to avoid degraded quality of life in the coastal zone as the combination of reduced ecosystem services and damage to the built environment from exacerbated coastal hazards increasingly burden communities, industries, and cultures."
Ariela	Zycherman	Text Region	09. Coastal Effects		8	8	11	11	Consider referencing the ecosystems chapter	We thank the reviewer for the comment. While we cannot have references in the Key Messages text itself, the ecosystem chapter is cross referenced in the narrative for KM2.
Jeff	Peterson	Whole Page	09. Coastal Effects		8				This Key Message (9.2) does a good job of addressing the ecosystem risks posed by coastal flooding. The significant impacts of coastal flooding on infrastructure need to be addressed in this Chapter by revising this key message or adding a new key message focused directly on flood and sea level rise risks to major infrastructure. Some impacts of coastal flooding and sea level rise include: oTransportation facilities, including highways, railroads, bridges, and ports; oDefense assets, including military bases and construction and repair facilities; oWastewater treatment and drinking water treatment facilities; oHospitals and major medical centers; and oEnergy generation and transportation assets and petroleum refining plants. Note that ‚Äúmajor infrastructure,Äù generally includes large scale assets that provide services on a regional or national basis. Issues related to management of small-scale infrastructure (e.g., local roads, local power networks, localized water pipes and septic systems) and should be addressed through a community focused planning process. Risks to major coastal infrastructure facilities are well documented in prior National Climate Assessments and in other chapters of the draft NCA5 (e.g., brief mention of sea level rise in Transportation Chapter). However, the consequences of the cumulative losses of multiple types of infrastructure assets in coastal areas need to be recognized in the Coastal Effects chapter. The Coastal Effects chapter needs to address flood and sea level rise risk to major infrastructure assets for several reasons: oCoastal infrastructure assets are critical to the economy and national security and clear assessment of risks of damage or loss of these assets is needed in order to prompt implementation of public and private sector measures to reduce potential damage; oPlanning for new, major infrastructure assets needs to include avoidance of coastal flood and sea level rise risks and new facilities are less likely to be poorly sited in coastal flood and sea level rise risk areas if risks to existing infrastructure assets are well understood; and oMajor infrastructure assets are often a key source of local employment and planning for relocation of	We thank the reviewer for this comment. While we appreciate the scope and scale of the requested edits, these additions would go beyond the scope of the chapter. We have added additional references this built infrastructure in the chapter overview in response this and other comments, with a cross reference to the KM12.2 in the Built Environmental chapter. Regional chapters also cover these issues that cross multiple disciplines in more detail, as appropriate.
Ariela	Zycherman	Figure	09. Coastal Effects		8				Again, in this figure there are clearly drawn some built environment features of the landscape, but their contribution (along with potential future development) is not mentioned in the figure text. Infrastructure is only mentioned as being impacted by flooding, not contributing to it.	Thank you for your comment. Figure 9.3, 9.4, and 9.5 have been revised for consistency with the text. No change is made in response to this comment.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Reid	Sherman	Figure	09. Coastal Effects		8				This figure is not labelled and may be confusing to people who do not know what effect is represented in each element of the graphic. It is best understood when seen beside figures 9.4 and 9.5-- which would also benefit from labels. An example figure with labels is 5.1.	Thank you for your comment. Figure 9.3, 9.4, and 9.5 have been revised for consistency with the text. No change is made in response to this comment.
Reid	Sherman	Text Region	09. Coastal Effects		9	9	1	1	Reword to this or similar: "Coastal communities are threatened by rising seas and changing storm patterns. These threats jeopardize place attachment, economies, and safety."	The text has been revised to incorporate this suggestion
Ariela	Zycherman	Text Region	09. Coastal Effects		9	9	2	2	Place attachment sounds jargon-y, could use cultural heritage	We thank the reviewer for the comment. The term cultural heritage, however, doesn't completely get at the element we are trying to describe, which is the inherent value of these systems to people. Therefore we've added some plain language around the term "place attachment" to "attachment to place".
Ariela	Zycherman	Text Region	09. Coastal Effects		9	9	2	2	I'm not sure that the general reader will understand the term "place attachment"	We thank the reviewer for the comment. The text has been revised to clarify "place attachment" by adding a plainer language description ("attachment to place") before introducing the term "place attachment".
Ariela	Zycherman	Text Region	09. Coastal Effects		9	9	3	19	Consider citing EPA social vulnerability report with chapters on coastal flooding impacts on different populations https://www.epa.gov/cira/social-vulnerability-report	We thank the commenter for this suggestion and have added the suggested citation to the chapter.
Jim	Titus	Text Region	09. Coastal Effects		9	9	6	7	The Neumann et al. 2015 reference does not support the assertion "Continued population growth and urbanization expose an ever-increasing number of people to 6 coastal flood risks". That paper makes projections for the future, but it does not measure trends in population or urbanization of coastal floodplains. However, a new paper reports "the population in the 100 and 500 year coastal floodplains increased 22% and 44%, respectively from 1990 to 2020, and the population below 1m and 3m increased 16 and 31 percent, respectively. See JG Titus 2023, "Population in floodplains or close to sea level increased in US but declined in some counties,Âîespecially among Black residents," Environmental Research Letters.	We have reworded the sentence slightly and added several more recent references, including the reference recommended by the commenter.
Tiffany	Turner	Text Region	09. Coastal Effects		9	9	7	10	The sentence should include agriculture. Agriculture is being deeply impacted by inundation and intrusion and the risk is high for our food and economic security if lands aren't being managed for this.	We appreciate this suggestion, but space is limited. Because impacts to agriculture the commenter outlines are already highlighted later on page 9, lines 20-21, the text has not be revised to incorporate this suggestion.
Jim	Titus	Text Region	09. Coastal Effects		9	9	16	19	Problem: Too many statements in the text are ostensiby supported by references that do not, in fact, support the proposition stated--and in many cases the do not even mention the proposition stated. That situation reflects very poorly on the entire process. Proposed Solution: The chapter needs an ombudsman or internal critic to somehow ensure quality. Alternatively or in addition, references purporting to support a proposition should cite the specific page(s) of subsections of the report cited that support the proposition, unless the entirety of the cited work supports the proposition stated. Not only does that make it possible for a reviewer to validate the reference, it also ensures that the author has verified the accuracy of the reference.	Thank you for your comment; however, USGCRP guidance does not recommend citing specific page numbers within the citations. The author team has verified citations as appropriate.
Jim	Titus	Text Region	09. Coastal Effects		9	9	16	19	The Huppert and Sparks paper is a dated and fairly weak citation for this sentence. That paper was neither the first nor the most recent to point out that both development and changing climate can combine to increase hazards; and it has neither a US focus nor a quantitative demonstration of the point being made. There are many recent publications that address this point with greater authority from different angles. First, the many efforts to curtail development in hazardous areas because of climate change are responding to this very interaction, not just talking about it. Second, there are papers that quantify both changing hazards and migration. For example, Titus (2023) shows that sea level rise is responsible for 75% and 14% of the change in population below 1m and 3m, respectively, while migration into low areas is responsible for 25 and 86%, respectively. See JG Titus 2023, "Population in floodplains or close to sea level increased in US but declined in some counties,Âîespecially among Black residents," Environmental Research Letters.	We thank the commenter for this suggestion and have added the suggested citation to the chapter. We agree that Titus (2023) provided a more recent assessment for this statement. We removed the Huppert and Sparks (2006) reference as suggested.
Reid	Sherman	Text Region	09. Coastal Effects		9	9	22	22	Delete second period.	Thank you for your comment. The second period was deleted.
Jeff	Peterson	Text Region	09. Coastal Effects		9	9	25	25	Page 9; line 25 refers to the long-term challenges of rising sea level but then speaks to the impacts of saltwater intrusion and related impacts. Although rising groundwater is an important coastal impact of storm flooding and rising sea level, it is far less critical than the expected loss of homes and communities to more expansive and permanent inundation. Local governments face difficult choices about managing development in coastal areas and implementing coastal flood resilience strategies and this chapter should more fully describe expected impacts on homes and communities. Page 9; line 25: Add a new paragraph describing the extensive, permanent inundation of existing coastal homes and communities expected as a result of rising sea level similar to the following draft paragraphs: ‚ÄúRising sea level will result in the gradual inundation of land area that is now occupied by millions of homes, neighborhoods, and communities in the decades ahead. Some two million homes, about two percent of all US homes, are at risk of inundation as a result of six feet of sea level rise. Almost 300 U.S. cities would lose at least half their homes, and 36 U.S. cities would be completely lost. One in eight Florida homes would be under water. These properties have a value of over $800 billion. As coastal communities gain understanding of inundation risks, implementation of response strategies, such as protective structures, can delay inundation. In most cases, however, the high cost of such structures and the millions of properties seeking such protection, will limit the percentage of the properties at risk that can be protected. In addition, the expected continuation of sea level rise for decades and centuries will result in the overtopping of even the most ambitious protection structures. Gradual relocation of homes in flood risk areas is likely to be needed.‚Äù	We thank the reviewer for this comment. The points the commenter raises related to the expected loss of homes and communities to more expansive and permanent inundation are addressed and described in the chapter. However, the chapter also includes the state of the science in terms of SLR driving rising coastal groundwater tables, leading to a series of potential hazards, including emergence and ponding at the land surface, reduced capacity for precipitation drainage, saltwater intrusion into irrigation and drinking water supplies, damage to underground utilities and septic systems, mobilization of contaminants, and degradation of coastal marshes, agriculture, and forested wetlands due to its importance in terms of impacts to coastal communities.
Ariela	Zycherman	Text Region	09. Coastal Effects		9	9	31	32	Discharge to where? Would be good to explicitly say how discharge connects to public health. What's the exposure pathway?	We thank the reviewer for the comment. The text has been revised to incorporate this suggestion. The sentence now reads: “This could lead to public health concerns, such as increased likelihood of pollutant discharge into the environment.”
Emma	Conrad-Rooney	Text Region	09. Coastal Effects		10	10	3	4	This sentence, "The impacts of…across US communities" should reference Key Message 20.5 and Box 20.2 in the Social Systems and Justice chapter.	We thank the reviewer for the comment. The text has been revised to incorporate this suggestion. Citation added (KM20.5 and Box 20.2).
Steve	Roth	Text Region	09. Coastal Effects		10	10	8	13	This is pretty one-sided. Lots of rich people with their second homes get hit with coastal floods. The problem of poor people in floodplains is mostly an issue for the flyover states.	This is not in agreement with the consensus of the science. Maya K Buchanan et al 2020 Environ. Res. Lett. 15 124020 10.1088/1748-9326/abb266
Steve	Roth	Text Region	09. Coastal Effects		10	10	8	12	Don't blame redlining if Blacks get flooded more. Blame their own decisions to live in cities like New Orleans that get flooded more. Stop trying to find racial injustice behind every corner.	This is not in agreement with the consensus of the science. Conzelmann et al. Long-Term Effects of Redlining on Environmental Risk Exposure (November 1, 2022). FRB Richmond Working Paper No. 22-9, Available at SSRN: https://ssrn.com/abstract=4284307 or http://dx.doi.org/10.21144/wp22-09
Ariela	Zycherman	Text Region	09. Coastal Effects		10	10	17	18	the words "locked in a cycle of impoverishment" and "ill-equipped" reinforce deficit framing and lack of community agency. Consider instead stating that economically disadvantaged communities have fewer access to resources and are at greater risk for flood impacts due to lack of flood protection measures and infrastructure improvements.	We thank the reviewer for their excellent suggestion. We have reworked the sentence to read "Decades of limited community inclusion in decision-making and disinvestment in critical infrastructure and community services in these areas have reduced access to resources and generated greater risk to physical and socioeconomic impacts of coastal hazards."
Emma	Conrad-Rooney	Text Region	09. Coastal Effects		10	10	22	24	This sentence, "In the Hawaiian Islands… coastal community resilience" should reference key messages 30.1 and 30.5 in the Hawai'i and Pacific Islands regional chapter.	Thank you for this suggestion. IT was added
Reid	Sherman	Text Region	09. Coastal Effects		10	10	24	24	Additional citations needed to support this statement. For example, threats to Alaska Subsistence Use. 10.1007/s00267-020-01382-6 Tran et al 2021 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7854430/)	Thank you for this suggestion. We have added this citation.
Ariela	Zycherman	Text Region	09. Coastal Effects		10	10	31	32	I'm not sure I understand what is meant by "lack of workforce" in this context -- is it that people have moved away? Or that people participating in coastal economies cannot afford to live at the coasts?	We thank the reviewer for the comment. The commonly understood definition for workforce is "the people engaged in or available for work, either in a country or area or in a particular company or industry." The reviewers second definition is correct. No change has been made to the text.
Reid	Sherman	Text Region	09. Coastal Effects		10	10	34	34	Replace "in" with "due to" or similar.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Emma	Conrad-Rooney	Text Region	09. Coastal Effects		11	11	2	15	As a reader, this paragraph does not seem detailed enough, given its importance. The effects of climate change on coastal ecosystems are important to understanding their resilience, but some aspects of this paragraph are glossed over. For example, it would be helpful to include why and how are tidal wetlands are both expanding and declining, and what effect does expanding tidal wetlands and mangroves overtaking tidal wetlands have on the ecosystem's ability to protect from climate hazards.	We thank the reviewer for the comment. The text of this paragraph has been substantially modified to address the comment.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Donna Marie	Bilkovic	Text Region	09. Coastal Effects		11	11	7	11	I recommended modifying the following sentence: "In Chesapeake Bay (Raabe and Stumpf 2016), Florida (Schieder et al. 2018), and New Jersey (Kirwan and Gedan 2019), tidal wetlands have expanded and will continue to do so, often at the expense of other ecosystems, including upland habitats, agricultural areas, and forested lands (Osland et al. 2022).,Âù Unfortunately, this statement presents a conclusion that that does not represent the scientific consensus. Also, I cannot find a Raabe and Stumpf 2016 paper about the Chesapeake Bay (only one about Florida) and Schieder et al. 2018 was about the Chesapeake Bay. The references may have been confused; moreover, this represents only a limited review of the state of the science. Below is (non-comprehensive) list of references that should be considered in this section: Chesapeake Bay region ,ÄCKearney MS, Rogers AS, Townshend JRG, Rizzo E, Stutzer D, Stevenson JC, Sundborg K (2002) Landsat imagery shows decline of coastal marshes in Chesapeake and Delaware bays. Eos 83:173,Äi178. https://doi.org/10.1029/2002EO000112 ,ÄCWrayf, R.D., Leatherman, S.P. and Nicholls, R.J., 1995. Historic and future land loss for upland and marsh islands in the Chesapeake Bay, Maryland, USA. Journal of Coastal Research, pp.1195-1203. ,ÄCMitchell, M., Herman, J. and Hershner, C., 2020. Evolution of tidal marsh distribution under accelerating sea level rise. Wetlands, 40(6), pp.1789-1800. ,ÄCMitchell M, Herman J, Bilkovic DM, Hershner C (2017) Marsh persistence under sea-level rise is controlled by multiple, geologically variable stressors. Ecosystem Health and Sustainability 3:10. https://doi.org/10.1080/20964129.2017.1396009 ,ÄCKearney, M.S., Grace, R.E. and Stevenson, J.C., 1988. Marsh loss in Nanticoke estuary, Chesapeake Bay. Geographical Review, pp.205-220. ,ÄCBeckett, L.H., Baldwin, A.H. and Kearney, M.S., 2016. Tidal marshes across a chesapeake bay subestuary are not keeping up with sea-level rise. PloS one, 11(7), p.e0159753. New York	We thank the reviewer for the comment. The text of this paragraph has been substantially modified to address the comment after review of the references provided.
Molly	Mitchell	Text Region	09. Coastal Effects		11	11	7	12	This is a very limited review of the literature(3 papers), leading to a conclusion that does not represent the scientific consensus. Many studies from New York through Chesapeake Bay conclude that 1) historic marsh extent is declining and 2) it will continue to decline under sea level rise. In addition, the Blue Carbon chapter concludes that "Currently, 43%,Äi48% of wetlands along the Atlantic and Gulf Coasts are vulnerable to SLR, with northern wetlands limited by inland migration capacity and southern wetlands limited by local subsidence, which increases the relative rate of local sea level rise (Holmquist et al. 2021)." This is more consistent with scientific literature than the statements included in this chapter. Please consider the following references in the review of this topic: Chesapeake Bay region ,ÄCKearney MS, Rogers AS, Townshend JRG, Rizzo E, Stutzer D, Stevenson JC, Sundborg K (2002) Landsat imagery shows decline of coastal marshes in Chesapeake and Delaware bays. Eos 83:173,Äi178. https://doi.org/10.1029/2002EO000112 ,ÄCWrayf, R.D., Leatherman, S.P. and Nicholls, R.J., 1995. Historic and future land loss for upland and marsh islands in the Chesapeake Bay, Maryland, USA. Journal of Coastal Research, pp.1195-1203. ,ÄCMitchell, M., Herman, J. and Hershner, C., 2020. Evolution of tidal marsh distribution under accelerating sea level rise. Wetlands, 40(6), pp.1789-1800. ,ÄCMitchell M, Herman J, Bilkovic DM, Hershner C (2017) Marsh persistence under sea-level rise is controlled by multiple, geologically variable stressors. Ecosystem Health and Sustainability 3:10. https://doi.org/10.1080/20964129.2017.1396009 ,ÄCKearney, M.S., Grace, R.E. and Stevenson, J.C., 1988. Marsh loss in Nanticoke estuary, Chesapeake Bay. Geographical Review, pp.205-220. ,ÄCBeckett, L.H., Baldwin, A.H. and Kearney, M.S., 2016. Tidal marshes across a chesapeake bay subestuary are not keeping up with sea-level rise. PloS one, 11(7), p.e0159753. New York	We thank the reviewer for the comment. The text of this paragraph has been substantially modified to address the comment after review of the references provided.
Andrew	Miller	Text Region	09. Coastal Effects		11	11	7	11	Please note that the Raabe and Stumpf paper discusses the Gulf Coast and does not seem to refer to Chesapeake Bay; in any case the statement that tidal wetlands have expanded in Chesapeake Bay and will continue to do does not appear to match up with empirical observation by scientists working in the Chesapeake Bay and mid-Atlantic region. In fact the observation made in the Osland et al. paper: ,ÄúWhen considering all coastal wetlands together, landward migration cannot compensate for seaward wetland losses (Fig. 7),Âù seems a reasonable summary of current concerns about the future of tidal wetlands bordering Chesapeake Bay. Large areas of low-lying topography are likely to be lost, often in places where the chances for landward migration of wetlands may be limited by physical barriers or by issues related to human activity and land ownership. Work currently being done by colleagues working with the NSF-funded Coastal Critical Zone Cluster, headed by Dr. Holly Michael at University of Delaware, is attempting to document the dynamics of wetland migration with accelerating inundation of both forest and agricultural land. Many tidal wetlands around the margins of Chesapeake Bay and its tributaries cannot keep pace with rising sea level and the jury is still out on whether the amount and rate of inland migration can feasibly keep pace with the rate of loss. For Chesapeake Bay scientists the suggestion that tidal wetlands have expanded and will continue to do so appears questionable. Accelerating net loss seems like a more likely outcome.	We thank the reviewer for the comment. The text of this paragraph has been substantially modified to address the comment.
Matthew	Kirwan	Text Region	09. Coastal Effects		11	11	7	15	The authors should be commended for their nuanced view of marsh response to sea level rise acknowledging that marsh migration can conserve marsh area even as existing marshes drown and erode. However, they should consider that in the Chesapeake Bay, marsh erosion and marsh migration have roughly offset each other (94 km2 and 101 km2, respectively since 1850's: Schieder et al., 2018), rather than a clear expansion trend. Another helpful citation could be Chen and Kirwan, 2022 Nature Geoscience reporting a 2% gain (48.4 km2) of marshes between 1984-2020 in the broader mid-Atlantic region (VA, MD, DE, and NJ). These findings are consistent with offsetting patterns of marsh gain and loss at the global scale (Murray et al., 2022 Science), though there has been a slight decrease in global wetland area when other types of wetlands (i.e. non marsh) are considered. Finally, the cited Raabe and Stump and Schieder references should be flipped so that Raabe is associated with Florida and Schieder is associated with the Chesapeake Bay.	We thank the reviewer for the comment. The text of this paragraph has been substantially modified to address the comment after review of the references provided.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Pamela	Mason	Text Region	09. Coastal Effects		11	11	8	11	Thanks for the opportunity to comment. This claim of marsh expansion via migration is based on very few citations and seems inconsistent with the current thinking of marsh experts in the Chesapeake Bay. It is also not bounded by a time frame. The capacity for marsh migration is confounded by the opportunity to do so and some studies do not account for the anthropocentric impacts to marsh migration likelihood. In addition, there are a broad range of peer reviewed papers from a highly regarded research cohort (many of whom are cited elsewhere in this chapter) that draw different conclusions than presented here. I think the citations are improperly noted. The Raabe and Stumpf 2016 paper is about Florida and Schieder et al. 2018 is on the Chesapeake Bay. Relevant Chesapeake Bay literature for inclusion: Kearney MS, Rogers AS, Townshend JRG, Rizzo E, Stutzer D, Stevenson JC, Sundborg K (2002) Landsat imagery shows decline of coastal marshes in Chesapeake and Delaware bays. Eos 83:173,Äi178. https://doi.org/10.1029/2002EO000112 Wrayf, R.D., Leatherman, S.P. and Nicholls, R.J., 1995. Historic and future land loss for upland and marsh islands in the Chesapeake Bay, Maryland, USA. Journal of Coastal Research, pp.1195-1203. Mitchell, M., Herman, J. and Hershner, C., 2020. Evolution of tidal marsh distribution under accelerating sea level rise. Wetlands, 40(6), pp.1789-1800. Mitchell M, Herman J, Bilkovic DM, Hershner C (2017) Marsh persistence under sea-level rise is controlled by multiple, geologically variable stressors. Ecosystem Health and Sustainability 3:10. https://doi.org/10.1080/20964129.2017.1396009 Kearney, M.S., Grace, R.E. and Stevenson, J.C., 1988. Marsh loss in Nanticoke estuary, Chesapeake Bay. Geographical Review, pp.205-220. Beckett, L.H., Baldwin, A.H. and Kearney, M.S., 2016. Tidal marshes across a chesapeake bay subestuary are not keeping up with sea-level rise. PloS one, 11(7), p.e0159753. (I base my Chesapeake Bay expertise on my role as Chair of the Chesapeake Bay Program Wetlands Workgroup)	We thank the reviewer for the comment. The text of this paragraph has been substantially modified to address the comment after review of the references provided.
Jeff	Peterson	Text Region	09. Coastal Effects		11	11	8	8	Although very gradual sea level rise may allow some wetlands to survive in place through a process of accretion, accelerated sea level rise will overcome accretion in many places. A recent USGS study found that coastal wetlands will migrate landward, transforming coastlines but not compensating for the area expected to be lost on the seaward side. This study predicted significant loss of wetlands in several states including Louisiana (29%), Florida (25%), North Carolina (10%), Texas (8%), and South Carolina (7%). On the Pacific coast, some 83% of wetlands are projected to become open water by 2110 and along the Gulf of Mexico, estimated conversion of wetlands to open water varies for each state, with rates from 24% to 37% by 2060. The phrase ‚Áúboth expanding and declining‚Äù is confusing and may be misunderstood to suggest that wetlands benefit from ‚Áúexpanding‚Äù in area, rather than expanding into upland areas as they are forced to migrate landward as sea level rises. This landward migration will often result in reduced area and function when it occurs, and many existing wetlands will face obstacles to landward migration and thus will become open water. This sentence should be revised to read: ‚ÁúTidal wetlands may migrate landward where landscape and lack of human obstructions allow and may transition to open water where migration is not possible. Studies of potential for landward migration suggest that landward migration will not compensate for wetland area lost on the seaward side, with losses exceeding twenty percent in some states.‚Äù Here is the source for the USGS study: https://www.science.org/doi/10.1126/sciadv.abo5174 Here is the source for Pacific wetlands: https://pubmed.ncbi.nlm.nih.gov/29507876/ Here is the source for the Gulf of Mexico: https://link.springer.com/article/10.1007/s10750-006-0413-8	We thank the reviewer for the comment. The text of this paragraph has been substantially modified to address the comment after review of the references provided.
Julie	Reichert-Nguyen	Text Region	09. Coastal Effects		11	11	8	11	The comment below is in reference to the statement on page 11 that starts on line 8: In Chesapeake Bay (Raabe and Stumpf 2016), Florida (Schieder et al. 2018), and New Jersey (Kirwan and Gedan 2019), tidal wetlands have expanded and will continue to do so, often at the expense of other ecosystems, including upland habitats, agricultural areas, and forested lands (Osland et al. 2022). This statement is not well supported by the larger body of research on tidal wetlands and climate change impacts. The larger body of published research demonstrates a net loss of tidal wetlands over time. Additionally, the wording of this statement is misleading and does not represent the complexity of climate change impacts on coastal wetlands since it only emphasizes the land conversion challenges. This statement leaves out the very real challenges that regions are facing now with tidal wetland losses and consequent losses in ecosystem services (e.g., bird and fish habitat, carbon sequestration, shoreline protection, flood mitigation, water quality improvements) that these coastal wetlands provide. For instance, in the Chesapeake Bay, there are ongoing discussions by the Chesapeake Bay Program partnership on tidal wetland loss from sea level rise and other drivers (e.g., subsidence, development) and identifying strategies to address these losses to allow for the achievement of water quality, habitat, and living resources goals outlined in the 2014 Chesapeake Bay Watershed Agreement (www.chesapeakebay.net/what/what-guides-us/watershed-agreement). A recent workshop (www.chesapeakebay.net/what/event/wetland-outcome-attainability-workshop) in August 2022 brought together more than 100 experts from the Chesapeake Bay region to identify barriers to outcome attainability of the wetland restoration goals. They stated in their summary (https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/2023.01.17-2023-Wetlands-Action-Plan_FINAL.pdf) that the paradigm used for the wetland goal assumed that the baseline of tidal wetlands would stay static through time is inadequate given climate change influences that was not considered when developing the goals. Tidal wetlands are particularly vulnerable to sea level rise, in addition to glacial subsidence and other drivers (e.g. development) resulting in loss in acreage. For the Chesapeake Bay region, resource managers are looking at marsh migration as an adaptation strategy to counteract some of the losses of tidal wetlands (e.g., Maryland Climate Adaptation and Resiliency	We thank the reviewer for the comment. The text of this paragraph has been substantially modified to address the comment after review of the references provided.
Kirk	Havens	Text Region	09. Coastal Effects		11	11	8	11	The statement that tidal wetlands are expanding in the Chesapeake Bay is in error. Some limited areas may experience migration and expansion but on the whole the Chesapeake Bay has lost, and continues to lose, significant amounts of tidal wetlands. The statement is misleading at best. A cursory review of the literature would show this: ‚ÄCKearney MS, Rogers AS, Townshend JRG, Rizzo E, Stutzer D, Stevenson JC, Sundborg K (2002) Landsat imagery shows decline of coastal marshes in Chesapeake and Delaware bays. Eos 83:173,Äi178. https://doi.org/10.1029/2002EO000112 ‚ÄCMitchell, M., Herman, J. and Hershner, C., 2020. Evolution of tidal marsh distribution under accelerating sea level rise. Wetlands, 40(6), pp.1789-1800. ‚ÄCBeckett, L.H., Baldwin, A.H. and Kearney, M.S., 2016. Tidal marshes across a chesapeake bay subestuary are not keeping up with sea-level rise. PloS one, 11(7), p.e0159753.	We thank the reviewer for the comment. The text of this paragraph has been substantially modified to address the comment after review of the references provided.
Nick	Procopio	Text Region	09. Coastal Effects		11	11	9	10	Is this an appropriate summary of Kirwan and Gedan 2019? Reference focuses on increasing amounts of ghost forests. Most accounts indicate net loss of wetlands in NJ. Please account for this article that summarizes a lot of wetland acreage change articles in NJ: Weis, J. S., Watson, E. B., Ravit, B., Harman, C., & Yepsen, M. (2021). The status and future of tidal marshes in New Jersey faced with sea level rise. Anthropocene Coasts, 4(1), 168--192. https://doi.org/10.1139/anc-2020-0020	We thank the reviewer for the comment. The text of this paragraph has been substantially modified to address the comment after review of the reference provided.
Julie	Reichert-Nguyen	Text Region	09. Coastal Effects		11	11	9	9	It appears that the citations for the regions may have been mixed up. Raabe and Stumpf 2016 is a study in Florida and Schieder et al. 2018 is a study in Chesapeake Bay. Recommend double-checking these references.	We thank the reviewer for this comment. The citations have been corrected.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jeff	Peterson	Text Region	09. Coastal Effects		11	11	10	10	Although very gradual sea level rise may allow some wetlands to survive in place through a process of accretion, accelerated sea level rise will overcome accretion in many places. A recent USGS study found that coastal wetlands will migrate landward, transforming coastlines but not compensating for the area expected to be lost on the seaward side. This study predicted significant loss of wetlands in several states including Louisiana (29%), Florida (25%), North Carolina (10%), Texas (8%), and South Carolina (7%). On the Pacific coast, some 83% of wetlands are projected to become open water by 2110 and along the Gulf of Mexico, estimated conversion of wetlands to open water varies for each state, with rates from 24% to 37% by 2060. Page 11; line 10: change ‚Äúexpanded‚Äù to ‚Äúshifted landward‚Äù.	We thank the reviewer for the comment. The text of this paragraph has been substantially modified to address the comment after review of the reference provided.
Ariela	Zycherman	Text Region	09. Coastal Effects		11	11	13	14	I think it would be worthwhile to indicate why there is a lack of space for expansion -- is this due to development? Topography?	We thank the reviewer for the comment. The text has been clarified to reflect that coastal development and steep topography limit inland migration for the Pacific coast.
Kelly	Van Baalen	Text Region	09. Coastal Effects		11	11	13	15	Please consider the findings of the paper, Resilience of U.S. coastal wetlands to accelerating sea level rise, by Buchanan et al. in 2022, which models the response of all US coastal wetlands to sea level rise under a wide range of emissions, coastal development, and accretion scenarios. This paper finds that while net coastal wetlands loss is expected in many scenarios, it is not inevitable or expected in all scenarios. Buchanan et al. found that in a more pessimistic scenario, one in which all refugia are developed, there is a moderate maximum vertical growth rate (3 mm/yr), emissions grow unchecked (RCP 8.5), and there is higher than expected sea level rise due to ice sheet instability, 97% of coastal wetlands may be lost by 2100. However, in a more optimistic scenario, one in which all refugia are conserved, emissions are sharply reduced (RCP 2.6), and there is a high maximum vertical growth rate (8 mm/yr), coastal wetlands may increase by 25% by 2100. Including the findings of this paper would also allow this section to address all US coastal wetlands, not just those along the Pacific.	We thank the reviewer for the comment. The text of this paragraph has been substantially modified to address the comment.
Ariela	Zycherman	Text Region	09. Coastal Effects		11	11	26	26	"Overwash" seems like jargon	Thank you for your comment. We have revises the text to remove the term overwash.
Ariela	Zycherman	Text Region	09. Coastal Effects		11	11	38	38	There is also research on marsh migration corridors and overlap with contaminated sites which communities will need to plan for that may be of interest https://www.sciencedirect.com/science/article/pii/S0301479723000063?casa_token=6YzFsZnclCUAAAAA:OrPQYqMTbOneqi6IyEyHHSd5Jy4Y4fWgo-jmPrG2EiIGL8DD2v81ZIW7cziIOG1dGZLSMYgynA	We appreciate this suggestion, but space is limited. The author team has deliberated and prioritized the information to include. Based on these agreed priorities, the chapter has not been revised.
Ariela	Zycherman	Text Region	09. Coastal Effects		12	12	3	3	I think it would be good to include a sentence here about the environmental justice implications for the tradeoffs mentioned in this paragraph. Also is the word "communities" in this paragraph used to indicate ecological communities, or human communities?	Thank you for your comment. Throughout the chapter we have only used the term communities to refer to human communities; therefore we believe this context is clear to the reader. Due to space limitations, we have not included additional text on equity and tradeoffs in this paragraph, although the chapter as a whole does prioritize equity considerations related to coastal effects.
Jeff	Peterson	Text Region	09. Coastal Effects		12	12	10	10	The Key Message is not really a ‚Äúmessage‚Äù and should be revised to be more action oriented, e.g., ‚ÄúTransformative Adaptation Needed to Reduce Coastal Storm Flooding and Sea Level Rise Risk‚Äù.	Thank you for your comment. We have modified the KM3 title to reflect this comment, while keeping with NASEM recommendations for KM title length
Ariela	Zycherman	Text Region	09. Coastal Effects		12	12	11	11	Consider "marginalized communities in coastal areas"	Thank you for your comment. We have removed the word marginalized and replaced it with "overburdened and under resourced" to better reflect the systemic nature of the challenge, putting the onus back on the system rather than individuals.
Jeff	Peterson	Text Region	09. Coastal Effects		12	12	15	18	This sentence describing ‚Äútransformative adaptation‚Äù is broadly written to apply to almost any response strategy and does not explain how ‚Äútransformative‚Äù adaptation is different from adaptation that is not transformative (e.g., does attention to inequity make it ‚Äútransformative„‚Äù or inclusion of nature-based solutions, or implementation of managed retreat? The sentence as written suggests that almost any response strategy is ‚Äútransformative‚Äù. A clearer statement of the need to reimagine the coast and support new policies and programs that are scaled to meet the significant challenges of adapting millions of homes, ecosystems, and major infrastructure assets to more severe storms and rising seas, such as: ‚ÄúTransformative adaptation strategies consider both storm flooding and sea level rise risks, use nature-based solutions where appropriate, and account for significant long-term sea level rise by making coordinated relocation of communities, ecosystems, and major infrastructure part of coastal flood resilience plans. Although transformative coastal flood resilience strategies need to be coordinated with state and federal programs, they reflect sustained engagement of diverse, local populations and recognize the needs and interests of disadvantaged people. Local governments need both technical and financial support to undertake these strategies.‚Äù	Thank you for providing this refined language. We have used some of the language in revising the key message and chapter content.
Ariela	Zycherman	Text Region	09. Coastal Effects		12	12	15	15	This isn't a definition of transformative adaptation but rather examples of adaptation actions that might be transformative depending on the context and the extent to which they change systems that cause climate vulnerability. Explaining this better could also be an opportunity to connect back to the thread of equity.	Thank you for providing this comment. We rely on the definition of transformative adaptation as outlined and discussed further in the Adaptation Chapter and have included a reference to that chapter in the body of our chapter. We have also modified the text to make it clear that transformative adaptation is a systemic process rather than an incremental process.
Reid	Sherman	Text Region	09. Coastal Effects		13	13	28	28	Replace East and West Coasts with Atlantic and Pacific Coasts	Thank you for this comment. We are using Atlantic, Pacific, and Gulf coasts
Andrew	Miller	Text Region	09. Coastal Effects		14	14	1	5	The headline, ‚ÄúOn the Road to Success: Norfolk, Virginia‚Äù sounds like a potentially misleading title even if the project being described is a successful example. It is true that innovative projects using Nature based Solutions in the Norfolk area are being created and hopefully some will lead to long-term success. The value of those efforts should be recognized. But on a regional scale there is still likely to be substantial loss of land and there is still the open question of how much managed retreat will be needed. Therefore the definition of what is meant here by ‚Äúsuccess‚Äù should be articulated. Does it mean partial protection of a community amenity even if the landscape around it ends up being fragmented? Does the local community regard this as success, or as a temporary respite? Given future SLR scenarios, what is the time period over which success can feasibly be sustained and for how much of the community? Without that context the words ‚ÄúRoad to Success‚Äù raise more questions than they answer. This is not a critique of the example itself, but rather of the potential misinterpretation of what the headline is suggesting.	Thank you for your comment. We change the title to "On the Road to Adaptation".
Jeff	Peterson	Text Region	09. Coastal Effects		15	15	8	8	Although nature-based solutions have many benefits, they are most effective in reducing flooding resulting from storms and have only modest benefits in preventing permanent inundation resulting from rising sea level. A new sentence making this point is needed. ‚ÄúNature-based solutions are especially effective in reducing temporary flooding resulting from storm surges and are less effective in preventing inundation of communities and infrastructure from rising seas.‚Äù	Thank you for your comment. The paragraph in question was revised to state "Although NBS have many benefits, they are most effective in reducing flooding resulting from storms and have only modest benefits in preventing permanent inundation resulting from rising sea level."
Ariela	Zycherman	Table	09. Coastal Effects		15				I think this table would be easier to read if it was pivoted	Thank you for the comment. In response this table, and its corresponding Figure in Box 9.1, have been combined in order to express the content more clearly to the reader.
Nick	Procopio	Text Region	09. Coastal Effects		16	16	4	4	Grammatical error. Suggesting remove period after ¬≥iUS".	Thank you for you comment. We have made this modification in the text.
Ariela	Zycherman	Text Region	09. Coastal Effects		16	16	10	11	In this section, I think it would be good to explain or provide examples of what "ecological enhancement" means and what hybrid solutions might include	Thank you for your comment. The openings sentence of the paragraph in question was revised to read "NBSs integrate natural and engineering processes with traditional engineering approaches to reduce flood risk (Bridges et al. 2021), while also preserving or enhancing ecological value of natural landscapes (e.g., maintaining essential habitat for protected species)."
Ariela	Zycherman	Text Region	09. Coastal Effects		16	16	24	24	One of the challenges with the public perception of managed retreat is that people don't like to feel like they're being managed. I suggest rewording here to say that managed retreat "helps communities move" rather than "moves communities"	Thank you for you comment. We have made this modification in the text.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jeff	Peterson	Text Region	09. Coastal Effects		16	16	28	28	The discussion of managed retreat focuses on current public reluctance and does not point to the inevitability of relocation in light of the scientific projections of near and long-term sea level rise or the critical importance of coordination of community relocation with efforts to support landward migration of ecosystems and repositioning of major infrastructure. The sentence ‚ÁúManaged retreat may become the only viable response for many coastal communities in the future‚Ä¶Äù should be replaced by a new paragraph: ‚ÁúManaged retreat or relocation will become the only viable response for many coastal communities in the future and should be a central element of transformational adaptation to more severe storms and especially rising sea level. Relocation plans for communities need to be coordinated with plans to facilitate the landward migration of ecosystems as sea level rises and with relocation of major infrastructure assets. Managed retreat policies can initially apply to new construction, steering new homes and businesses away from areas at risk of rising seas. Alignment of local and state policies with existing federal provisions such as the Coastal Barrier Resources Act (CBRA) can facilitate short-term implementation. As sea level rise increasingly threatens existing structures, communities can counter reluctance to relocate with education about long-term sea level rise risks, requirements for disclosure of flood and sea level rise risk at time of property sale or rent, and voluntary buyouts programs. Advancements in social science can enhance insights into how to move policies forward in ways that are most likely to be effective.‚Äù	Thank you for your comments. We have made changes to the introduction that address some of the suggestions in your comment. Unfortunately, due to space limitations and the mandate of NCA5 to not be policy prescriptive, we cannot include all of your suggestions in the chapter text. Chapter 20, social systems, includes additional information related to managed retreat.
Ariela	Zycherman	Text Region	09. Coastal Effects		17	17	1	27	As with the rest of the chapter, the discussion of transformative adaptation is very technical, focused landscape and infrastructure rather than the social systems that cause risk and vulnerability in the first place. This section should begin with explaining how social systems such as marginalizing policies (e.g. red-lining), and economic systems that create disadvantage (e.g. lower property values) create risk and vulnerability. Then explain the kinds of actions that transform these systems which result in reduced vulnerability and more equitable distribution of risk, and give examples of what they look like in terms of physical changes.	We appreciate your comment. The author team had collaborative discussons with the authors of the Social Systems and Adaptation chapter authors, as well as select authors from regional chapters. We believe we have included a reasonable breadth of insight into transformative adaptation, including social systems, funding, and equity. We realize this is a growing topic, and we recognize that in the traceable account for KM9.3.
Thomas	Knutson	Text Region	09. Coastal Effects		18	18	12	13	Change to: SLR is increasing the flooding risk from coastal storms and associated impacts, per observations, ..." (Note that US landfalling hurricanes and major hurricane frequencies have not increased since the late 1800s.)	Thank you for your comment. We made minor edit for consistency with response to 174329 above
Jeff	Peterson	Text Region	09. Coastal Effects		19	19	9	9	A key factor in public under-recognition of sea level rise risks is the perception that sea level is barely changing at all and that impacts are far in the future. The steady increases in the annual rate of change (i.e., the acceleration in the rate of sea level rise) are not understood by the public. Although projections of sea level change include many other factors, public failure to appreciate the cumulative impacts of annual increases in sea level rise that are bigger and bigger each year (i.e., acceleration in the rate of sea level rise) undermines recognition of risks and degrades public support for implementation of response measures. The data and graphics showing the rate of change of sea level rise available from NOAA NASA, and EPA generally show the measured or projected cumulative change without noting the annual rate of change. The graphics also show a rising trend line that looks like an increase each year (i.e., straight line) but not a year-to-year increase in the annual rate of increase (e.g., rising curve). It would be useful if a federal agency would establish an online indication/metric reporting annual change in sea level for the United States, lower 48, and NCA5 regions expressed as total change from a baseline and as an annual increment, rather than simply global annual total change/increment. Showing this data for the U.S. coast, including each NCA5 region, rather than globally, would also be useful. On page 19; line 9: add the following: ‚Äúln order to strengthen public recognition of the acceleration of the rate of sea level rise, federal agencies should collaboratively develop web-based graphics showing the year-to-year increment of sea level rise (i.e., acceleration) for the U.S. coast and the NCA5 regions.‚Äù NOAA source: https://www.climate.gov/media/14659 NASA source: https://sealevel.nasa.gov/understanding-sea-level/key-indicators/global-mean-sea-level/ https://www.nasa.gov/specials/sea-level-rise-2020/#:~:text=NASA%20studies%20All%20Aspects%20of%20Sea%20Level%20Rise&text=Global%20sea%20level%20is%20rising,measure%20ocean%20heights%20in%201992. EPA source: https://www.epa.gov/climate-indicators/climate-change-indicators-sea-level	We appreciate the comment. NCA5 is by nature, not policy prescriptive, therefore we cannot include your recommendation for a federal agency to provide these products within our chapter. We have collaborated with the authors of chapter 2, and the regional chapters along the coasts, to encourage consistency in sea level rise information across NCA5. We have also expanded our discusion of sea level rise in KM9.1 and included information about the regional variability along the coasts.
Thomas	Knutson	Text Region	09. Coastal Effects		19	19	14	16	Change this sentence to: "Observations show that U.S. landfalling hurricane and major hurricane frequencies have not increased since the late 1800s (Vecchi et al. 2021). Some model simulations suggest that U.S. landfalling Category 4-5 hurricanes (Knutson et al. 2022) or extratropically transitioned tropical cyclones for the northeast U.S. (Liu et al. 2017) may increase in frequency over the coming century, which, together with SLR, would compound flood risks from these storms. One study projects that tropical cyclone rainfall-surge joint hazard is greatly increased by higher rainfall amounts driven by higher cyclone intensities and slower propagation speeds, along with sea level rise (Gori et al. 2022); in contrast only small/nonsignificant changes of tropical cyclone propagation speed are projected by Zhang et al. (2020) for most near-US coastal regions. Another multi-model study suggested that future changes in North Amerian landfalling tropical cyclone intensities and their return levels will be rather slight, and that projections depend on the model used (Jing et al. 2021). " Refs: Knutson, T.R., Sirutis, J.J., Bender, M.A., Tuleya, R.E., and Schenkel, B.A.: Dynamical downscaling projections of late twenty-first-century U.S. landfalling hurricane activity. Climatic Change 171, 28 (2022). https://doi.org/10.1007/s10584-022-03346-7 Vecchi, G.A., C. Landsea, W. Zhang, G. Villarini, and T. Knutson, 2021: Changes in Atlantic major hurricane frequency since the late-19th century. Nature Communications, 12 (1), 4054. http://dx.doi.org/10.1038/s41467-021-24268-5 Jing, R., Lin, N., Emanuel, K., Vecchi, G., & Knutson, T. R. (2021). A Comparison of Tropical Cyclone Projections in a High-Resolution Global Climate Model and from Downscaling by Statistical and Statistical-Deterministic Methods, Journal of Climate, 34(23), 9349-9364. https://journals.ametsoc.org/view/journals/clim/34/23/JCLI-D-21-0071.1.xml Liu, M., Vecchi, G. A., Smith, J. A., & Murakami, H. (2017). The Present-Day Simulation and Twenty-First-Century Projection of the Climatology of Extratropical Transition in the North Atlantic, Journal of Climate, 30(8), 2739-2756. https://journals.ametsoc.org/view/journals/clim/30/8/jcli-d-16-0352.1.xml	Thank you for your comment. Changes to the intensity and fequency for different storm types are covered in Chapters 2 and 3 to provide a foundation for the other chapters. We have added cross references to Ch 2.2 and KM3.6 where this information is presented in NCA5.
Thomas	Knutson	Text Region	09. Coastal Effects		19	19	19	19	Change "will also increase" to "is also projected to increase"	Thank you for your comment. We have made this edit as suggested.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jeff	Peterson	Text Region	09. Coastal Effects		19	19	31	35	A critical issue in sea level rise projections is the timing of future degradation of the West Antarctic Ice Sheet, and most immediately, the Thwaites Glacier. The current description does not convey the potential for large changes in future sea level rise as a result of changes in Antarctic ice sheets, up to two feet of additional sea level rise due to loss of the Thwaites Glacier, or the potential for these changes to occur within the next decade. The paragraph should be revised as follows: ‚ÁúMajor uncertainties and research gaps include improving modeling and observational capabilities to assess long-term global mean SLR trajectories as a function of uncertainties in both emissions pathways and the sensitivity of ice-sheet dynamical processes to a given level of warming in both Greenland and Antarctica. In Antarctica, new research points to instability in the West Antarctic Ice Sheet and the potential for loss of glaciers in as little as ten years leading to two feet or more of additional sea level rise. Given the large scale of impacts flowing from earlier than expected sea level rise, research to resolve the ‚Ávlow confidence‚Äù judgement on ice sheet dynamics per IPCC AR6 (Fox-Kemper et al. 2021) should be a high priority.‚Äù The "new research" cited above is sourced to: https://www.scientificamerican.com/article/antarcticas-collapse-could-begin-even-sooner-than-anticipated/	We appreciate your comment. Chapter 2 and Chapter 3 provide the foundation science that informs the other chapters of NCA5. We have added references to these chapters where relevant. We have also expanded the discussion of the sea level rise in KM9.1 and include additional information on the sea level rise scenarios, including the high scenarios that include rapid ice sheet loss and disintegration. The Scientific American article should be placed in contect of geologic time. The entire Thwaites Glacier has enough ice to raise global sea level rise by 2 feet. However, the referece to potential changes over the next 10 years is in reference to a small portion of the glacier referred to as the Thwaites Ice Shelf. See the figure in the article "Thwaites Glacier, Ready to Flow". The disintrigation of this portion of the glacier will not result in 2 feet of sea level rise. However, it will be a warning sign that scientists will continue to monitor to better understand when the full Thwaites Glacier could flow, melt, and disintegrate over the next century or centuries.
Tiffany	Turner	Text Region	09. Coastal Effects		20	20	23	25	Include "agriculture" in the list of impacted sectors (i.e., including tourism, agriculture, recreation, fishing,)	We appreciate this suggestion; the text has been updated to incorporate "agriculture" in the list of affected industries.
Jeff	Peterson	Text Region	09. Coastal Effects		29	29	19	26	Lines 19-26 on page 29 generally refer to options for managing impacts of more severe storms and rising seas, including protective structures and relocation, and for ‚Áútransformative adaptation allows for deliberate and fundamental reimagination of coastal communities.‚Äù This statement begins to capture the huge scale of the changes needed to cope with more severe storms and rising seas, but does not adequately highlight the need for coordinated planning and program implementation to focus on relocation of communities, ecosystems, and infrastructure to higher ground. Revise lines 19-26 on page 29 after ‚Áúbest chance of success,‚Äù to read: ‚ÁúThe combined impacts of more damaging storms and accelerating sea level rise will require fundamental reimagining of the coast. For some coastal assets, such as homes and infrastructure facilities, engineered structures and enhanced nature-based solutions can provide temporary protection. (Oestreich et al. 2019; Green et al. 2021; Siders et al. 2021. Engineered protection structures, however, can‚Äôt protect all communities and infrastructure or most ecosystems. Gradual relocation of communities, ecosystems, and infrastructure to higher ground will be needed. Coordinated and deliberate coastal relocation, implemented in a manner that serves all people equitably, is the highest priority for coastal adaptation to a changing climate. (Fedele et al. 2019; Kuhl et al. 2021; Shi and Moser 2021).‚Äù	Thank you for the comment. We have revised this paragraph and incorporated the suggestions.
Emma	Conrad-Rooney	Whole Chapter	09. Coastal Effects						For figures 3, 4, and 5, given that they are spaced out across multiple pages, it would be helpful to have labels indicating what is changing across them.	Thank you for your comment. Figure 9.3, 9.4, and 9.5 have been revised for consistency with the text. No change is made in response to this comment.
Ariela	Zycherman	Whole Chapter	09. Coastal Effects						The chapter is missing a definition of transformative adaptation and it is not clear to the reader what this term means. Therefore the discussion in the section on transformation seems disjointed. In particular it is missing an emphasis on the transformation of social systems which cause vulnerability. Transformative adaptation isn't defined by certain actions - any given action may or may not be transformative depending on the context.	Thank you for your comment. We have collaborated with other chapters on transformative adaptation, and have included the definition used in the Adaptation Chapter. We have also revised the section on transformative adaptation based on other comments and discussions with other chapters, and it includes discussion on the to consider social systems, equity, etc.
Ariela	Zycherman	Whole Chapter	09. Coastal Effects						Although there is some discussion of equity issues and community engagement, in general literature from the social sciences is under-represnted. This is particularly evident in the discussions of transformative adaptation. For example, Shi and Moser (2021) write "transformative adaptation is not just about 'climate-proofing' existing structures and systems, but deliberately and fundamentally changing systems to achieve more just and equitable outcomes." Using this framework would better integrate social systems throughout the chapter.	Thank you for this comment. The author team collaborative with authors across other chapters and we have reworked KM3 more broadly in response to other comments and integrated additional research.
Ariela	Zycherman	Whole Chapter	09. Coastal Effects						There is little to no discussion of indigenous or tribal communities, even though they are some of the most impacted by coastal erosion and displacement such as in Alaska and Louisianna. Some discussion of how tribal communities are dealing with these challenges would likely be informative and add unique perspective. If coastal issues are discussed in the indigenous chapter a link could be added.	We thank the commenter for this suggestion and have added the following sentence under KM2, cross referencing other chapters that describe these challenges in detail: "Many tribal and indigenous communities face severe impacts from coastal storms, erosion, permafrost thaw, and sea-level rise, with limited resources to support adaptation to these changes" (KM 16.1, 29.4, KM 30.3)
Reid	Sherman	Whole Chapter	09. Coastal Effects						Consider what figures in other chapters to reference, especially for sea level and built environment.	Thank you for the comment. The author team has coordinated across chapters to increase the cross references to relative and supporting content.
Reid	Sherman	Whole Chapter	09. Coastal Effects						There are a suite of 3 figures without many more graphics in this chapter. Consider what additional graphics could be used to show transformative adaptation, etc. Graphics can be powerful, especially since they are frequently taken from the report and shown in other places.	Thank you for this comment, we have pointed back to figures in other Chapters including 22 and 31 where the range of adaptation strategies is described in more detail.
Tiffany	Turner	Whole Chapter	09. Coastal Effects						Living shorelines are a proven useful NBS that, while noted within the text, need a sentence or two to describe what they are and their utility in coastal resilience as well as carbon capture (depending on design).	Thanks you for your comment. The opening paragraph of the section on NBS was revised to include improved carbon sequestration potential and reference to the NCA Box on Blue Carbon. "NBSs integrate natural and engineering processes with traditional engineering approaches to reduce flood risk, while also preserving or enhancing ecological value of natural landscapes (e.g., maintaining essential habitat for protected species, maintaining or increasing carbon sequestration potential)."
Emma	Conrad-Rooney	Text Region	10. Oceans		4	4	2	11	To follow the Risk-Based Framework, Key Message 10.1 should be revised to include what can and should be done about these highlighted problems.	Thank you for this comment. We have added a sentence to this message to indicate that risks will be influenced by the scenarios we are following and pace of adaptation, implying that what needs to be done to reduce risks entails following lower scenarios and supporting ecosystem and human adaptation.
Emma	Conrad-Rooney	Figure	10. Oceans		8				As a reader, the legends of this figure are not clear. The coastal impacts block looks very similar to the fishery disasters block, but they seem to serve different purposes. It would be helpful to have slightly different formatting, potentially a different color for the background, to differentiate these two types of boxes, since once seems to be a legend key. Also, for the coast-wide impacts box, it is unclear if these impacts refer to the Alaskan coast too, or just the western coast of the continental US. It would be helpful to clarify in the figure caption if the timeline at the bottom refers to all of the areas pictured in the figure.	We agree that the Fishery Disaster and Coast-wide impacts blocks are not clearly distinguished, and will revise the figure to improve on this point (currently waiting on TSU). We revised the caption to clarify that coast-wide impacts are for all four states (AK, WA, OR, CA) and to clarify the relationship between the map and the timeline.
Reid	Sherman	Text Region	10. Oceans		12	12	7	7	Link this section on marine transportation and cruise ships to Ch 13 transportation.	Thank you for this comment. We have requested that Chapter 13 cross-reference the Oceans chapter and we have inserted a reference to Chapter 13 in our chapter.
Nick	Procopio	Text Region	10. Oceans		12	12	27	30	The statement on efforts to reduce GHG emissions is vague, leaving more explanation desired.	Thank you for this comment. We have reworded this sentence slightly to make it clear that the examples listed are approaches that are being initiated in the marine transportation sector to reduce its greenhouse gas emissions. These efforts are just getting underway, so we do not have further information on the extent of implementation or magnitude of greenhouse gas reductions that have been achieved.
Nick	Procopio	Text Region	10. Oceans		13	13	5	7	Note, NJ alone has a goal of 11 gigawatts capacity by 2040. Learn more here, https://www.nj.gov/governor/news/news/562022/20220921a.shtml.	Thank you for this comment. We have added a sentence to note that state goals for offshore wind energy development may further advance energy-generating capacity beyond the federal goal.
Emma	Conrad-Rooney	Text Region	10. Oceans		13	13	15	20	To follow the Risk-Based Framework, Key Message 10.3 should start by highlighting what we value which is at risk.	Thank you for this suggestion. We have moved details of what is at risk to the first sentence, highlight that crucial ocean resources and sectors (i.e., fisheries, transportation, energy, and tourism) are at risk.
Reid	Sherman	Text Region	10. Oceans		13	13	28	28	Replace East and West Coasts with Atlantic and Pacific Coasts	Thank you for this comment. Upon reviewing this sentence closely, we decided to remove the reference to specific coasts, as these efforts are underway or starting to advance in other regions of the U.S. as well.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Matthew	Eisenson	Text Region	10. Oceans		13	14	37	2	This paragraph should clarify the type of evaluation that is being done on ocean-based CDR techniques. The authors should clarify that projects are evaluating both the economic and technological feasibility of the techniques (this could use the studies already cited), alongside public acceptance and political considerations. For political consideration research, the authors could cite to research into the legal framework applicable to ocean CDR, see, e.g., Scott C. Doney et al., A Research Strategy for Ocean-based Carbon Dioxide Removal and Sequestration (National Academy of Sciences, Engineering, and Medicine, 2022) https://nap.nationalacademies.org/read/26278/chapter/1, and the varied levels of federal, state, and local regulation of ocean CDR. See, e.g., Korey Silverman-Roati et al., Removing Carbon Dioxide Through Seaweed Cultivation: Legal Challenges and Opportunities (2021), https://scholarship.law.columbia.edu/faculty_scholarship/2980/. For public acceptance, the authors could cite to research on public acceptance of ocean CDR, see, e.g., Christine Bertram and Christine Merk, Public Perceptions of Ocean-Based Carbon Dioxide Removal: The Nature-Engineering Divide?, Frontiers in Climate (2020), https://www.frontiersin.org/articles/10.3389/fclim.2020.594194/full, and model codes of conduct for ocean-CDR research, see, e.g., Rebecca Loomis et al., A Code of Conduct Is Imperative for Ocean Carbon Dioxide Removal Research, Frontiers in Marine Science (2022), https://www.frontiersin.org/articles/10.3389/fmars.2022.872800/full.	Thank you for this comment. We have revised the text to be more specific and read "Public- and private-funded projects are evaluating the technical, economic, and social dimensions of ocean-based carbon dioxide removal techniques being developed (Ch. 32; Focus on Blue Carbon; NASEM 2022; ARPA-E 2022; XPRIZE 2022)(Bertram and Merk; Silverman-Roati et al)." We do not have room for a long added discussion but we hope the more specific wording with the two additional new social/legal references will serve the need.
Emma	Conrad-Rooney	Figure	10. Oceans		14				In the high emissions scenario, for the labels "plenty of access but fewer and different fish", and "fewer fish, different species", it is unclear if these are for two different areas in the ocean or if they could be combined into one clearer statement. It would be helpful to clarify this.	Thank you for this comment. We inadvertantly placed an extra label in that panel of Figure 10.5. We have modified this figure and the issue you noted has been corrected.
Keith	Wolf	Whole Chapter	10. Oceans						Can you consider addressing the loss of ocean parasites as part of the ecosystem effects of Climate Change? Cite: Biological Conservation Volume 250, October 2020, 108596 A global parasite conservation plan Author links open overlay panelColin J.CarlsonAb1SkylarHopkinsc1Kayce C.BelldeJorgeDoV±afqStephanie S.GodfreygMackenzie L.KwakhKevin D.LaffertyiMelinda L.MoirjkKelly A.SpeerdImGiovanniStronanMarkTorchinoChelsea L.Woodp	Thank you for this comment. We have added a phrase to note that biodiversity of lesser-studied components of ecosystems may be affected by climate change and may influence the potential for other ecosystem components to adapt to climate change.
Keith	Wolf	Whole Chapter	10. Oceans						Consider this citation and these two assessment conclusions: Disproportionately rapid warming in the Arctic, a phenomenon known as Arctic amplification, may be contributing to summer heat waves and hot, dry autumn weather in Oregon [and I'll assume this is not an Oregon-only effect KSW]. Oregon Climate Assessments were released in 2010, 2013, 2017, 2019, 2021, and 2023. DOIs for the assessments are pending. Fleishman, E., editor. 2023. Sixth Oregon climate assessment. Oregon Climate Change Research Institute, Oregon State University, Corvallis, Oregon. Extreme winter wind speeds may increase, while annual mean wind speeds and the frequency of strong easterly winds in summer and autumn are expected to decrease slightly. Wind patterns impact electricity delivery, transportation safety and the spread of wildfire and pollutants. --- Additional Citations for consideration: Drake, S.A., D.E. Rupp, C.K. Thomas, H.J. Oldroyd, M. Schulze, and J.A. Jones. 2022. Increasing daytime stability enhances downslope moisture transport in the subcanopy of an even-aged conifer forest in western Oregon, USA. JGR Atmospheres 127:e2021JD036042. doi: 10.1029/2021JD036042. Fogarty, F.A., E. Fleishman, and M. Zillig. 2022. Evaluating the ability of occurrence models to predict breeding locations and associated environmental attributes. Ibis 164:519,Äi534. Fogarty, F.A., J.D.L. Yen, E. Fleishman, R. Sollmann, and A. Ke. 2022. Multiple-region, N-mixture community model to assess associations of riparian area, fragmentation, and species richness. Ecological Applications 32:e2698. doi: 10.1002/eap.2698. Hawkins, L.R., J.T. Abatzoglou, S. Li, and D.E. Rupp. 2022. Anthropogenic influence on recent severe autumn fire weather in the west coast of the United States. Geophysical Research Letters 49:e2021GL095496. doi: 10.1029/2021GL095496. Roques, C., D.E. Rupp, J.-R. de Dreuzy, L. Longuevergne, E.R. Jachens, G. Grant, L. Aquilina, and J.S. Selker. 2022. Recession discharge from compartmentalized bedrock hillslopes. Hydrology and Earth	We thank the reviewer for this comment. We have added a sentence to note that Arctic amplification may be contributing to more extreme weather patterns in the mid-latitudes of the US. Within the "Oceans and Marine Resources" chapter, this addition offers an example of how an ocean-based climate-related change may affect many residents of the interior of the US. However, there remains a lack of scientific consensus on the nature and attribution of these relationships, as reflected in the range of citations we provide for this added sentence. Many of the specific citations suggested in this comment were beyond the scope of the "Oceans and Marine Resources" chapter. As such, we have shared them with the Northwest chapter author team for their consideration.
David	Dow	Whole Chapter	10. Oceans						You might want to mention the EMaX (Energy Modeling and Analysis Exercise) energy budget for the Northeast Continental Shelf Ecosystem which added the microbial food web to the marine food chain in order to balance primary production from satellite data with the yield of Living Marine/Protected/Natural Trust Resources in the rapidly warming Gulf of Maine. The microbial food web is longer than the the grazing food chain which increases community respiration in the water column and effectively decreases the net primary production from the base of the marine food chain. My University of Georgia graduate school advisor, Dr. Lawrence Pomeroy, described the microbial food web in the late 1960,Âôs and I conducted research on their metabolism in the Antarctic Ocean in 1971. It has taken over 40 years to incorporate the microbial food web in fisheries research and hopefully include it in management /Fifth National Climate Assessment of the Ocean. Increases in pelagic predators like Black Sea bass at higher levels in the food chain and shifts in competition as predators and prey alter in time & space (i.e. shifts in large zooplankton prey of North Atlantic right whales with increased mortalities in the lobster/crab pot fishery provides a useful case study). Summer flounder and other Mid-Atlantic species are moving into New England waters with collapses of bay scallops; sea herring and Atlantic cod from a combination of climate change; eutrophication and overfishing. In Cape Cod Bay, bottom water hypoxia from a combination of Nitrogen pollution from septic systems and climate change has killed lobsters in their pots. Lobster fishing is moving into deeper US offshore waters or Canadian jurisdictional waters. The NOAA Fisheries 2021 State of the Ecosystem reports for the Mid-Atlantic and New England region	Thank you for this comment. We appreciate the range of topics covered and resources provided. However, due to work count limitations, we were not able to incorporate all of the suggestions. We did not have space to explain the microbial food web (or many other processes in marine ecosystems), but we did mention microbes as one end of the food web, in contrast to top predators, in Key Message 1. Similarly, we were not able to mention individual species shifting their distributions but addressed this topic in a more general manner. We were also not able to discuss black sea bass and lobsters specifically but cited McMahan et al. 2021 that shows higher predation of black sea bass on lobster in northward portions of its range as an example of predator-prey relationships being amplified as a result of species distribution shifts. We mention hypoxia and deoxygenation as physical impacts of climate, which interact with other climate and non-climate stressors, incuding eutrophication and overfishing. We added a statement (and citations) explaining that climate change impacts to nursery habitats, spawning habitats, and other essential fish habitats could impact productivity and distribution of species. Finally, we mention ecosystem-based fisheries management (in Key Message 2) and ecosystem-based management more broadly (in Key Message 3) as strategies for incorporating climate considerations in the management of fisheries and a broader array of changing ocean uses.
Lyall	Bellquist	Whole Chapter	10. Oceans						You might consider including information in Chapter 10 specific to U.S. federally declared fishery disasters driven by extreme environmental events associated with climate change. Please see published study here: https://peerj.com/articles/11186/	Thank you for this comment. We have noted the increase in commercial fishery disaster declarations related to extreme events in this sentence: "Disaster declarations for commercial fisheries have increased markedly from 1994 to 2019, with more than 84% of fishery disasters linked to extreme environmental events, resulting in $3 billion of lost revenue and $2 billion (2019 dollars) in Congressional allocations for disaster relief (Bellquist et al. 2021)."
Reid	Sherman	Whole Chapter	10. Oceans						Extensive use of adaptation from start of the chapter. The term resilience is only used 6 times in entire chapter. Make sure that the usages of these terms is aligned with other chapters.	The evidence about how ocean-based climate impacts affect human communities shows that observed impacts are overwhelmingly neutral to negative (see, e.g., IPCC WGII Summary for Policymakers figure 2). Resilience (see Glossary) is defined as "The capacity of interconnected social, economic and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure. Resilience is a positive attribute when it maintains capacity for adaptation, learning and/or transformation." Adaptation (see Glossary) in human systems is "the process of adjusting to an actual or expected environmental change and its effects in a way that seeks to moderate harm or exploit beneficial opportunities. In natural systems, adaptation is the process of adjustment to an actual environmental change and its effects; human intervention may facilitate adjustment to expected changes." Because adaptation is a method of increasing resilience, the relative greater emphasis on assessing ocean-based adaptation in the pursuit of resilience in this chapter is, in the authors' view, aligned with the literature.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Emma	Conrad-Rooney	Text Region	11. Agriculture, Food Systems, and Rural Communities		2	2	6	6	For Key message 11.3, the authors could consider adding the word "unique" between the words "face" and "challenges", if the goal of this key message is to highlight that rural communities face unique challenges and opportunities.	We thank the reviewer for the comment. The text has been revised accordingly
Emma	Conrad-Rooney	Text Region	11. Agriculture, Food Systems, and Rural Communities		3	3	2	2	For the first sentence, it would be helpful to clarify whose health and prosperity is being referred to. It is unclear whether this sentence is referring to the health and prosperity of the country as a whole or individual people who live in the country.	We thank the reviewer for the comment. We have rewritten introduction and this sentence has been removed.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		3	3	3	4	While agriculture provides employment and contributes to GDP, agriculture also provides food and contributes to food security. The authors should address the food security and food source piece with appropriate statistics in addition to just alluding to employment.	We thank the reviewer for the comment. We have added the following statement "Food insecurity affected 10.2% (13.5 million) of U.S. households in 2021 "
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		3	3	5	5	Page 3 Lines 5-6 Disruptions to food production, storage etc. won't just affect US food supply chains but also the lives and livelihoods of people who depend on those resources directly for subsistence (e.g. Chapter on Alaska).	We thank the reviewer for the comment. Key Message 2 explicitly mentions climate change impacts on subsistence-based individuals and communities, and refers readers to the Chapter on Alaska.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		3	3	5	6	What are some of the examples of these 'unpalatable challenges' the authors are referring to?	We thank the reviewer for the comment. We have removed "unpalatable" and have added the following text "A changing climate, characterized by more frequent and severe extremes events, such as heat waves, droughts, and extreme rainfall, (KM 2.1 and 2.2), will affect U.S. agriculture, food systems (a topic not addressed in previous NCAs), and rural communities. Climate change has increased risk to agricultural production, for example, by disrupting growing zones, growing days, and seasonality, making adaptation necessary to increase resilience in an evolving landscape (KM 11.1). Climate change is projected to reduce the availability and affordability of nutritious food, with impacts being unevenly distributed across society (KM 11.2). Rural communities, which manage much of the Nation's land and natural resources, face unique challenges and opportunities due to climate change (KM.11.3). "
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		3	3	6	7	Page 3 Lines 6-7 Make sure to include effects on farmer's lives and livelihoods in the impacts	We thank the reviewer for the comment. We have added the following text "These disruptions will make food more expensive and less accessible, particularly for lower-income individuals and households, including those in rural settings."
Ariela	Zycherman	Figure	11. Agriculture, Food Systems, and Rural Communities		3				Change title to match the caption since many of these jobs are quite distant from agriculture	We thank the reviewer for the comment. This figure has been removed from the chapter
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		4	4	5	12	Suicide among rural farmers is already 3.5 times higher than other professions so future disruptions could make this situation even worse -- may be worth discussing this issue Was just reading this article but it is based on data from the National Rural Health Association: https://www.texastribune.org/2023/01/11/texas-farmer-mental-health-helpline-suicide/	We thank the reviewer for the comment. While we recognize this as an important issue in rural communites, the connection between deaths of despair is not well established in the literature.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		4	4	13	14	The authors should explain if agricultural production is concentrated in rural communities, and how rural communities are vital in supporting the nations agricultural production.	We thank the reviewer for the comment. Agricultural production is not concentrated in rural communities, but rural communities do have various support linkages to that economic sector. The sentence was edited to reflect that support.
Ben	Lilliston	Text Region	11. Agriculture, Food Systems, and Rural Communities		4	4	23	25	In describing agroecological practices, it would be better characterized as "building soil health", rather than "limiting soil disturbance". Soil health includes more than only limiting soil disturbance. The USDA/NRCS outlines the five principles of soil health here - https://www.fs.usda.gov/nac/topics/soil-health.php	We thank the reviewer for the comment. The text has been revised as suggested.
Reid	Sherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		4	4	23	23	Sentence on line 23-25 requires citations to support the outcomes, including enhanced resilience, of agroecological practices.	We thank the reviewer for the comment. Relevant references are included in the main body of KM1.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		4	4	23	25	The authors should expand on what agroecological approaches are being reffered to here.	We thank the reviewer for the comment. Text has been modified to include examples.
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		5	5	1	1	This key message reads as a fragment without a takeaway message. Consider a more actionable or impactful messgage with a takeaway point. For example "Agricultural Adaptation Increases Resilience in an Evolving Landscape"	We thank the reviewer for the comment. Suggestion has been accepted and the title has been changed.
Ben	Lilliston	Text Region	11. Agriculture, Food Systems, and Rural Communities		5	5	4	6	While it is true that more farmers are adopting agroecological practices, it is still a very small percentage of farmers and acres managed. A short qualification explaining that while adoption is increasing, it is still a small percentage of farm acres or farms, would be helpful.	We thank the reviewer for the comment. The text has been changed to "Some" adoption.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		5	5	11	14	The authors should refer to exact practices within the conventional agriculture realm that they are referring to here. The context is also not just historical, but relevant in current day as well.	We thank the reviewer for the comment. Text has been revised accordingly.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		5	5	11	14	The authors should provide a few examples of 'adaptive conservation management approaches' to help the reader understand what these are.	We thank the reviewer for the comment. Text has been revised accordingly.
Reid	Sherman	Whole Page	11. Agriculture, Food Systems, and Rural Communities		5				Key Message 11.1 Could include a more systematic assessment of the climate adaptation versus mitigation benefits, costs, and trade offs of different agricultural practices. There is no assessment of how effectively current agricultural programs incentivize these practices to meet these goals, examples include Basche et al. (2020). Another example of an analysis/assessment framework is Table 7.1 in the Forests chapter that lists climate effects, adaptation responses, and provides supporting citations.	We thank the reviewer for the comment. Authors added Basche et al. (2020) to KM11.1 paragragh referring to conservation programs.
Rachel	Antidormi	Figure	11. Agriculture, Food Systems, and Rural Communities		6	6	7	16	I love this figure! I would love to see an explanation of which LCZs cause what types of climate effects. That would be super interesting and helpful to gain real world perspectives (especially because of the photos).	We thank the reviewer for the comment. Comment content not well defined - authors could not determine what "LCZ" meant. Authors added references to the caption referring readers to Fig 8.1 (ecosystem adapations to climate change) and Fig. 8.18 (expected direction of climate change impacts on ecosystem services).
Ariela	Zycherman	Figure	11. Agriculture, Food Systems, and Rural Communities		6				I wanted to look at the Metro Vancouver 2018 information in more detail and found that it has been removed from their website. Just thought it was worth mentioning -- what to do about it is someone else's call.	We thank the reviewer for the comment. The authors confirmed that link provided in references is accurate and active (confirmed on 4/11/2023). http://www.metrovancouver.org/services/regional-planning/PlanningPublications/EcologicalHealthFramework.pdf
Ariela	Zycherman	Figure	11. Agriculture, Food Systems, and Rural Communities		6				Fig 11.3 The figure is insufficiently detailed within the text. Agriculture needs to be situated as a provisioning service, that can also provide regulating services like climate resilience and supporting services like biodiversity. Currently, the text between lines 11-14 (on page 5) does not describe how food fits into the TEEB framework.	We thank the reviewer for the comment. Figure 11.1 caption has been updated (formerly Fig 11.3 in 3OD).
Holly	Prendeville	Figure	11. Agriculture, Food Systems, and Rural Communities		7	7	1	3	Maps exist for Alaska as well https://www.mdpi.com/2071-1050/13/22/12713	We thank the reviewer for the comment. The figure has been modified accordingly.
Reid	Sherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		8	8	6	6	"Soil health management can improve the resilience of agricultural systems to climate change and support sustainability goals (Figure 11.5)." How? To be more useful, this paragraph should explain the how/why of this point.	We thank the reviewer for the comment. Box 11.1 added on agroecological approaches to management to address this concern.
Rachel	Antidormi	Figure	11. Agriculture, Food Systems, and Rural Communities		8	8	8	9	I am not able to understand how to read this figure. I am unsure of why some dots are larger than others. It would be helpful if the caption gave more explanation or insight.	We thank the reviewer for the comment. The question is unclear and lacking adequate information for the authors to craft a response. Caption to Fig 11.3 (Soil as a Foundation) was revised to specify soil functions.
Reid	Sherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		8	8	9	9	Can you provide updated citations on the definition of "agroecology" and/or "agroecological practices" rather than citing the figure 11.6?	We thank the reviewer for the comment. We have clarified "agroecology" and "agroecological practices" in newly added Box 11.1.
Reid	Sherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		9	9	6	6	Please provide updated citation instead of Prager et al. 2011	We thank the reviewer for the comment. More recent citations have been added.
Ben	Lilliston	Text Region	11. Agriculture, Food Systems, and Rural Communities		9	9	13	15	The increase in agriculture emissions is not only linked to an increase in fossil fuel inputs. As stated within the EPA's Greenhouse Gas Inventory, it is also the transition toward large-scale concentrated animal feeding operations (CAFO), particularly those that are liquifying their manure. This system of storing large amounts of manure within lagoons increases emissions from the potent greenhouse gases methane and nitrous oxide. Further emissions from this large CAFO system arise when that liquified manure is often over-applied on neighboring fields, often ending up in waterways, and resulting in additional nitrous oxide emissions. This shift in animal production toward large-scale CAFOs, particularly for dairy, beef and hog production, needs to be included within a discussion about increased agriculture emissions.	We thank the reviewer for the comment. Liquid manure is referenced in the figure 11.5 which is still to come in the text, thus addressing this comment.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		9	9	13	15	The authors should provide some evidence in supoort of this sentence.	We thank the reviewer for the comment. We've removed the reference to increasing reliance on fossil fuels to just reliance on fossil fuels.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		9	9	13	15	The authors should cite approaite liteture to support this sentence.	We thank the reviewer for the comment. We have added appropriate citation.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		9	9	13	17	In this section, it would make sense to discuss where these emissions come from both in terms of food chain, type of ag practice, and size of farm. Not all ag production contributes to GHGs equally.	We thank the reviewer for the comment. Text has been added to acknowledge that GHG emissions vary by production scale.
Emma	Conrad-Rooney	Figure	11. Agriculture, Food Systems, and Rural Communities		9				As a reader, this figure was unclear and confusing. It would be helpful if the white text could be changed to be something more visible. Potentially adding text boxes in a solid color could help with this. Overall, it is not clear whether the white words on the figure are supposed to refer to certain aspects of the figure or whether they are just concepts placed randomly. For example, for the label "Clean water", it is not clear that there is water in the figure, and for the label "Profitability", it is unclear what that label is referring to in the photo.	We thank the reviewer for the comment. Figure is being revised/possibly removed.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Reid	Sherman	Figure	11. Agriculture, Food Systems, and Rural Communities		9				Can you provide updated citations on the practices listed under Figure 11.6 for agroecology?	We thank the reviewer for the comment. The Figure 11.6 was removed from the chapter.
Rachel	Licker	Figure	11. Agriculture, Food Systems, and Rural Communities	11.6	9	9			This is figure does not explain how agroecology merges ecological and social concepts to build a more equitable food system beneficial for the environment and people. As such the image does not add to the narrative it has been addded to support.	We thank the reviewer for the comment. We have developed a new figure and added a new call out box to address this comment
Ben	Lilliston	Text Region	11. Agriculture, Food Systems, and Rural Communities		10	10	5	6	The highlighting of improved emissions per capita, and the statement that "progress is being made," is belied by the fact that overall emissions are increasing. And for the climate, it is only the overall emissions that are important. It is important not to give readers a clear impression on the state of agriculture emissions.	We thank the reviewer for the comment. We've agreed to the revision to clarify the text.
Reid	Sherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		10	10	15	15	Please provide updated citations in addition to Howlett et al. 2011 and Lorenz and Lal 2014.	We thank the reviewer for the comment. Citations have been updated.
Rose	Daily	Figure	11. Agriculture, Food Systems, and Rural Communities		11	11	1	1	Figure 11.8 contains a lot of repeated words in the "improved agroecosystem services" section (i.e. "reduced" is repeated 4x, "increased" repeated 3x, "improved" repeated 2x). Maybe include each word only once as a header and then list the items below it. For example: Reduction in: * erosion * carbon emissions * gulf hypoxia * global warming potential This will reduce the number of words on the figure and make it easier for someone who is quickly skimming the figure to digest the information. Additionally, I think it would be helpful to use formatting to differentiate between "prime" and "marginal" farmland focus. Someone reading the figure quickly may not read headers and just read the bullet points below them, assuming all will be weighed equally in an agroecological farm. Is there anyway to make the "prime" section different from the "marginal" section? Can it be encased in a large circle and marginal in a smaller circle? Different color text boxes?	We thank the reviewer for the comment. This figure as been removed and replaced by figure on agroecological concepts and outcomes.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		11	11	6	7	The authors should review that there are various scales of livestock production, and industrial-scale concentrated animal feeding operations are notoriously more polluting than small-scale ones. Also, the same mangement prcatices will not apply to operations on different scales.	We thank the reviewer for the comment. We've included a qualifying statement on scale.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		11	12	6	3	This section is slightly disorganized, I think it would make sense to divide into two paragraphs - animal agriculture contribution to GHG and then adaptive practices.	We thank the reviewer for the comment. The paragraph has been revised for clarity.
Reid	Sherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		11	11	9	9	The sentence "Some extreme weather events have become more frequent and intense" is very nebulous and vague, and most likely not useful or actionable to stakeholders. It would be helpful to provide examples of what type of weather events have become more frequent and extreme (e.g., drought, rainfall) as those are very relevant to agriculture and rural communities. This needs to be very specific so that it is most useable.	We thank the reviewer for the comment. We have added the following text to the introduction: "A changing climate, characterized by more frequent and severe extremes events, such as heat waves, droughts, and extreme rainfall, (KM 2.1 and 2.2), will affect U.S. agriculture, food systems (a topic not addressed in previous NCAs), and rural communities" and "Agriculture has always faced unpredictable weather, but a changing climate poses additional challenges. Examples highlighted in NCA5 include: extreme precipitation events damaging crops, delayed planting and harvesting, and expanding pest ranges in the Northeast (KM 21.1); increased average and extreme temperatures adversely affecting farmworker health in the Southeast (KM 22.4); reduction in corn yield due to excessive water and extreme drought in the Midwest (KM 24.1); greater incidence of heat stress on livestock in the Southwest (KM 28.3); and collapse of major fisheries in Alaska (KM 29.3)."
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		11	11	12	12	Page 11 Line 12 Don't forget the accents ¬ñ Fermv"ndez-GimV©nez	We thank the reviewer for the comment. Accents are not included in the author line in referenced paper
Ben	Lilliston	Text Region	11. Agriculture, Food Systems, and Rural Communities		11	11	14	16	The characterization of "contemporary livestock production" is better described as the shift toward large "concentrated animal feeding operations" as defined by the EPA. Not all current livestock production uses the CAFO system. There is growing adoption of managed grazing and organic meat and dairy production around the country. It is important to acknowledge and differentiate those segments of the market.	We thank the reviewer for the comment. We've changed contemporary to confined.
Reid	Sherman	Figure	11. Agriculture, Food Systems, and Rural Communities		11				Please provide an actual citation for Figure 11.8 for the various practices listed instead of "USDA and USDA-ARS" as a source. This single figure provides very important information on sustainable farming systems with perennials, yet there is no actual scientific literature tied to the figure in the references.	We thank the reviewer for the comment. Figure 11.8 was removed from the chapter.
Rachel	Licker	Figure	11. Agriculture, Food Systems, and Rural Communities	11.8	11	11			This figure is better represented as a table where how each agroecological and perennialized strategy in conjunction with multiple other practices produce the desired outcome is explicitly explained.	We thank the reviewer for the comment. This figure has been removed from chapter.
Rachel	Antidormi	Figure	11. Agriculture, Food Systems, and Rural Communities		12	12	1	7	This figure is confusing to interpret. I'm not sure how to suggest to fix it because I am having trouble conceptualizing the circles and arrows.	We thank the reviewer for the comment. Reference to Fig. 11.5 (Cattle-based methane emissions) - caption has been revised to specify proportion of methane emissions by source as depicted in circles with arrows.
Rachel	Licker	Figure	11. Agriculture, Food Systems, and Rural Communities	9	12	12	4	8	Considering rapid expansion of the meat processing industry in the last few decades, the data sources are outdated ranging from 2000-2016. Suggest using more recent literature to estimate methane emissions.	Thank you for the comment. The authors acknowledged the availability of abatement options and added text regarding manure storage mitigation and ruminant feed supplements in the main text. Because newer ruminant feed supplements (like seaweed, biochar) are a relatively new area of exploration and not widely used by livestock producers in the US, the percentages shown for relative source contributions of CH4 in the figure represents the current state of conventional cattle production systems.
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		12	13	9	3	These two paragraphs discuss the complexity of agricultural solutions. These paragraphs would benefit from inclusion of the social and economic complexities for putting any of these solutions into action (i.e. implementation). Farmer and rancher decision making is not just reliant on the availability of data, but rather the flexibility and will to make changes to their production model. A single and short acknowledgement would help for the paragraph not to fall back on an information deficit model. I acknowledge the sentance on page 13 line 14- as being socially oriented perhaps this can be moved up, or reiterated in a problem statement above.	We thank the reviewer for the comment. A reference and acknowledgement about data availability is now included.
Nick	Procopio	Figure	11. Agriculture, Food Systems, and Rural Communities		12				The figure explains how cattle belching accounts for 85% of methane emissions from cattle. Suggest adding brief discussion of ways to reduce methane emissions from cattle, such as dietary supplements of red seaweed and grain (https://www.mdpi.com/2076-2615/12/19/2687).	We thank the reviewer for the comment. Reference to KM 32.3 added to text highlighting mitigation options via ruminant feed supplements and increased energy capture from liquid manure systems.
Ben	Lilliston	Text Region	11. Agriculture, Food Systems, and Rural Communities		13	13	1	3	The introduction of more advanced data collection and management is important, but missing here is who controls that data and associated technology. Currently, much of that data is held privately, with farmers only marginally benefiting, and in fact providing much of the data to larger companies for free. A sentence on how data collection and management, and associated technologies, should serve farmers and rural communities (and the public), would be appreciated here.	We thank the reviewer for the comment. We've added a sentence on agricultural data availability.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Madeline	Cohen	Text Region	11. Agriculture, Food Systems, and Rural Communities		13	13	4	16	The Good Food Institute has submitted a long-form version of these comments via email in a PDF document titled GFI Comment on Third Order Draft NCA5. The Good Food Institute (GFI) writes to address one issue raised in the Chapter. On page 13, the authors describe a variety of alternative methods for producing protein in the face of growing demand for meat and concerns over food security and sustainability. Those alternatives include ‚Äúplant-based meats, and cell-cultivated food production.‚Äù GFI commends the inclusion of these alternative protein sources in the Chapter. As noted by the authors, ‚Äúthese options offer the potential to reduce GHG emissions associated with the amount of food needed to ensure food security,‚Äù and ‚Äúincrease the range of food options available to consumers.‚Äù In addition, alternative proteins use less land and water (Odegard & Sinke, 2021; University of Oxford & Global Change Data Lab) and contribute less to erosion (Steinfeld et al., 2006), biodiversity loss (Odegard & Sinke, 2021), eutrophication (Saget et al., 2021), acidification (Saget et al., 2021), and deforestation (Steinfeld et al., 2006) compared to conventional animal protein. They also increase the resilience of our food systems. The conditions for producing adequate food,‚Äîlike arable land, favorable temperatures and precipitation, sufficient water levels, and healthy animals,‚Äîare under threat due to climate change. Many forms of alternative protein production are less reliant on these conditions and thus suitable to a changing climate. These alternative production methods also diversify our protein supply which can help ameliorate the effects of supply chain disruptions. In addition to plant-based and cultivated meat, fermentation-derived proteins can accomplish many of these same goals, providing the potential to create a variety of protein-rich foods without the land and water required for traditional protein production, and with a lower climate impact. Proteins can be grown through biomass fermentation or derived through precision fermentation. Both production methods offer climate benefits. For example, a life cycle assessment of lignocellulosic mycoprotein produced through biomass fermentation found that the product resulted in less than 14 percent of the GHG emissions of beef and used less arable land than beef, chicken, or tofu (Upcraft et al., 2021). Another study found that substituting 20 percent of ruminant meat consumption per capita by 2050 with protein derived through biomass or fermentation using precision would have the overall deforestation and	We thank the reviewer for the comment. Authors specified that some, not all, alternative food production systems can have greater GHG emissions compared to conventional food systems.
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		13	13	4	16	The potential drawbacks to some of these solutions are not addressed as much as would be helpful. Many human interventions that were supposed to be producing solutions to problems humans created have not been good for human health (partially-hydrogenated oils to replace saturated fats led to worse health outcomes - they have now been banned). To not express some concern about ultra-processed plant-based foods or nutrient deficiencies from pushing vegan diets on populations whose cultural practices have always included animal foods, the potential for unknown dangers from cell-based meats, etc. is ignoring the many reasons we need to worry about constant interventions that don't improve the situation over respecting and returning to traditional practices and more local food systems.	We thank the reviewer for the comment. There are many caveats written into this text already, speaking of potential improvements and increased options, not wholesale replacement.
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		13	13	26	28	Page 13 Line 26-28 What kinds of social and ecological concerns? Please explain. It's insufficient to say that there are concerns without at least summarizing a few of them. Aquaculture should not be considered a panacea. In addition, there are differences depending on the species for acquaculture where bivalves and seaweed may produce the lowest stressors while flatfish and crustaceans may generate the highest emissions (see Gephart et al., 2021, Nature https://www.nature.com/articles/s41586-021-03889-2)	We thank the reviewer for the comment. Revised text adds types of social and ecological concerns. Information has been added about bivalves/seaweed and used Gephart et al. 2021 citation.
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		14	14	10	11	Page 14 Line 10-11 I'm so happy you brought up the Conservation Reserve Program! Great. I think a nod to some of the other state and local incentive programs might be worthwhile here.	We thank the reviewer for the comment. With limited space we were only able to provide a few programs as examples.
Emma	Conrad-Rooney	Text Region	11. Agriculture, Food Systems, and Rural Communities		14	14	14	19	Key message 11.2 should be reordered to follow the Risk-Based Framework.	We thank the reviewer for the comment. This key message has been revised to follow the risk-based framework
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		14	14	14	14	Page 14 Line 14 include ¬iaccessibility" to the list. This is supported by lines 18-19 talking about the ability of subsistence-based people to obtain food (and is included in Figure 11.13 and throughout the text).	We thank the reviewer for the comment. Assuming this comment refers to Key Message 2, the authors were asked in previous rounds of review to use words that were easier for the general public to understand and relate to, especially within Key Messages. It was determined that "availability" and "affordability" would be most easily understood by the general public. In light of these earlier discussions, we decided it would be unnecessarily confusing to add "accessibility" to the list of terms used in Key Message 2. However, in the revised caption of a later figure, we do list all four elements of food security. And we inserted "accessibility" or "access" in a few other sentences, where appropriate.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		14	14	15	18	Can you clearly connect food insecurity to heat stress among farm workers? (Or is heat stress among farmworkers a general challenge rather than a food insecurity challenge)	We thank the reviewer for the comment. This statement has been revised within Key Message 11.2, such that heat stress among farmworkers is now mentioned in a separate sentence from food insecurity. However, we have added a sentence to the Introduction that states, "For example, many food system workers are both food insecure and disproportionately exposed to the effects of climate change, intensifying the socioeconomic impacts of these intertwined inequities (Meierotto et al. 2020)." We then provide an example in section 11.2: "For example, drought reduces demand for farm labor and thus workers' income and ability to buy food (Greene 2018)."
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		14	14	18	19	Page 14 line 18-19 It might be worth highlighting Indigenous peoples as some of the most at risk subsistence-based peoples.	We thank the reviewer for the comment. In previous rounds of review, we were discouraged from mentioning Indigenous peoples as an example, in order to avoid stereotyping diverse peoples who are not equally vulnerable.
Ariela	Zycherman	Figure	11. Agriculture, Food Systems, and Rural Communities		14				Since I can't actually see this figure I am commenting based on some guesses about what it says. If this picture shows one number for the greenhouse gas emissions for each type of meat, beef, pork, etc. it likely is denying some very important aspects of the way meat is produced. I am then assuming that these numbers are based on the mass production agricultural system common in the US. This then does not represent regenerative agriculture practices that are closer to the practices common among many populations and cultures that exist throughout our system -- assuming that people will change the foods they eat in significant ways from traditional cultural practices because of mass production agriculture in the US rather than transitioning back to sustainable and regenerative practices to produce these traditional foods is a problem that undermines many peoples' way of life.	We thank the reviewer for the comment. Figure 11.6 on GHG emissions per 100 g of protein is based on median values of global protein production systems. Figure was modified to add other plant-based and fermentation-based proteins. The intent of the figure was not to delineate between conventional and regenerative production systems.
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		15	15	6	6	Page 15 line 6 Include: "contributing to food spoilage"	We thank the reviewer for the comment. While this is a legitimate point, word limits on our chapter preclude us from including this specific issue here. To our knowledge of the scientific literature, food spoilage is not one of the largest impacts of extreme weather and compound events.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		17	17	17	19	I wonder if there is a trade-off to doubling technology in agriculture - are there any unintended consequences of trying to compensate for TFP loss in this way?	We thank the reviewer for the comment. The meaning of the word "technology" in Liang et al. (2017) is general, including not just newer technologies like robotics and gene editing, but also older technologies such as crop-breeding. To avoid "technology" being conflated with specific practices that some might perceive as having unintended consequences, we have replaced "a doubling of technology" with "a doubling of the positive effects of innovation and adaptation", a phrase that Liang et al. (2017) also use. The sentence now reads, "Agricultural TFP is projected to decline back to pre-1980s levels by 2050 unless the positive effects of innovation and adaptation in U.S. agriculture (after accounting for any negative effects) can be doubled relative to recent historical rates (Liang et al. 2017)."
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		17	17	22	28	This chapter implies that higher temps and humidity impact farm worker productivity, earnings and safety. Specifically for the latter, this is an opportunity to mention the intersectionality between farmworker rights and social stressors and how when coupled with climate change, they can become even more vulnerable. it is not just the temps and humidity.	We thank the reviewer for the comment. We have added two sentences to highlight another social stressor that farmworkers are disproportionately affected by, food insecurity. We then go on to explain, using an example, how climate change is worsening food insecurity among farmworkers. We also added a new sentence in the chapter introduction to acknowledge the historical structural inequities underlying these disproportionate impacts.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		17	17	22	28	I would recommend higher emphasis on equity in farmworker issues. I am also a bit worried about the concluding sentence that implies that farmworkers are only important for productivity and ag output. We should also remember that farmworkers are often food insecure themselves - and food insecurity becomes even more urgent during climate change related extreme weather events. Review of how extreme weather events affect farmworkers should also be included.	We thank the reviewer for the comment. We added a sentence at the end of this paragraph stating, "Farmworkers also disproportionally experience food insecurity (Meierotto et al. 2020, Al-Bazz et al. 2022), which extreme events fueled by climate change can worsen. For example, drought reduces demand for farm labor and thus workers' income and ability to buy food (Greene 2018 ; Ch. 28)." To increase emphasis on equity in farmworker issues, we have also added three sentences in the Introduction, which state: "Historical structural inequities have influenced the distribution of resources, participation, accessibility, benefits, and burdens within the food system (Fig. 20.1). Climate change will exacerbate these inequities (Fig. 18.2). For example, many food system workers are both food insecure and disproportionately exposed to the effects of climate change , intensifying the socioeconomic impacts of these intertwined inequities (Meierotto et al. 2020) (KM 3.2)."

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		17	17	29	37	Since this is a key message on disproportionate impacts of climate change, I wonder if there is evidence on disproportionate impacts in this section - e.g. would all producers benefit? would all consumers be hurt? or is there a disproportionality?	We thank the reviewer for the comment. In the section immediately following this comment, we discuss whether climate change will impact all consumers equally, stating: "Projected increases in food prices and inaccessibility due to climate change, as well as food system disruptions during increasingly frequent and severe extreme events, will disproportionately affect the nutrition and health of some groups including, women, children, older adults, and low-wealth communities." Due to chapter word limits, we are unable to discuss disproportional impacts among producers, instead citing other chapters that do discuss it.
Ben	Lilliston	Whole Page	11. Agriculture, Food Systems, and Rural Communities		17				It would be helpful to add a short section about how climate policy could impact these projections. For example, it is likely that corn prices will decline as electric vehicles take up a rising market share and the need for corn ethanol decreases. Climate policy could also impact nitrogen fertilizer production and costs, as well as transportation costs for the segments of our farm economy that rely on exports. This is not a policy assessment, but it would be informative for readers to understand that climate responses/policies could also impact the projections outlined on this page.	We thank the reviewer for the comment. We have added a new phrase to acknowledge the interplay between domestic institutions, trade, and resulting commodity food price changes due to climate change. It now reads, "Price increases depend on complex interactions between climate change, international trade, and domestic institutions and policies (Baylis et al. 2021), but generally benefit producers but hurt consumers (Beach et al. 2015)..."
Emma	Conrad-Rooney	Text Region	11. Agriculture, Food Systems, and Rural Communities		18	19	7	23	This section should reference Key Message 15.2 in the Human Health chapter.	We thank the reviewer for the comment. KM 15.2 now referenced in this section
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		18	18	7	11	In this paragraph, you should also establish other dimensions of marginalization - you only mention income, but that's not the only predictor of food insecurity. (Also, note that almost a third of households with up to 185% of poverty line are food insecure - that is a much stronger statement and shows that poverty line and food security do not necessarily track).	We thank the reviewer for the comment. We have revised this sentence to include other dimensions of marginalization, including "women, children, older adults, and lower-wealth communities." Due to word-count constraints on the chapter, we were unable to explain that food insecurity also affects households above the poverty line.
Rebecca	Fournier	Text Region	11. Agriculture, Food Systems, and Rural Communities		18		12		While nutrient and micronutrient presence in soil is discussed, it is almost exclusively in terms of uncertainties in cycling, impacts to aquatic systems, and brief mention of methods to retain certain, limited compounds in soil. This may be a missed opportunity to draw the link between reductions in soil nutrient/micronutrient density and subsequent reductions in food quality, tying these changes to further issues of equity and environmental justice. This is hinted at here in terms of food insecurity and differences in women v. men in managing adequate nutrition but in brief and limited terms. [also relevant, Chapter 15: Human Health]	We thank the reviewer for the comment. Due to word-count limits on the chapter, we were not able to discuss the link between reductions in soil nutrient density, food quality, and food insecurity. However, in at least one figure we visually indicate that linkages exist between food security, nutrient density, and climate change.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		18	18	12	20	Is this a limited association between food security and climate change? What about obtaining food during extreme weather events and other dimensions? I would also be careful about linking physical activity to climate change in a chapter on food insecurity - that seems like a much longer discussion for somewhere else with additional evidence.	We thank the reviewer for the comment. We revised this paragraph by removing sentences about the intersection of climate change with health and gender. We instead focused and strengthened the discussion on the intersection of climate change with food insecurity among older adults, providing an example of how extreme weather events make it even more challenging for them to access food. We deleted all language about climate change and physical activity.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		18	19	17	2	I am not sure if you are demonstrating association between climate change, food insecurity and age/gender or just the latter two. You would have to demonstrate how climate change moderates the relationships you outline between food security and age/gender.	We thank the reviewer for the comment. We edited this paragraph to more directly explain the intersection of climate change with age, and provide a specific example.
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		18	18	18	18	Do you really mean gender here? I am not exactly sure what you mean by extending to age and gender but please consider the difference between sex and gender here -- for too many years these terms were used interchangeably and only recently people have understood the difference only to find that now people are denying a difference again for different reasons. Now as I have read lines 20 and 21 I would say sex here instead of gender but I would ask is it really men vs women or is it traits of femininity and masculinity in our culture that affect this -- sex vs gender.	We thank the reviewer for the comment. This sentence has been deleted from the text.
Emma	Conrad-Rooney	Text Region	11. Agriculture, Food Systems, and Rural Communities		18	19	20	1	The sentence "women who experience... macro and micronutrients" should be clarified. When the sentence refers to "men", it is unclear if this is referring to men as a whole or men who also experience food insecurity.	We thank the reviewer for the comment. This sentence has been deleted
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		18	19	20	2	Can you explain why women are less likely to meet dietary requirements?	We thank the reviewer for the comment. In response to multiple comments/questions about this sentence, we have decided to delete it from the chapter.
George	Kling	Text Region	11. Agriculture, Food Systems, and Rural Communities		19	19	5	8	There should be a deeper description of Arctic Indigenous Food Systems to include traditional resource management practices, the communal nature of hunting and harvesting, and the significance of extensive sharing of Indigenous food. These act to help mitigate the variability of climate change on Arctic Indigenous communities.	We thank the reviewer for the comment. This request for a deep description of Arctic Indigenous food systems is highly specific. There is an entire chapter on Indigenous people which gives a good overview of the challenges they face. Within that there is reference to food systems but not specifically arctic. It seems as though that is the best fit for this topic. The Alaska chapter has a lot of information about food systems -- some specific to Indigenous but also to rural communities in general. Reference have been made to the Alaska chapter.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		19	19	10	16	I think it would make sense to also highlight that these communities are more likely to be food insecure to begin with (and explain why). There is also an intersection with policy -- they may be prevented by policy from accessing their preferred diets. Does policy also intersect with climate change? (E.g. climate change leads to biodiversity loss which policy may try to fix by limiting access to specific species which may be essential in food foraging)	We thank the reviewer for the comment. Addressing such policy issues are outside the scope of NCA, and this chapter.
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		19	19	12	14	Page 19 line 12-14 Link to Chapter 29 on Alaska.	We thank the reviewer for the comment. Link has been made.
Ariela	Zycherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		19	19	21	23	Page 19 Line 21-23 I love this example. Consider adding another example of the Alaska Chugash Regional Resources Commission which is developing kelp farming to mitigate ocean acidification, as a carbon sink, while providing a potential source of income (more information in Chapter 29, page 37).	We thank the reviewer for the comment. A link to this example in the Alaska chapter has been made.
Emma	Conrad-Rooney	Text Region	11. Agriculture, Food Systems, and Rural Communities		19	19	25	26	This sentence, "Most food consumed...Midwest and California" should reference Key Message 24.1 in the Midwest chapter and Key Message 28.3 in the Southwest chapter, since both of these key messages discuss agriculture specifically in those regions.	We thank the reviewer for the comment. Key Messages are now included in the text.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		19	19	25	33	I would be careful around arguments regarding food waste and food security. I would recommend explaining drivers of food waste - including on the consumer level. You should also provide a clear explanation how food waste prevention would increase food security.	We thank the reviewer for the comment. We have updated the statement and cross referenced similar discussions in the Land Chapter and Mitigation Chapter.
Emma	Conrad-Rooney	Text Region	11. Agriculture, Food Systems, and Rural Communities		20	20	8	9	It is unclear if indigenous people are included as rural communities. Indigenous people are important stewards of land. It would be helpful to specify in this key message section whether Indigenous people are included within rural communities here or reference the Indigenous peoples chapter for more information about Indigenous land stewardship.	We thank the reviewer for the comment. Incorporated into first paragraph of KM text.
Reid	Sherman	Text Region	11. Agriculture, Food Systems, and Rural Communities		20	20	17	17	Great introduction to KM 11.3 but would prefer an adjective to highlight whose enjoyment of ecosystem services and examples - suggest "society's enjoyment of ecosystem services including hunting, etc"	We thank the reviewer for the comment. The Revision has been made.
Ariela	Zycherman	Figure	11. Agriculture, Food Systems, and Rural Communities		20				Fig 11.14 This figure is confusing and misleadingly discussed in the text. The text says "¬Öan estimated 30-40% spoils or is wasted, occurring largely at the consumption stage." But the figure shows that most of the green house gas emissions occur in the production stage (and only 4% of emissions are at the consumption level). Consider omitting the text in lines 28-20 of page 19.	We thank the reviewer for the comment. The figure is looking at GHG emissions by food supply chain. Most food loss and waste occur at the consumption stage, at which point most of the GHG emissions have already occured. This is also discussed in the Land Chapter and Mitigation Chapter.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		21	21	2	3	Could you elaborate on these three threats to rural America? I am having a difficult time understanding the link between those three and climate change without additional information.	We thank the reviewer for the comment. The authors have rephrased to make connection clearer.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		21	21	28	30	I am wonderfing if it is possible to think about the wording of this sentence - as written now it does not really reflect what caused these disparities - which I think is important to identify if you want to provide a discussion of how this overlaps with climate change.	We thank the reviewer for the comment. Edited to indicate EJ as a root cause of climate resilience disparities
Emma	Conrad-Rooney	Figure	11. Agriculture, Food Systems, and Rural Communities		22				It would be helpful to specify in the figure caption that this is about rural community resilience.	We thank the reviewer for the comment. The figure caption has been modified accordingly.
Reid	Sherman	Whole Page	11. Agriculture, Food Systems, and Rural Communities		22				Figure 11.16 presents the 'Baseline Resilience Indicators for Communities" Suggest cross referencing this with other chapters' discussion of community resilience and indcators (includes social, infrastructure, insitutional, environmental, economic, and community capital resilience.	We thank the reviewer for the comment. Cross references have been added.
Reid	Sherman	Figure	11. Agriculture, Food Systems, and Rural Communities		22				Is the Community Resilience Index available for AK, HI, and/or Puerto Rico? Definitely include if available, and if not explain alternative data sources so that they do not get ignored.	We thank the reviewer for the comment. We have added data for AK and HI which are available and noted the lack of data for other regions.
Rachel	Licker	Text Region	11. Agriculture, Food Systems, and Rural Communities		23	23	3	14	I appreciate this particular example, but am left thinking whether this lays the blame on the communities themselves for having a single source of income and relying on resource extraction. The implications of this paragraph seem to be that these communities need to diversify without contributing to further climate change. Is that what the authors are hoping to portray - or are there different implications of this situation?	We thank the reviewer for the comment. We consider this to be a neutral statement of facts and want to avoid policy prescriptive solutions.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
George	Kling	Text Region	11. Agriculture, Food Systems, and Rural Communities		23	23	7	14	This discussion must include the failure of science-based management and commercial fishing regulation to provide proper conservation and sustainability of fish stocks and the introduction of invasive species (e.g., buffalo, musk ox), which have created unequal hardship on Indigenous food security.	We thank the reviewer for the comment. This is a policy related comment and thus we cannot address and beyond the scope of this chapter.
Reid	Sherman	Traceable Account	11. Agriculture, Food Systems, and Rural Communities		25	25	15	15	The topic of "agricultural resilience" reads more like "mitigation" and the subtitle seems disconnected from the text and citations.	We thank the reviewer for the comment. We've updated the title to "Mitigation via Agroecological Management"
Reid	Sherman	Traceable Account	11. Agriculture, Food Systems, and Rural Communities		26	26	3	3	This sentence seems very subjective (i.e., the phrase about "if soils were as healthy as possible" and there is no literature to support this claim, or connect to other important points on how to have crop production. Please provide recent literature to back up this claim and/or re-word to be objective and connect to literature and text in the body of the chapter.	We thank the reviewer for the comment. Text has been modified for clarity. "Crop production could be more resilient to climate changes if soils were as healthier than currenty as possible, but the speed with which such a transformation is possible using anin agroecological conditions approach could be made remains unknown (Qiao et al., 2022, Bunemann et al. 2018) . Future water availability has a major impact on soil health, and forecasting this will be a challenge."
Bob	Randall	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						Generally I like most of the chapter. There are a few things that I think are not sufficiently emphasized. The chapter is entitled "agriculture" but is more accurately "the food system." In any case, some things that the general public need to know that are not emphasized include (1) the effect that high temperatures have on the growth of plants. In my research, 61% of common supermarket vegetables don't grow above 80ÀôF, 83% don't grow above 90ÀôF and most seed production will be destroyed at temperatures much above 90ÀôF. For less common veggies, figures are	We thank the reviewer for the comment. Food systems is included in chapter title and is one of the main emphases of the chapter. The remainder of the comment appears to be truncated, and thus cnnot be addressed by the authors.
Rachel	Antidormi	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						Perhaps it is common knowledge, but I did not know what plant hardiness was until I looked it up, it would be helpful to have a brief description of what plant hardiness is.	We thank the reviewer for the comment. Plant hardiness zones are a common reference standard for the general public to understand what plants will grow within a given area. Seeds and plants are usually listed by which zones outdoor plants grow in. This was decided to be the most access and common reference metric for vegetation growth in the U.S. We've included a short description in the text, "Plant hardiness zones, a common metric for plant appropriateness for a given local climate,..."
Rachel	Antidormi	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						The four percentages at the bottom of the figure (48, 26, 22, 4), what are these refering to? Do these make up US GHG emissions from the food supply chain? 11-6 - 11-8	We thank the reviewer for the comment. The caption has been updated to describe what GHG values relate to in the figure.
Rachel	Antidormi	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						Redlining is mentioned briefly in this chapter. Even a lot of sustainability folks and environmentalists do not know what redlining is. It would be helpful to have a definition of redlining and speak more about how these communities are disproportionately effected. Some great resources: [An, B., Orlando, A. W., & Rodnyansky, S. (2019). The physical legacy of racism: How redlining cemented the modern built environment. SSRN Electronic Journal. doi:10.2139/ssrn.3500612], [Nardone, A., Chiang, J., & Corburn, J. (2020). Historic Redlining and urban health today in U.S. cities. Environmental Justice, 13(4), 109-119. doi:10.1089/env.2020.0011], [Peacock, W. G., Van Zandt, S., Zhang, Y., & Highfield, W. E. (2014). Inequities in long-term housing recovery after disasters. Journal of the American Planning Association, 80(4), 356-371. doi:10.1080/01944363.2014.980440]	We thank the reviewer for the comment. The term redlining is no longer used in this chapter, and has been removed.
Rachel	Antidormi	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						There are a lot of warming/cooling effect number changes listed in this section. It would be helpful to create a figure to show these all together to help conceptualize them in an easy way.	We thank the reviewer for the comment. However, the comment is not well-defined as it refers to the "whole chapter." Figure 11.2 illustrates changes in plant hardiness zones, which is an analogue of temperature changes.
Sheila	Fleischhacker	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						Appreciate inclusion of nutrition	We thank the reviewer for the comment. However, a response is not required.
Asha	Sharma	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						I am submitting this comment on behalf of Pesticide Action Network North America to urge recognition and inclusion of the contributions of synthetic pesticide use to greenhouse gas emissions in the agriculture chapter of the NCA5. Climate change is also anticipated to cause an increase in pesticide use, which also necessitates inclusion in the assessment. In this comment, I have included the Executive Summary of Pesticide Action Network's upcoming report, Pesticides and Climate Change: A Vicious Cycle, below in order to better detail these points and urge their inclusion in the assessment. Thank you, Asha Sharma Organizing Co-Director Pesticide Action Network North America Climate change is one of the greatest challenges facing humanity today. Scientific evidence indicates that pesticides contribute significantly to greenhouse gas emissions while also making our agricultural systems more vulnerable to the effects of climate change. However, the reduction of synthetic pesticide use has been omitted from climate change solutions, and synthetic pesticide use is even presented as a climate change mitigation strategy by industrial agriculture interests. Pesticides contribute to climate change throughout their lifecycle via manufacturing, packaging, transportation, application, and even through environmental degradation and disposal. Importantly, 99% of all synthetic chemicals,Äîincluding pesticides,Äîare derived from fossil fuels, and several oil and gas companies play major roles in developing pesticide ingredients. Other chemical inputs in agriculture, such as nitrogen fertilizer, have rightly received significant attention due to their contributions to greenhouse gas emissions. Yet research has shown that the manufacture of one kilogram of pesticide requires, on average, about 10 times more energy than one kilogram of nitrogen fertilizer. Like nitrogen fertilizers, pesticides can also release greenhouse gas emissions after their application, with fumigant pesticides shown to increase nitrous oxide production in soils seven to eight-fold. Many pesticides also lead to the production of ground-level ozone, a greenhouse gas harmful to both humans and plants. Some pesticides, such as sulfuryl fluoride, are themselves powerful greenhouse gases, having nearly	We thank the reviewer for the comment. Reduction of synthetic agrochemical inputs has been acknowledged in KM1 as a part of agroecological management approaches.
Emma	Conrad-Rooney	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						It could be clearer to switch key message sections 1 and 2. Key Message 2 is more focused on the impacts of climate change on food systems, while Key Message 1 is more about adaptation. Therefore, it might be helpful to begin with the Key Message 2 content.	We thank the reviewer for the comment. Key messages are ordered according to the chapter title, and is outside the author-team's purview.
Emma	Conrad-Rooney	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						There were no mentions of the effects of fungi, bacteria, and microbes on ecosystems. Microbial and microscopic life, especially bacteria and fungi, play critical roles in supporting life on Earth. Microorganisms are extremely abundant--there is more than 40x the biomass of microorganisms on earth than that of animals (Bar-On et al. 2017)-- and their functions have enormous impacts on every ecosystem. Fungi and bacteria are responsible for much of the movement of nutrients through ecosystems. They perform decomposition, through which dead matter is broken down, and nutrients in organic matter are transformed back into usable forms, recycling infinitely. Without decomposing microorganisms, our planet would be covered in dead matter and life on Earth would cease. Thus, the many factors that impact the composition and activity of decomposer microorganisms (such as climatic, edaphic, and biotic factors) should be of critical interest, especially as these factors, along with microbial diversity and distributions, are changing rapidly with global change. Fungi are also responsible for most of the nutrient transfer to vegetation. 80% of all plants and nearly every tree species on earth form associations with mycorrhizal fungi (Wang and Qiu 2006), which are responsible for providing nutrients from the soil to the plants in return for sugars from photosynthesis (Smith and Read 2008). Like soil decomposers, the composition and activity of mycorrhizal fungi are strongly dependent on factors that are changing rapidly with global change, which will affect plant productivity, soil carbon storage, and nutrient cycling. There seems to be a lack of expertise among the authors to address information about microbial communities and functions in ecosystems. We suggest adding information on these topics, perhaps by adding one or more technical contributors who have expertise in how fungi and bacteria impact ecosystems. Suggestions include Drs. Jennifer Bhatnagar at Boston University, Serita Frey at the University of New Hampshire, V. Bala Chaudhary at Dartmouth College, Ashish Malik at the University of Aberdeen, Mark Anthony at WSL Umweltforschung, and Peter Kennedy at the University of Minnesota. Citations: Bar-On, Y. M., R. Phillips, and R. Milo. 2018. The biomass distribution on Earth. Proceedings of the National Academy of Sciences 115:6506--6511. Smith, S. E., and D. J. Read. 2008. Mycorrhizal Symbiosis. Elsevier. Wang, B., and Y.-L. Qiu. 2006. Phylogenetic distribution and evolution of mycorrhizas in land plants. Mycorrhiza 16:299--363	We thank the reviewer for the comment. There is an emphasis in key message one that the entire ecosystem should be involved in the decision making process of agricultural management and biotic factors such as fungi are considered a part of this consideration. Microbiological functions has been added to caption of Figure 11.3 (Soil as a Foundation).

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Nadia	Gronkowski	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						The Early Years Climate Action Task Force appreciates the authors,Âô many mentions of pregnant people throughout the draft, and encourages them to consider expanding this to include ‚Äúpregnant and lactating people." Lactation is not only key to healthy infant development, but presents an important strategy for infant food security in climate emergencies.	We greatly appreciate the reviewer's comment. Chapter 11 does not explicitly mention pregnant and lactating people, so this comment may have been directed at another chapter (e.g., Health Chapter). Chapter 11 does mention women and children among those disproportionately impacted by climate-related threats to food security. Within this general context, it feels overly-specific to call-out women who are pregnant or lactacting, so we chose not to add these specific subsets of women to the sentence.
Juanita	Constible	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						Please consider using the term PEOPLE OF COLOR to mean non-white people instead of the word MINORITY. Minority carries a connotation of lesser worth, and is not even mathematically accurate in some parts of the U.S. (including some rural areas).	We greatly appreciate the reviewer's comment. The term minority has been removed from the chapter
Rebecca	Fournier	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						Harmful impacts that animal agriculture and meat production have on GHG emissions and climate change are discussed, however dairy production is entirely missing from this assessment; dairy is only mentioned throughout the text in context of impacts climate change is having, or will have, on the livelihood of dairy producers. Dairy production is both intrinsically tied to the meat production market (via culling, slaughtering of surplus calves, patterns of land use, feed and intensive water use at each trophic level, runoff and other sources of contamination from pollutants, antibiotic use, product transport, and the like) as well as independently contributing to GHG emissions. [also relevant, Chapter 32: Mitigation, Chapter 6: Land]	We greatly appreciate the reviewer's comment. The authors attempted to provide a broad coverage of agricultural state and adaptations which are focused on agroecological considerations. Reviews of contributions of GHG are also provided, but it is difficult to isolate and dissect all of the intricacies of agricultural production within the confines of one chapter, especially one covering food systems as well as rural communities.
Matthew	Eisenson	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						In the chapter on Agriculture, there are several references to renewable energy production on agricultural land, including wind energy, advanced biofuels, and agrivoltaics, but there is no discussion of conventional biofuels, such as corn ethanol, which use far more land. For example, the subsection on "Rural Community Resilience" notes that rural communities are "making positive contributions in enhancing climate resilience and mitigating climate change through renewable energy production" (page 23, lines 15-16). As examples of positive contributions, the subsection notes progress in deploying "wind energy" (page 23, line 23), "advanced biofuels" (page 23, line 24), and "agrivoltaic systems, which combine solar photovoltaic energy production with agriculture" (page 23, lines 24-25). Corn ethanol is not mentioned in that subsection or any other part of the chapter. Studies suggest that rural communities could enhance their contributions to climate resilience and mitigation by shifting away from corn ethanol production and using that same land instead for solar power-whether as part of an agrivoltaic system or not. Indeed, as described below, the production of corn ethanol uses a vast amount of land (approximately 40 million acres) but delivers relatively low yield in terms of energy production and few, if any, climate change benefits. This should be noted in the chapter. In particular, please consider noting that: (1) solar and wind energy projects use very little agricultural land compared to the production of biofuels; (2) photovoltaic (PV) solar delivers far more energy per acre than corn ethanol; and (3) corn ethanol delivers few, if any, climate change benefits. With respect to point (1), approximately 40 million acres of agricultural land is currently being used to grow corn for ethanol, an area the size of Florida. According to the U.S. Department of Agriculture (USDA), 90 million acres of agricultural land in the U.S. are used to grow corn, and 45% of that corn is used for ethanol production. See Claire Hutchins, Feedgrains at a Glance, USDA Economic Research Service (last updated October 3, 2022), https://www.ers.usda.gov/topics/crops/corn-and-other-feedgrains/feedgrains-sector-at-a-glance/. By comparison, solar installations on all types of land (both agricultural and non-agricultural) occupy only 0.5 million acres, while wind turbines occupy only 0.07 million acres. See Dave Merrill, "The U.S. Will Need a Lot of Land for a Zero-Carbon Economy."	We thank the reviewer for the comment. Biofuels are given brief mention in the text and can be considered as a part of the larger agroecological calculations that are made in the decision making process for integrated landscape management. There isn't sufficient space to provide an indepth review of biofuels and their role in climate change in this chapter.
Richard	McNider	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						While much attention is given to climate change impacts on agriculture less is given to geographical changes in the nation,Âôs agricultural production that occurred in the last century that threaten agriculture in the coming decades. In the last century the geography of the Nation,Âôs agricultural production changed dramatically, as food and fiber production shifted from the East to the arid West under irrigated agriculture. Similarly, as transportation improved corn and grain production migrated to deep water holding soils in a small area of the upper Midwest. As a result, agriculture in the East dropped precipitously. In a positive sense, this migration of agriculture produced a bountiful fare of food at a price afforded by ordinary Americans. However, the present drought in the West and the 2012 Midwest drought perhaps expose the vulnerability of the new geography of U.S. agriculture. Additionally, the shift in agriculture brought about adverse impacts on river ecosystems in the West and the concentration of nutrient export to the Mississippi River. This leads to several strategic questions. Is the geography that evolved in the last century, due to immediate market forces and government investments, sustainable and reliable for the future? Will the geography of agriculture continue to evolve and, if so, can information be developed that can guide future migrations of agriculture. The East lost its agriculture in large part because of drought losses, so bringing agriculture back to the East will require expanded irrigation. Can some portion of the production in the West now under water stress due to increasing demand from population growth and potential reduction in supply from climate change be migrated back to the East or Northwest under irrigation? Can grain production be more geographically distributed to avoid the environmental issues (e.g. nutrient run-off) and vulnerability to small regional droughts that the present concentration of grain production in such a small area entails? An NSF Workshop was convened in Boulder, Colorado October 21-23, 2015 that brought together hydrologists, agronomists, economists, engineers, climatologists, ecologists, energy experts, data scientists and water resource planners to discuss the vulnerabilities of the present geography of agriculture. The workshop discussed whether information might be developed to assess the geography of economic and agricultural sustainability in the future that might guide private sector investments and government policy as needed to sustain production in the coming century in the face of climate change	The authors appreciate this comment and refer to their inclusion of agroecological management practices as a goal to be in synchronicity with this statement. The migration of growing zones and evolution of future planning is directly in line with the authors focus.
Reid	Sherman	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						The chapter as a whole seems unbalanced with KM 11.1 veering towards advocacy and policy-prescription rather than the policy-relevance of the NCA, and missing specific details and recent citations. Moreover, many of the citations are old and/or missing throughout sweeping statements. Especially for very policy-relevant topics like agroecology, more than one citation should be used to highlight the description, benefits, etc of the topics.	We thank the reviewer for the comment. Citations have been updated where feasible and a review for policy prescription has been done. Some language within the text has been revised to remove the impression of prescription.
Reid	Sherman	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						The first Key Messsage could benefit from a discussion to the policy environment that can enable climate adaptation, modeled on Key Message 7.3 Adaptation Solutions in the Forests chapter.	We thank the reviewer for the comment. It is difficult to reconcile calls for more discussion of policy while simultaneously avoiding policy prescription. The authors have made an attempt to discern impediments to mitigation and adaptation efforts while remaining policy neutral.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Cathy	Day	Whole Chapter	11. Agriculture, Food Systems, and Rural Communities						Jan. 27, 2023 Dr. Wayne Higgins Chair, Subcommittee on Global Change Research NOAA Climate Program Office 1315 East-West Hwy, SSMC-3, Rm 12124 Silver Spring, MD 20910 Re: Fifth National Climate Assessment (87 FR 67873) Submitted electronically via review.globalchange.gov Dear Dr. Higgins, On behalf of the National Sustainable Agriculture Coalition, we would like to thank the U.S. Global Change Research Program (USGCRP) for the opportunity to provide feedback on the Draft Fifth National Climate Assessment. The National Sustainable Agriculture Coalition (NSAC) is an alliance of over 130 grassroots organizations nationwide that advocate for federal policy reform to advance sustainable agriculture and food systems. For decades, NSAC has advanced sustainable agriculture research, including the Sustainable Agriculture Research and Education program. Our members include researchers strongly involved with the development of increasingly climate-focused agricultural research. NSAC strongly supports the work of the USGCRP because we see it as including the important agricultural research, extension conservation systems, and technical assistance that will ensure that our agricultural lands and rural communities are sites of greenhouse gas (GHG) emissions reductions, carbon sequestration,resilience to extreme weather and other stresses, and increasing biodiversity in both productive spaces and in lands that have been set aside from active production. We at NSAC see the National Climate Assessment as a key means of informing the public, including farmers and ranchers, as climate change impacts their lives and livelihoods. We applaud the use of [illegible]	Thank you for comment. Chapter titles have been determined by the Federal Steering Committee, are beyond the author's control, and cannot be changed in NCA5. Chapter title changes will need to be considered for future assessments.
Rachel	Licker	Figure	11. Agriculture, Food Systems, and Rural Communities	Figure 11.1					I wonder if it is useful to show and include food service jobs as food systems jobs in a chapter on climate change. Is there a direct link between US service jobs and climate change that you can demonstrate?	We thank the reviewer for the comment. We have removed this figure in the most recent draft.
Rachel	Licker	Figure	11. Agriculture, Food Systems, and Rural Communities	Figure 11.11					This figure is very complex, can you explain it in text including the implications of organizing information in this way? Focusing specifically on interventions would be helpful too (interventions for what?).	We thank the reviewer for the comment. Figure caption has been expanded to guide readers through this complex figure. Included in the caption is a sentence specficially focusing on interventions, which reads: "Interventions, such as mitigation and adaptation, can reduce risks to food security."
Rachel	Licker	Figure	11. Agriculture, Food Systems, and Rural Communities	Figure 11.13					Very interesting figure portraying the three dimensions of food security - but it's missing stability that was introduced at the start of the chapter as the fourth dimension. It would also make sense to introduce the figure in text more comprehensively rather than just provide a figure for one example mentioned in text.	We thank the reviewer for the comment. This figure was adapted from Chodur et al. (2018), who did not include the fourth dimension of food security (stability) as defined by El Bilali et al. (2019). To keep the figure true to its original source and of reasonable size, we chose not to add the fourth dimension. The figure is now cited within the chapter text 3 times, and the caption has been expanded to better explain its meaning.
Rachel	Licker	Figure	11. Agriculture, Food Systems, and Rural Communities	Figure 11.14					I am not clear where the CO2 emissions are coming from within each stage of the food system, it might be helpful to explain that to be able to envision interventions.	We thank the reviewer for the comment. The caption has been updated to explain GHG emissions from the food supply chain.
Rachel	Licker	Figure	11. Agriculture, Food Systems, and Rural Communities	Figure 11.15					I appreciate this figure as an illustration of variability and we can clearly see regional trends. Does FEMA or other research provide an explanation of this variability? Again, being able to situate the causes of variability would contribute to our understanding of interactions with climate change drivers and possible interventions.	We thank the reviewer for the comment. The figure has been revised to include maps for each of six sub-indexes which provide better understanding of the factors influencing resilience of communities in different regions
Marcy	Rockman	Text Region	12. Built Environment		3	3	3	4	Appreciate mention of culture and heritage here! Suggest the following rephrasing to incorporate a bit more context: "As people have often lived areas that are now urban systems for long periods of time, they incorporate culture and heritage, alongside nature."	Many thanks for highlighting the chapters acknowledgement of historical heritage! The chapter authors also appreciate the reviewer's suggested edit. However, we believe that the existing sentence construction more completely addressed the range of conditions that define the built environment. Namely, we are concerned that it might be a bit of an overstep to suggest that people live in urban systems. Urban systems are social and analytical devices that help us understand the complexity of our world. As such, people do not live in urban systems. Again, we appreciate your consideration for raising this suggested edit.
Rachel	Licker	Text Region	12. Built Environment		3	3	16	29	The text does not acknowledge the lack of inclusion of frontline communities in climate governance. I would recommend adding a sentence or two about power & decision-making.	Many thanks for this comments. As suggested, we have inserted an additional sentence at the beginning of section KM12.4 to highlight recent improvements in climate governance and decision-making. This sentence reads: "Urban planning has made progress to include communities that have been historically excluded from decision-making." We have also reframed our language around equity to improve writing clarity and conciseness across the chapter.
Ariela	Zycherman	Text Region	12. Built Environment		3	3	21	22	Suggest adding "transportation" to the list provided	Many thanks for this suggestion. We have added 'transportation' to this sentence.
Jim	Titus	Text Region	12. Built Environment		3	4	30	21	The key message and text referring to "urban areas" is potentially confusing. It is true that urban areas contribute alot of emissions, but emissions per capita are less than in rural and exurban areas for many reasons that are well-known, yet not highlighted here at all and only mentioned in a way that seems designed to dismiss the benefits of smart growth on lines 16-18. The implication seems to be that urbanization increases emissions, when in reality, it is the rising population and total economic activity. This text should be rewritten to more carefully explain that higher densities generally have lower per capita emissions than the lower density areas, but because this is where most of the people live, its where most of the emissions are.	Thank you for your comment. Per your comment, while it is well known that emissions per capita in urban areas are lower, the text and the recent cited work indicate that (a) urban areas are responsible for some of the rural and exurban emissions due to consumption and attribution; (b) greenhouse gas emissions from urban areas are under-counted (Gurney et al 2021); and (c) there are considerable variances between cities and suburban areas. This should emphasize the importance of smarter growth patterns, regardless of where it occurs in urban regions. Finally, if avoiding the worst effects of climate change requires complete decarbonization of our energy sources, then all areas will have to transition their use of energy regardless of per capita emissions.
Rachel	Licker	Text Region	12. Built Environment		3	3	30	30	The title is unclear - what is a "center of climate change"? If this is about cities as hotspots, per Fig 12.4, use that instead.	Many thanks for this suggestion. The section title has been amended. The word 'hotspot' has been removed from the chapter.
Rachel	Licker	Text Region	12. Built Environment		3	8	30	16	This section could be significantly strengthened by adding other urban drivers of climate change. Elaboration on buildings, transportation systems, industry, consumption, waste, and land use would be helpful. Data would allow us to compare between the different types of cities and practices (e.g. availability of public transportation). Theoretical framing - perhaps in terms of urban metabolism would allow the readers to understand the flows of materials and wastes (including greenhouse gas emissions) in urban areas. In the finaly paragraph, p. 8 lines 9-16, the authors state that advances in science exist but do not tell us what the new science shows. Having those insights is critical for a new NCA release.	There are a great number of system interactions that we, unfortunately, do not have the room to accommodate. We have cited specific updated information and tools, removed the broad references science advances and refer updates in science to Chapter 2 Climate Trends. Thank you for your commentary.
Rachel	Licker	Whole Page	12. Built Environment		3	3			In the introduction before key message 12.1 I was surprised to see little mention of population/urbanization treands; even though its briefly discussed around Figure 12.2 I think in the 1st several paragraphs its important to name the extent to which America is urbanizing to further situate this chapter. and the extent to which more residents in cities will be exposed to the kinds of climate changes presented here.	Thank you for this comment. Partly due to the fact that the Census Bureau's definition of urban and rural areas has changed over the past century, and partly because urban and rural landscapes continue to change in composition and character, we do not have space in our chapter to address this point.
Rachel	Licker	Text Region	12. Built Environment		4	5	14	2	This section is somewhat unclear in explaining absolute and relative urban emissions and assigning responsibility/future projections. It would be great to see some numbers (per capita emissions between urban/suburban/rural areas, variation with density, variation with income levels). Figure 12-1 also suggests that transportation might make a difference, so comparing transportation systems might be helpful here. Finally, I would recommend careful evaluation of any arguments regarding growing urban population based on this data given the (racist and xenophobic) historic arguments regarding the role of population in environmental issues.	Many thanks for this comment. Given space limitations, we are unable to offer projections of future per capita emissions between urban/rural areas and variations in density, income levels, etc. Our chapter draws on existing projections and assessments from SOCCR2 (2018) and cross-references to other NCA5 chapters such as Chapter 32: Mitigation. The revised text also included cross-references to Chapter 13: Transportation. In terms of the text on growing urban populations, our objective is to highlight the relationship between urban population density and GHG emissions (and future projections). This is paired with elaborations on social equity and justice discussions in sections KM12.3 and KM12.4, including a nuanced approach to assessing impacts on frontline and overburdened communities (including cross-references to Chapter 20: Social Systems).
Jim	Titus	Figure	12. Built Environment		5		3		Figure 12.2 is misleading and should be redone. Given all the prose about urbanization and density, the chapter needs a figure depicting density. This map does not show density but rather shows the total population of counties. As a result, a large low density county can potentially look darker than high-density but smaller counties. Hence Arizona is darker than New Jersey. It would be pretty easy to revise this map by simply replacing total population by density in the attribute table used to generate the map--then displaying it all county by county would not be misleading. The state boundaries also need thinner, and replaced with actual state boundaries rather than superfluous shorelines with the possible exception of Lake Michigan. But something else is amiss with Lake Michigan: The figure shows lots of counties in the Lake.	Many thanks for this comment. The focus of KM12.1 is on emissions from cities, so we have therefore redrawn Figure 12.1 to show production-based emissions at the county-level, both in terms of (a) total emissions and (b) emissions per capita. The map on population projections has been removed and changed into a line graph that shows overall urban-suburban-rural population proportions from now until 2100 in the context of SSPs. We no longer show population density or state/county boundaries.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Nick	Procopio	Figure	12. Built Environment		5				Figure 12.2 is difficult to interpret due to the small sized image and county scale. Recommend at least making the images larger. It is difficult to infer variability in NJ counties. Additionally, what is the value in showing short term differences from 2010 to 2020? It might be more informative to replace the 2010 portion with an older US census dataset (e.g., 1980?).	Thank you very much for highlighting the legibility and utility of Figure 12.2. We have communicated this visual limitations of this figure to the assessment design team. A final version of the graphic will meet a variety of design and visual accessibility standards. As it relates to the underlying temporal dimensions of the data, the concensus of the chapter authors is that such a range is useful, particularly because carbon benchmarking in the U.S. is often benchmarked to dates contained within a more recent range. Furthermore, selecting the 2010-2020 timeframe directly builds on the Built Environment Chapter in NCA4, which references previous decadal censuses, so there is no need to duplicate previous assessment efforts.
Rachel	Licker	Text Region	12. Built Environment		7	8	1	8	While discussing urban temperature (and urban heat island) in relation to LCZs is important, I am having a hard time seeing how it fits into the key message that is about drivers of climate change. It seems like it would be more fitting into a separate section about climate change impacts and adaptation strategies? (Since this is about heat?)	Thanks for your comment. The section has been revised according to this suggestion. The paragraphs on LCZs are now moved section KM12.2 on climate impacts. Our assessment of mitigation and adaptation options remain in section KM12.3.
Ariela	Zycherman	Text Region	12. Built Environment		7	7	5	5	There is the word "Figure" at the end of this line that doesn't seem to be part of a sentence.	Many thanks for pointing this out. The word has been removed from this sentence.
Ariela	Zycherman	Figure	12. Built Environment		7				The relationship between the icons in the left and the bars on the right in the figure isn't completely clear to me. If this is the proportion of effect a pie chart would be simpler. But the associations with temperature change imply a magnitutde or type of geometry, etc. that is not specified.	Many thanks for this comment. We have revised the figure title to better explain the relationship between the icons and bars in this figure. The figure is a replication of one that appears in the IPCC 6th Assessment Report Working Group 3 report (see Doblas-Reyes 2021). The figure is a general illustration highlighting the potential of each built environment category to moderate/mediate temperatures in urban settings.
Rachel	Licker	Text Region	12. Built Environment		8	8	21	23	Unclear sentence - risks are concentrated in cities vs. rural areas or are concentrated in some areas in cities?	The chapter authors appreciate the reviewer's comment. The passage has been revised to clarify this point. Rural areas are outside of the scope of this chapter.
Rachel	Licker	Text Region	12. Built Environment		8	9	26	7	In this section, you start with infrastructure and financial cost and provide examples, but do not include human costs. I would recommend adding an example.	The chapter authors appreciate the reviewer's comment. Human costs are difficult to assign a monentary value, hence the authors noted first the impacts to resident's security, health and quality of life and then follow with damages which have had monetary values determined and cited in the literature.
Rachel	Licker	Text Region	12. Built Environment		9	9	2	6	The sentence on these lines combines two facts that are not connected - different climate change impacts, different way to quantify risks, different locations... It would be useful to classify the types of impacts (you suggested infrastrcture, human, and financial) and then providing an example of accounting for each perhaps in the same disaster (e.g. a hurricane impact on infrastructure, costs, and human impacts).	The chapter authors appreciate the reviewer's commentary regarding the combination of types of impacts and quantification. The chapter text in section KM12.2 has been revised to offer a high-level synthesis of average annual costs of climate change on select built environment sectors. However, word count constraints mean that we are unable to classify in detail the different types of impacts.
Rachel	Licker	Text Region	12. Built Environment		9	9	2	3	The reference is from 2019 but the line reads "From 2017 onward...". Is that past 2019? Is it a projection? Do we know if it is accurate since it's past 2019?	Many thanks for this comment. This passage has been removed from the main chapter text. A revised sentence citing Congressional Budget Office estimates of average annual losses into 2100 is now placed in the Traceable Accounts section.
Jim	Titus	Figure	12. Built Environment		9		3		The reference to "climate-influenced hurricanes" is confusing without additional explanation. Are there separate classes of climate-influenced and climate-insensitive hurricanes? If so that needs explanation. Or is this the incremental damage from the hurricanes due to global climate change relative to what we would have with pre-industrial atmospheric concentrations?	The chapter authors greatly appreciate the reviewers comments regarding the attribution of extreme weather perils to climate change. The chapter text has been revised to remove this sentence for clarity and conciseness.
Jim	Titus	Figure	12. Built Environment		9	9	5	5	The meaning of being 1255% more exposed to extreme wildfires is unclear. Nor is it clear whether this is attributed to climate change or building in the forest-urban boundary. One would assume from the text that this is the impact of climate change; but either way this needs clarification.	The chapter authors greatly appreciate the reviewers comments regarding the attribution of extreme weather perils to climate change. The chapter text has been revised to remove this sentence for clarity and conciseness.
Rachel	Licker	Text Region	12. Built Environment		9	9	6	7	The final sentence of the paragraph does not follow the information presented in the paragraph. To be able to conclude with the sentence, the paragraph should explain how extreme events are attributed to climate change. Instead, the paragraph is about putting numbers on the cost - so perhaps this sentence should be "being able to calculate the financial and human costs ..."? (Of course, human costs are uncalculatable...)	The chapter authors appreciate the reviewer's comment. This section has been substantially revised for clarity and conciseness. We have inserted a cross-reference to KM6.3 that discusses attribution of climate impacts to infrastructure losses. This can be found in a revised section assessing average annual losses in section KM12.2.
Ariela	Zycherman	Table	12. Built Environment		9				Projections to 2090 seem very far away for most people to imagine. People tend to discount things very far in the future and to assume that technological solutions will be found. Would it be possible to use a closer date like 2050 and note that this is in 30 years? Also consider putting the figures in billions since that was used in the text above, and will make the numbers shorter and easier to read.	Thank you for this comment. The research that is cited by Martinich and Crimmins 2019 only has estimates for 2090. We have taken your suggestion to change this to billions.
Ariela	Zycherman	Table	12. Built Environment		9				I don't know if SSPs and RCPs are going to be described in the overall report frontmatter, but I think that it would be worth explaining the differences between them, and why for example this table is focused on RCPs while earlier in the text the focus was on SSPs.	The chapter authors appreciate the reviewer's comment. This table has been removed from the chapter and so RCPs and SSPs will been defined in the overview chapter (Chapter 1) and in the supplemental glossary.
Reid	Sherman	Table	12. Built Environment		9				Check for updated cost estimates for roads, bridges, rail. These may be out of date.	Many thanks for this comment. In our revised chapter text, we have double-checked the loss estimates for transportation infrastructure including roads, bridges, and rail and these numbers are correct (unadjusted 2015 US$). The sentence reads: "For transportation infrastructure, average annual losses are estimated to range from $8.1-20 billion for roads, and $510 million to $1 billion for bridges in 2090 (undiscounted 2015 dollars) (Martinich and Crimmins 2019)."
Jim	Titus	Text Region	12. Built Environment		10		2		The reference to coastal community is vague or inaccurate, and the sentence seems to mix counties and community. The population estimates are for counties, not communities. Counties extend inland, so the suggestion that 65% of the GDP is exposed to sea level rise is simply wrong. The fact is not totally irrelevant, but it would be better placed earlier where there is a general discussion of urbanization than here, where it is misleading.	The chapter authors greatly appreciately the reviewer's comments with regard to communities and counties. The chapter text has been revised to list coastal counties specific to the population and GDP numbers, as is consistent with the citations. The rest of the section has been removed. The bulk of the discussion on sea level rise on coastlines has been left to the Coastal Effects chapter.
Ariela	Zycherman	Text Region	12. Built Environment		10	10	2	2	I assume there will be a link to the Coasts chapter here.	Many thanks for pointing out this cross-referencing opportunity. This sentence now refers to Chapter 9 "Coastal Effects".
Rachel	Licker	Text Region	12. Built Environment		10	10	2	8	What about storm surges during extreme weather events in areas with high sea level rise? And is there an equity dimension here? (Who will be displaced - who doesn't have resources to move?)	The chapter authors appreciate the reviewer's comment. The section has been revised to expand on the combination of sea level rise and extreme weather and the increase of risks disproportianately to overburdened communities (KM 4.2)
Rachel	Licker	Text Region	12. Built Environment		10	10	2	8	In this description of coastal community vulnerabilty- it's not immediately clear whether this is inclusive of rural coastal communities (like Alaskan villages for example), authors should take care to be explicit where possible about the differential threats to urban v rural coastal areas, based on your review of the literature.	Many thanks for this comment. Our chapter is tasked with assessing the science of climate change in/of the built environment, urban systems, and cities. As consistent throughout the entire chapter, this section of the text refers specifically to coastal communities that are denser and more urban in nature. However, in our assessment of average annual losses, we do include estimates for Alaska because of geographic inclusion.
Reid	Sherman	Text Region	12. Built Environment		10	10	5	5	Replace East Coast with Atlantic Coast.	Many thanks for this suggestion. This sentence has been amended to say "Atlantic Coast".
Jim	Titus	Text Region	12. Built Environment		10	10	6	6	This statement has two problems. First, the number of people who currently live below 1 meter has been revised downward from 3.5 million to 2 million by a 2023 paper that uses better data. (Titus. 2023 Environmental Research Letters). Second, the statement implies that all the people living there will be displaced, which is almost certainly incorrect for the next century, since most live in cities where shore protection rather than abandonment is likely and cost-effective at least for the first meter. (e.g. Table S14 of Titus 2023). On the other hand, there is some empirical evidence that in some of the most vulnerable counties, there have been displacements of about 70,000 people below 1 meter and over 500,000 people in floodplains.	Thank you very much for highlighting this recent paper from Titus (2023). We have included the suggested reference in section KM12.2. The language around displacement has been removed from this portion of the text. We now discuss displacement only in section KM12.3 in the context of the implications of mitigation and adaptation actions in cities.
Rachel	Licker	Text Region	12. Built Environment		10	12	9	6	I would recommend reorganizing the two paragraphs in this section based on topic and including commentary on disproportionate impacts in each. The first one should be about heat (and you can add an explanation why historically marginalized communities are more affected - this includes lack of vegetation, lack of infrastructure, comorbidity with other conditions that are caused by history of racism etc.) and impact of wildfires in another paragraph including an equity dimension.	Many thanks for this comment. We have reorganized the paragraphs here as suggested by the reviewer. We now include a bit more text on the disproportionate impacts of heat and its relationship to heat and health of urban residents. However, given space limitations, we are unable to extensively cover impacts posed by wildfires. Instead, we cross-reference the 'Focus on Western Wildfires' section of NCA5.
Jim	Titus	Figure	12. Built Environment		11		1		Figure 12.6 needs work and a better explanation. The plots suggest that the mean maximum temperatures in each of these cities is well over 115 degrees--possibly as high as 127 degrees--but that the mean maximum temperature is 30 to 35 degrees lower in other parts of the city. How is that possible? Are we comparing asphalt in the sun with shady areas with trees? The difference is so great that some discussion is needed. The temperature keys need work. These legends are repeated three times--and its unclear why they go down to 67 rather than 80 degrees. It would be better to remove the three identical legend scale from the maps, and instead have a single and fairly long scale below or to the right of those maps, allowing one to know what temperatures those keys signify.	Many thanks for this comment. The maps show maximum surface temperature for each of the three cities, hence there is a possibility that maximum temperatures vary by building environment type. We have checked these maps against the data source again and can confirm that they are indeed correct. We have inserted additional text to explain this in the caption. The variations in temperature are driven by a variety of reasons but our space constraints limit our ability to discuss them in the context of this figure. Regarding the legend, we have revised it to improve clarity.
Emma	Conrad-Rooney	Text Region	12. Built Environment		11	11	12	13	This sentence, "Observed and anticipated...lower educational access" should reference Chapter 20 Social Systems and Justice.	Many thanks for this suggestion. We have inserted a cross-reference to Chapter 20: Social Systems and Justice at the end of this sentence.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jim	Titus	Text Region	12. Built Environment		11		12		This sentence seems accurate by pointing out disproportionate impacts on low-income and people of color, but the sentences that follow only provide examples for low-income. Either "people of color" should be cut from the sentence of examples supporting that point should be added. For example, nationwide, Hispanics people are 50% more likely to live in a 500-year floodplain than the general population, Black citizens are 40% more likely to live below one meter. Nationwide, Black residents account for 58% of the people who have been displaced by coastal hazards from land below 1m, while accounting for less than 12% of the total population. TItus, JG "Population in floodplains or close to sea level increased in US but declined in some counties,Äîespecially among Black residents", Environmental Research Letters. 2023.	Many thanks for this comment. Our chapter has revised the way we refer to frontline and overburdened communities. The revised text now removed mention of 'people of color' and we have included a cross-reference to KM9.2 which makes the same point. We appreciate the suggested reference however we are unable to accommodate all suggestions due to space limitation.
Rachel	Licker	Text Region	12. Built Environment		11	12	12	6	This paragraph should make more explicit reference to environmental and climate justice issues as they manifest in urban systems and cities, and be more inclusive of other marginalized and overburdened communities beyond the brief list in the 1st sentence. This paragraph is a good overview of the exposure component of risk but I think under explains the sensitivity and role of segregation and racism in shaping the built environment and rendering those neighborhoods particularly vulnerable.	Many thanks for this comment. In the revised chapter, we have inserted additional references to environmental and climate equity/justice issues in both section KM12.3 and KM12.4. Our discussion of frontline and overburdened communities now includes more examples and specific cross-references to Chapter 20: Social Systems. We do not focus on the role of racism but we do make an explicit connection between past urban planning and development practices (including segregation) and how that has reinforced more exclusionary forms of decision-making in many cities.
Rachel	Licker	Text Region	12. Built Environment		11	11	15	15	What does productivity mean here and how does it contribute to your argument about disproportionate impacts of heat?	The chapter authors appreciate the reviewer's comment. The sentence has been removed from the revised chapter.
Ariela	Zycherman	Text Region	12. Built Environment		12	12	3	3	Is the "Ch. 28" here referring to the NCA Southwest chapter? There is not a section there called "Focus on Western Wildfires"	Many thanks for this comment. Yes, this sentences cross-references Chapter 28 "Southwest" and their extensive assessment of wildfire risks. The NCA5 writing style dictates that we name the chapter number and not say the entire chapter name in the cross-reference. NCA5 also includes a number of cross-chapter 'Focus on..." items such as the "Focus on Western Wildfires" component that we are cross-referencing here.
George	Xian	Text Region	12. Built Environment		12	12	7	9	Chapter 2 and Appendix 4 include Billion-Dollar Weather and Climate Disasters data. Most of disasters caused damages in built environments. This chapter can use these examples to explain the impact of climate disasters in urban areas.	Thank you for providing this editorial suggestion. Not all extreme events are attributable to climate change. Unfortunately, we do not have adequate literature to disaggregate between climate and non-climate attributable losses that represent internal and external impacts within the built environment.
Marcy	Rockman	Text Region	12. Built Environment		12	12	17	28	Topic that could be added here is the embodied carbon that is held in buildings that are already built - both historic and those that are built but not yet historic. This aspect of historic and existing buildings - that we've already emitted carbon in building them, so should make best possible use of them - is slowly gaining attention, but does not appear to be as well known as efforts to design new green buildings. The lead scholar for embodied carbon in historic and existing buildings is Carl Elefante, a reference that could added here is Elefante 2017, https://www.jstor.org/stable/10.2307/26250094. A new tool is also in the process of being launched that compares carbon costs of retrofitting existing buildings as compared to building new buildings, CARE Tool (Carbon Avoided: Retrofit Estimator): https://caretool.org.	Many thanks for this comment. The chapter authors have considered how to address the the concepts of embodied and operational carbon in new construction and in retrofits. For instance, one proposition that we reflected on is the idea that embodied carbon in buildings will continue to go up as operational carbon comes down. We concluded that drawings these distinctions might confuse a general audience and that it would be best to highlight a higher-order framing of the issue of carbon in buildings. We most definitely appreciate this comment, as it is consistent with our review of the literature and state of practice.
Ariela	Zycherman	Text Region	12. Built Environment		12	14	18	9	Suggest giving examples of land use and zoning changes. For example, form-based codes address the relationship between building facades and the public realm, the form and mass of buildings in relation to one another, and the scale and types of streets and blocks. See: https://formbasedcodes.org/definition/	Many thanks for this comment. In the chapter, land use and zoning tools have been referenced as mechanisms for both mitigation and adaptation. At present, there is not sufficient observational research to highlight recent experience in terms of broad scale deployment that would warrant the identification of precise applications and experiences. At this juncture, we simply recognize the value of such tools consistent with the available published literature.
Ariela	Zycherman	Text Region	12. Built Environment		12	12	18	18	Suggest giving examples of policies, such as Complete Streets, Vision Zero, and Safer Routes for All which can support active transportation.	Thank you for bringing forward the various transportation programs to our attention. The chapter has been revised to make a more explicit case between land use and transportation (including cross-references to Chapter 13: Transportation). However, the programs cited herein more or less relate to public safety programs that are secondary to the considerations defining this exercise.
Joseph	Sollod	Text Region	12. Built Environment		12	12	22	28	The following statement cites the 2021 International Building Code (IBC) as providing commentary on the adequacy of code content which is not the case. We recommend removing this reference. Building codes represent a highly cost-effective strategy to help protect communities from the risks posed by natural and man-made hazard events. According to the Federal Emergency Management Agency, the adoption of modern building codes is the single most effective response to extreme weather hazards. One change in building codes can save lives and protect property for generations to come. The National Institute of Building Sciences (NIBS), a research organization established by the U.S. Congress, found that investments in pre-disaster mitigation can save the U.S. between $4 and $11 for every $1 invested. The continual update of building codes provided the greatest benefit at $11. There is also a clear opportunity to introduce future-focused climate science into buildings codes and standards to account for the increased magnitude, frequency, and geographic distribution of extreme weather hazards due to climate change. Doing so will increase the effectiveness of buildings codes in response to these hazards and enhance comprehensive community resilience. The Global Building Resilience Guidelines (Guidelines), a guidance document developed by the Global Resiliency Dialogue through the gathering of insight from leading building sector stakeholders around the world, provides a basis for advancing building resilience through building codes. The fifteen principles of the Guidelines can inform the development of building codes and standards that incorporate future-focused climate resilience. This resource has been submitted to the NCA committees for further guidance in development of this chapter.	The chapter authors appreciate the reviewer's commentary specific to building, design and engineering codes. The passage has been revised to make two fundamental points. First, we acknowledge that there has been progress in incorporating hazard mitigation and adaptation elements within model codes. However, there has been insufficient progress in incorporating these models codes within state and local jurisdictions. Second, there has been a lack of a comprehensive review and revision of building, design and engineering codes to address a wide variety of climate impacts. We agree that the model codes can be effective in reducing losses, but there is a great deal of work that would need to undertaken in order to address everything from thawing permafrost on foundations to wider gutters for extreme precipitation events. The literature suggests that this is particularly true in light of the work of other countries who have approached this challenge much more systematically than have standard development organizations in the United States.
Marcy	Rockman	Text Region	12. Built Environment		12	14	29	18	In this section, most likely on pg. 14 but potentially could work earlier in section, recommend incorporating mention that the US government, specifically the National Park Service, provides guidance on adapting historic buildings with respect to flooding (reference, https://www.nps.gov/orgs/1739/upload/flood-adaptation-guidelines-2021.pdf) and for energy efficiency (reference, https://www.nps.gov/orgs/1739/upload/preservation-brief-03-energy-efficiency.pdf).	The chapter authors appreciate the citation to the valuable work of the National Park Service. Indeed, with agency adaptation and mitigation plans, there is a tremendous amount of work happening in the federal government in adaptation and mitigation. However, the charge of the National Climate Assessment is to evaluate the state of external peer review science. As such, there is a focus on citations and work that is drawn from the scientific community. If federal, state, local and tribal efforts are captured in the literature, we are obligated to evaluate that literature. But, unfortunately, this assessment is not the optimal forum for extensively citing agency-level work. Thank you for your contribution and thoughtful response.
Rachel	Licker	Text Region	12. Built Environment		12	13	29	2	In this section, you discuss the implications of climate change for real estate, but miss displacement (formerly low-income neighborhoods that may be currently shielded from climate change may face displacement when upper income people move from formerly upper income coastal areas - e.g. Miami).	Many thanks for this comment. Section KM12.3 has been revised to highlight two pathways for climate gentrification (CG), including increased amenitization from adaptation interventions and from shifts in consumer demand, as referenced in this comment.
Jim	Titus	Text Region	12. Built Environment		13	18	1	4	The section on Mitigation and Adaptation lacks a clear organization. Mixing mitigation and adaption is already a questionable high-level organizational decision, because mitigation and adaption are so different with relatively small overlaps other than--to some exent--some of the people who might be engaged in the process. It would be a lot easier to follow this section if it had separate subsections on mitigation and adaptation (though perhaps the entire report has a rule against second-level headings. This section needs more about planning/regulation to balance the engineering changes. Both mitigation and adaptation involve both engineering and planning, and while they overlap to some extent, it is easier to follow a report that discusses them separately. In this section, the report says too little about planning/regulation. For adaptation, a fundamental planning question is what the land use should even be in flood-prone areas. Both mitigation and adaption can involve smart growth which can leave one with fewer areas needing protection from floods and lower energy demands.	Many thanks for this comment. Our chapter is divided into four sections: characteritization of urban/regional changes to and effects on climate; vulnerabilities and risks to the built environment; urban mitigation and adaptation options; and inclusive and equity in urban climate action. We understand the reviewer's critique about the effectiveness of combining our assessment of mitigation and adaptation; however, given strict space requirements, our chapter has elected to assess mitigation and adaptation co-benefits in the built environment. This decision rests on our expert reading of recent literature calling for 'climate resilient development' in the built environment (i.e., efforts that combine GHG mitigation, climate adaptation, and environmental sustainability). As such, our section KM12.3 takes this integrative view rather than to reinforce the separation between mitigation and adaptation action, and so we decided not to pursue the restructuring as suggested by the reviewer. We understand that there are practical implications to pursuing mitigation-adaptation co-benefits, which we highlight in our discussion of governance (KM12.3) and social equity (KM12.4). However, further discussions of practicality (especially in terms of regulations and policies to enable smart growth) is beyond the scope of this chapter given that we're tasked not to be policy prescriptive. Still, we make an effort to highlight specific examples and to cross-reference other efforts to highlight urban mitigation scientific assessments (such as SOCCR2, 2018) and other NCA5 chapters on adaptation (Chapter 31) and mitigation (Chapter 32).
Ariela	Zycherman	Text Region	12. Built Environment		13	13	8	11	I don't know where the text is referring the reader to with "Focus on Risks to Supply Chains" and "Focus on COVID-19 and Climate Change", I assume these are special sections of the NCA?	Thank you for your comment. Correct, these are other parts of the NCA 5 which provide additional information on cross cutting topics in the assessment.
Rachel	Licker	Text Region	12. Built Environment		14	14	2	3	The first sentence of this summary is stating a current fact ("cities are doing this now"), should it include a confidence/likelihood?	Many thanks for this comment. A confidence and likelihood statement is provided for the Key Message sentence: "Cities across the United States are mitigating GHG and adapting to adverse climate impacts (likely, high confidence)." An explanation of this confidence/likelihood statement is provided in the chapter's revised Traceable Accounts section.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Licker	Text Region	12. Built Environment		14	14	8	9	It seems that the two categories of interest are adaptation (impacts) and mitigation (both lowering GHGs and withdrawal of CO2 for instance by changing land use…) rather than the three categories mentioned in the sentence (is land use a separate category, mitigation, or adaptation, or a subcategory of both?).	Many thanks for highlighting this. As suggested, this sentence has been revised to list mitigation and adaptation. The revised sentence now reads: "City governments and residents have numerous options to lower GHG emissions and adapt to climate impacts (Table 12.2)."
Rachel	Licker	Text Region	12. Built Environment		14	14	17	18	Is there a reference for the claim about several hundred jurisdictions having plans to lower GHG emissions?	Many thanks for this comment. The sentence has been revised to include an reference. The revised sentence now reads: "Several hundred local jurisdictions have drafted climate action plans that specifically include GHG emissions inventories and reduction targets (Markolf et al. 2020)".
Joseph	Sollod	Whole Page	12. Built Environment		14				This comment is relevant to the entire section entitled Key Message 12.3. Urban Climate Mitigation and Adaptation Opportunities. This chapter should include off-site construction as a growing solution to reduce climate impacts of buildings while addressing cost burdens and enhancing social resilience and sustainability throughout the built environment. Off-site construction is the planning, design, fabrication, and assembly of building elements at a location other than their final installed location to support the rapid and efficient construction of a permanent structure. Off-site construction includes a variety of processes including volumetric modules, panels, pods, pre-fabricated ADUs, tiny homes, and shipping containers. Off-site construction is characterized by an integrated planning and supply chain optimization strategy. Off-site construction or pre-fabrication has been identified as a core strategy in addressing multiple building industry and societal challenges, including sustainability and access to affordable housing. Off-site construction can reduce material waste while enhancing building quality and improving the safety of builders. Off-site construction can also provide opportunities for more expedient rebuilding post-disaster. Another key benefit of off-site construction is replicability and efficiency in process. With nearly 30% of all building materials delivered to a construction site ending up as waste and the possibility of off-site constructed projects providing embodied carbon savings up to 45%, off-site construction poses an extreme climate mitigation and sustainability benefits. The use of off-site construction is expected to increase significantly as the building industry and society struggle to address key challenges including the availability of affordable housing, a lack of skilled workers, material use and sustainability, job safety and industry productivity.	The chapter authors thank the reviewer for their focused commentary on the value of off-site construction. As the reviewer recognizes, the scalability of off-site construction is currently limited by transportation costs and capacities. The chapter authors have reviewed the literature and we find a lack of a systematic review of lifecycle analysis of off-site construction, particularly as it relates to energy, carbon and environmental benefits. Unfortunately, we are not able to highlight and address many valuable opportunities that are arising in practice. Again, thank you very much for brining this key opportunity to the forefront of consideration.
Ariela	Zycherman	Table	12. Built Environment		14				Suggest highlighting an example of zoning and land use reform. Enabling Better Places: A Handbook for Improved Neighborhoods (https://www.aarp.org/content/dam/aarp/livable-communities/tool-kits-resources/2020/AARP-CNU-EnablingBetterPlaces121520-singles.pdf) was developed by AARP and Congress for New Urbanism to provide options for communities to consider as they identify and select small-scale, incremental policy changes that can be made without overhauling entire zoning codes and land use policies	Thank you for highlighting the value of spatial planning in co-locating urban development with affordable and accessible transportation infrastruture as a means for reducing emissions. The chapter has been revised to include an additional reference to this linkage.
Ariela	Zycherman	Table	12. Built Environment		14				Are the chapter references here correct? Why is the SW called out for risk assessment specifically?	Many thanks for pointing this out. We have removed this cross-reference to Ch. 28 in Table 12.2.
Reid	Sherman	Table	12. Built Environment		14				Good use of examples from other chapters- this type of cross-walk could be applied in other chapters.	Many thanks for acknowledging this. We also agree that cross-referencing to other chapters will increase readability of our chapter.
Ariela	Zycherman	Text Region	12. Built Environment		15	16	9	3	It would be nice to also say that forward-looking designs can also be used to address EJ issues.	Thank you for the commentary to link the use of forward-looking information to address environmental justice issues. We believe this is mostly addressed already in the sentence reading "Forward-looking designs and governance solutions that consider joint social, ecological, and technological systems (SETS) can better anticipate and respond to future climate change", which also reinforces the link to core tenets of Environmental Justice.
Rachel	Licker		12. Built Environment		16	16	12	15	Can you name the equity concerns?	Many thanks for this comment. We have modified this paragraph significantly to now clarify that property value changes occur from increasing amenity values.
Ariela	Zycherman	Figure	12. Built Environment		16				Some of the bubbles here don't make sense to me. How do green roofs facilitate active mobility? Don't ag and gardens reduce heat stress?	Many thanks for this comment. The 'bubbles' in this figure are revised to reduce confusion. Specifically, under 'green walls', we have removed the 'active mobility' bubble. Under 'urban ag/gardens', we have removed 'active mobility' bubble. For urban gardens and heat stress, the literature notes the connection between urban gardens (as a form of green space) and their role in improving thermal comfort of urban residents. The role of urban gardens in reducing heat stress and increasing thermal comfort is well documented in the science (e.g., in the Shuaib et al. 2022).
Marcy	Rockman	Text Region	12. Built Environment		17	17	6	12	Recommend incorporating topic of encouraging building reuse here, as existing and historic buildings already embody the carbon used to build them. Key reference for this is Elefante 2017, https://www.jstor.org/stable/10.2307/26250094. Also, a new tool is also in the process of being launched that compares carbon costs of retrofitting existing buildings as compared to building new buildings, CARE Tool (Carbon Avoided: Retrofit Estimator): https://caretool.org.	Many thanks for this comment. The chapter authors have considered a wide variety of scientific literature associated with retrofits and decarbonization. We appreciate the citation that we have reviewed. At this time, the chapter will not be revised to add additional references with regard to building retrofits.
Rachel	Licker	Text Region	12. Built Environment		17	17	6	10	In the sentence, you bring up negative impact of cities on local and regional climate, yet you never discussed this before. It sounds very interesting, can you incorporate it?	Many thanks for this comment. Our chapter does assess the ways in which cities (the built environment in particular) affect/impact the local and regional climate. In section KM12.1, we highlight how land-use and land-cover change significantly influence local and regional climates (while cross-referencing Chapter 6). We also note how "changes in design, form, and mass of buildings and configurations of streets, open spaces, and water features—as well as their interactions—have direct effects on urban temperature". This assessment is reinforced by Figure 12.4 showing the effect of different factors at warming or cooling urban areas. At the end of Section KM12.1, we note how urban areas will continue to be significant drivers of climate change as future GHG emissions and land-use changes increase due to projected urban growth (while again cross-referencing Chapter 6).
Rachel	Licker	Text Region	12. Built Environment		17	17	10	12	Is there a connection between this sentence and the previous part of the paragraph? It seems like this fits with some of the work in previous paragraphs (e.g. building mitigation at the start of the key message) but does not necessarily follow the start of this paragraph.	Many thanks for highlighting this. This sentence on building certification programs has been moved up to the second paragraph in Section KM12.3. We agree that this sentence fits better at the start of this KM section.
Ariela	Zycherman	Text Region	12. Built Environment		17	17	11	11	This says Phius n.d., but in refs is listed as Phius 2022	Many thanks for noting this. The reference has been amended to say Phius 2022.
Jessica	Evans	Text Region	12. Built Environment		17	17	18	22	AMWA and WUCA recommend USGCRP consider adding information about the differing needs for climate change mitigation and adaptation across different built environment sectors in this section and chapter. One important piece of information to add is "Additional sector-based networks exist to help cities understand and connect on climate change adaptation (suggested citation: https://www.wucaonline.org/assets/pdf/WUCA-leading-practices-report-2021.pdf)."	Thank you for the commentary relating to a more precise outlining of differening institutional capacities and pathways for mitigation and adaptation. While this is an important consideration for local practice in terms of the politics of who pays and who benefits, we do not believe that the range of issues here can be adequately and succiently summarized for readers. As such, this is perhaps too far "in the weeds" for our readers. However, we have gone back through the chapter with this point in mind and we will continue to highlight capacity issues that we believe are critical for both mitigation and adaptation among infrastructure providers.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Matthew	Eisenson	Text Region	12. Built Environment		17	18	23	4	The subsection on opportunities for climate mitigation and adaptation in urban areas identifies several barriers to climate action by local governments, including the long duration of planning processes, financial constraints, knowledge gaps, and others. Missing from this analysis are the very concrete ways that local governments can face legal barriers to climate policy adoption and implementation: (1) by state preemption and shaping of local law; (2) fear of litigation and protracted controversy; and (3) limited staff legal capacity. Each of these factors makes it less likely that local governments will undertake the ambitious climate policies described throughout Chapter 12. With respect to point (1) above, when considering local authority to act on climate, it is important to note that all local governments are merely "creatures of the state" in which they are located. In the words of the Supreme Court, "A municipal corporation is simply a political subdivision of the State, and exists by virtue of the exercise of the power of the State through its legislative department. The legislature could at any time terminate the existence of the corporation itself, and provide other and different means for the government of the district comprised within the limits of the former city. The city is the creature of the State." Trenton v. New Jersey, 262 U.S. 182, 189-90 (1923). In establishing the U.S.'s federalist system, the Constitution allocated certain powers to the federal and state levels of government, but was silent on local governments. States, then, established local subdivisions with their own governing bodies to oversee aspects of governance more appropriate (by whatever measure) for a smaller geographic entity. Before getting to the substance of the state law limitations on local authority, then, it should be acknowledged that this fifty-state multiplicity of jurisdictions gives rise to confusion within local jurisdictions unclear on their authority to adapt climate mitigation policies enacted in municipalities in other states. For example, many local governments are currently considering all-electric building construction requirements, as enacted by dozens of municipalities in California, and building performance standards to regulate existing building energy use and carbon emissions, as in place in New York City, St. Louis, Washington, D.C. and elsewhere. In both instances, local governments in other states face significant questions about how to adapt these policies to their own local legal contexts. For more on the kinds of legal questions local governments may face with regard to authority to enact climate-	The chapter authors appreciate and value the reviewer's commentary specific to normative responses to barriers for climate mitigation and adaptation action by state and local stakeholders. We have reviewed the analysis and the cited academic and gray literature. Unfortunately, we are unable to accomoodate the request for edits. It is the policy of the National Climate Assessment and the U.S. Global Change Research Program to not to engage in normative or prescriptive policy positions. Our fundamental job is to review the state of the science and social science. We very much appreciate your thoughtful analysis and your time in preparing this analysis.
Rachel	Licker	Text Region	12. Built Environment		17	17	23	27	I wonder if there is a way to classify these barriers - information, financial, social, technological... I think barrier classification across domains could be very effective since this is a review of evidence.	Many thanks for this suggestion. The different barriers to urban climate action have already been extensively assessed and categorized in the NCA4 Built Environment chapter (Chapter 11) -- see Section KM11.4 (pages 454-455 of the public draft) which highlights the role of financial/funding, technical/technological, social, and governance barriers. Given space limitations in our NCA5 chapter, we think it is appropriate to just briefly synthesize these barriers in the chapter text. Our goal is to build on the work done in NCA4 to assess potential options to further climate action in light of (or inspite of) these barriers.
Rachel	Licker	Text Region	12. Built Environment		17	18	27	1	You mention that the barriers are acute in cities not able to plan for complex challenges, but isn't it the other way round - the cities have these barriers and therefore they are not able to plan for complex challenges? (Or would you argue that the complex challenges cause the barriers? Exacerbate the barriers?)	Many thanks for this comment. This sentence has been clarified to highlight how resource and capacity barriers constrain the ability of cities to plan for long-term climate changes. The sentence now reads: "These barriers constrain the ability of cities to plan for long-term and complex climate challenges (Ch. 18), such as extreme heat and drought (Keith et al. 2021), or to effectively evaluate planning progress (Lopez-Cantu et al. 2020)."
Joseph	Sollod	Whole Page	12. Built Environment		17				Building codes and standards are an important mechanism to drive the achievement of national and community goals (including resilience and sustainability). Recognizing the important role of building codes to serve community resilience, safety and welfare, the White House has developed the National Initiative to Advance Building Codes (NIABC). The NIABC is a government-wide effort to boost national resiliency and reduce energy costs. Under the initiative U.S. federal departments and agencies will review federal funding and financing of building construction to ensure projects follow updated model codes and provide incentives and support for communities to adopt modern building codes. However, building codes are not adopted universally across the country. The Code Council recommends enhancing the discussion on the essential role of building codes in advancing buildings and the building industry towards the emissions reductions necessary to achieve necessary climate targets and the resilience needed to respond to the growing impacts of climate change. The International Code Council,Äôs National Green Building Standard (ICC 700), as mentioned, is just one mechanism in ICC,Äôs suite of model codes and standards. The International Residential Code, International Building Code, International Energy Conservation Code, and International Green Construction Code all offer solutions to mitigate and adapt to the impacts of climate change. Energy codes are highly effective in reducing energy use and GHG emissions while enhancing their resilience, which is critical to mitigate the impacts of climate change. The U.S. Department of Energy (DOE) evaluates improvements in the International Energy Conservation Code (IECC) once a new edition is released every three years. Since 2006 the residential provisions of the IECC have delivered about a 40% improvement in energy savings. Improvements in the residential and commercial provisions of the IECC since 2009 will provide over 350 million metric tons (MMT) of CO2e savings for residential buildings and 340 MMT for commercial buildings, totaling nearly 700 MMT of savings. The residential provisions in the 2021 edition of the IECC provide a 9.4% improvement in energy use and an 8.7% reduction in carbon emissions over the 2018 edition. The commercial provisions in the 2021 IECC provide site energy savings of 12.1% and a 10.2% GHG emissions savings for commercial buildings relative to the 2018 IECC. Building codes address multiple other important climate factors including water use, materials and	Many thanks for this comment. The chapter authors have received a good number of productive comments with regard to building codes. The chapter authors greatly appreciate the reviewer's citation to the model codes and their estimated and projective impacts, particularly in terms of climate mitigation. The chapter text has been revised to highlight existing literature that has reviewed various emissions and energy reduction efforts memorialized in building codes. The chapter text has also been revised to highlight the extent to which state and local uptake of advanced model codes has been observed to be inconsistent at best. Thank you again for your valuable and productive commentary.
Joseph	Sollod	Whole Page	12. Built Environment		17				Trying to respond to disaster events in real time is unsustainable ,Äì too many lives are impacted, and the economic costs are too high. Pre-disaster mitigation, generally defined as investments in actions that can reduce the impacts of hazards, has been proven to be highly cost effective. Building codes must be recognized as an essential mitigation tool for communities. This section should highlight their important role. The National Institute of Building Sciences (NIBS), a research organization established by the U.S. Congress, found that investments in pre-disaster mitigation can save the U.S. between $4 and $11 for every $1 invested. The continual update of building codes provided the greatest benefit at $11. These benefits represent avoided casualties, property damage, business interruptions, first responder expenses, and insurance costs, and are enjoyed by all building stakeholders ,Äì from developers, titleholders, and lenders, to tenants and communities. Requiring the current International Residential Code (IRC) and International Building Code (IBC) would prevent roughly $14,000 in losses per building in jurisdictions where codes have not been updated in the past two decades. The U.S. Federal Emergency Management Agency (FEMA) in its Building Codes Save: A Nationwide Study found that the IRC and IBC provided more than $27 billion in cumulative mitigation benefits against flood, hurricane wind, and earthquake hazards from 2000 to 2016. If construction continues at the pace the study observed and if the proportion of that construction adhering to the codes is consistent with the trend the study identifies, codes could help communities avoid $132 billion to $171 billion in cumulative losses through 2040. If all new buildings across the U.S. were built to modern codes, the country would save more than $600 billion by 2060.	The chapter authors greatly appreciate the reviewer's commentary specific to building codes, hazard mitigation, engineering resilience and building resilience. The chapter text has been revised to highlight the the value of building codes in both mitigating and adapting to climate change. In addition, the text has been revised to highlight the extent to which hazard mitigation and resilience elements have been incorporated into model codes. Thank you again for taking the time to provide this valuable commentary.
Ariela	Zycherman	Text Region	12. Built Environment		18	18	3	4	Disparities of what? Need more meat here.	Many thanks for this comment. Comment #176515 also highlights this lack of clarity. This sentence has been rewritten to clarify how smaller cities experience the disparities highlighted in the previous sentence. The revised sentence now reads: "Smaller-sized cities and communities generally have less resources and capacity to deal with these challenges."
Rachel	Licker	Text Region	12. Built Environment		18	18	3	3	Disparities in what are documented in smaller cities? In barriers? Or in ability to deal with mitigation/adaptation?	Many thanks for this comment. Comment #175684 also highlights this lack of clarity. This sentence has been rewritten to clarify how smaller cities experience the disparities highlighted in the previous sentence. The revised sentence now reads: "Smaller-sized cities and communities generally have less resources and capacity to deal with these challenges"

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jessica	Evans	Text Region	12. Built Environment		18	18	11	13	AMWA and WUCA recommend USGCRP mention there are different needs for climate change investment across different built environment sectors in this section and chapter. It is worth mentioning that investment in water sector infrastructure specifically does not meet the estimated needs of the water sector. One assessment estimated the US water sector needs to invest a total of $109 billion per year in water infrastructure over the next 20 years in 2019 dollars to close the water infrastructure gap (https://www.uswateralliance.org/sites/uswateralliance.org/files/publications/The%20Economic%20Benefits%20of%20Investing%20in%20Water%20Infrastructure_final.pdf). Other water sector-specific investment resources that should be highlighted include https://journals.plos.org/water/article?id=10.1371/journal.pwat.0000039, https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/us-water-infrastructure-making-funding-count, https://infrastructurereportcard.org/investing-in-aging-water-infrastructure/.	Thank you for highlighting the funding gap that is projected to exist to maintain our current levels of service standards for water infrastructure and water quality. We have review the cited literature and grey literature. Given the lack of disaggregation between climate and non-climate attributed investment demands, we do not believe that these figures would be helpful in understanding climate-specific investments demands in the future.
Jim	Titus	Text Region	12. Built Environment		18	29	28	11	This section is too vague for most people to understand the points being made. It is also glib, starting with assertions about advancing equity and benchmarking social impacts, before it has even explained what the goal of social equity and benchmarking might be. But then, it never does explain the problem nor the options for solving the problem. This section needs to either be cut or allocated enough space to actually explain the issue--and also be reviewed by a someone like a journalist able to distinguish obscure writing from informative writing. The issues of social inclusion, equity, and diversity are already politically divisive in the United States. At least part of the problem is that many people react negatively to jargon (notable critical race theory) who would be willing to listen to the actual problems if explained in plain English.	Thank you for your assessment of the effectiveness of various sections of the chapter as they relate to issues of social equity and justice. We agree that these sections (and maybe even this response) are full of too much jargon. In response, we have thoroughly reviewed the chapter in order to provide more concrete examples and to remove unecessary jargon that stands of the way of communicating the state of the science and the social science. We have also synchronized our vocabularly around equity to improve clarity and conciseness. Please also see the additional contributions found in the glossary. Across NCA5, there has been a concerted effort to be consistent in our terminology and among our qualitative exmaples. Specific to your commentary on benchmarking, we direct you to the Social Systems and Justice chapter and Key Message 20.4 that has directly addressed this very important point.
Jim	Titus	Text Region	12. Built Environment		19	19	4	7	This sentence is jot clear. If floodplain restoration means converting residential/commercial areas back to agriculture of natural lands, it is not clear how that promotes development or shifts risks to disadvantaged communities. If it means something else, then I have no idea what even the first clause means, let alone the causality asserted.	The chapter authors appreciate the reviewer's commentary with regard to a lack of clarity associated with a reference to floodplain restoration. The sentence has been revised to assert that development may be achieved in adjacent areas and that risk may be diffused in unexpected ways, including in a situation where low-income households who are forced or choose to relocate often end-up (consistent with the observational literature) in low-costs areas that have high-hazard risks.Therefore, for some households, they are just substituting one risk for another. Thank you again for spotting this sentence. We hope that the revision is more effective in communicating this fundamental point.
Rachel	Licker	Text Region	12. Built Environment		19	19	10	12	I don't think this example is parallel to the first example - poor reotrofit is not an example of trade-offs between urban development, GHG emissions, and adaptation, but rather a trade-off between those three and financial barriers (I think!).	Many thanks for noting this. The original example has been removed from this section. Instead, this example of retrofits has now been moved to KM12.4 and is further clarified to better explain the point about potential trade-offs. The revised sentence now reads: "While high-quality building retrofits could prospectively improve comfort and indoor air quality, poor-quality building retrofits that simply seal-off buildings to minimize infiltration can worsen indoor air quality with higher levels of trapped indoor air pollutants (Ortiz et al. 2020).The corresponding occupant health burdens pose additional risks to groups that have historically received poorer healthcare services and have lived in historically redlined neighborhoods (Jessel et al. 2019; Thomas et al. 2019)."
Jim	Titus	Text Region	12. Built Environment		19	19	13	15	This glib assertion without any backup is not useful. Explain how the nature-based solutions are sometimes inequitable.	Many thanks for this comment. We have inserted additional examples and supporting assessment text to better explain the potential equity implications of nature-based solutions in section KM12.4.
Rachel	Licker	Text Region	12. Built Environment		19	19	13	15	Do you have examples of this in nature-based solutions?	Many thanks for this comment. We list notable examples of nature-based solutions in the text (KM12.3 section), in Table 12.2 (for instance under the 'natural infrastructure' header), and in Figures 12.9 (such as green walls, greenways, etc.) and in Figure 12.9 which shows the spectrum of technological to ecological/natural options. We also cross-reference Chapter 8 'Ecosystems, Ecosystem Services, and Biodiversity' to further highlight examples. Given space limitations in this chapter, we are not able to extend many valuable examples of all natured-based solutions found across US cities and regions.
Joseph	Sollod	Whole Page	12. Built Environment		25				To date, building codes include provisions and reference technical standards for design and construction to take account for most weather-related natural hazards based on minimum performance levels typically informed by historic data generated by past events. Building codes now must incorporate future-focused climate science and data to ensure resilience against the different hazards a building may face over its lifetime. The Global Building Resilience Guidelines (Guidelines) is a guidance document which consists of fifteen principles that provide a basis for advancing building resilience through building codes. The Guidelines were developed by the Global Resiliency Dialogue, through the gathering of global data from leading building sector stakeholders, intended to help inform the development of building codes and standards that incorporate future-focused climate resilience. This resource should be used to integrate some more context on the urgent need for building codes to adapt to the potential climate hazards of the future. This resource has been submitted to the NCA committees for further guidance in development of this chapter.	The chapter authors greatly appreciate the reviewer's commentary specific to building codes, hazard mitigation, engineering resilience and building resilience. The chapter text has been revised to highlight the the value of building codes in both mitigating and adapting to climate change. In addition, the text has been revised to highlight the extent to which hazard mitigation and resilience elements have been incorporated into model codes. Thank you again for taking the time to provide this valuable commentary.
Ariela	Zycherman	Text Region	12. Built Environment		37	37	21	21	This DOI did not work for me when I clicked on it.	Many thanks for noting this. As of the drafting stage of our chapter, the IPCC Sixth Assessment Report Working Group 3 (2022) chapter titled "Urban Systems and Other Settlements" is still under editorial processing. This explains why the DOI is not functional yet. The final chapter will be released by the time NCA5 is released. Currently the this source can be downloaded here: https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_Chapter08.pdf.
Jim	Titus	Text Region	12. Built Environment		44	44	7	12	It is not at all clear what these sentences mean. What is this heat planning that makes for worse indoor AQ? If it means trees, AQ, and eaves, then say so. What are these poor quality retrofits? Replacing window fans with Air conditioners that do not permit ventilation?	The chapter authors appreciate the reviewer's commentary with regard to urban heat planning and poor quality retrofits. The subject sentence has been revised to clarify that urban heat planning involves both the retrofit of buildings and the design of active landscapes that can help manage indoor and outdoor air quality and heat stress. In addition, the sentence citing the unintended health consequences of poor-quality retrofits has been significantly revised. In this case, retrofits that simply seal-off buildings to minimize infiltration and air flow have the unintended consequence of trapping indoor air pollutants that that have long been observed to drive a wide range of occupant health conditions. We hope that this revision helps readers understand that deep energy retrofits aren't as simple as air sealing a building.
Kathryn	Atherton	Whole Chapter	12. Built Environment						The chapter does not aptly describe the challenges and uncertainties around green infrastructure options. Many cities are investing in urban forestry and street trees, but studies have shown that maintaining urban trees is not as "green" as we make it out to be. I think that the chapter should prioritize describing these limitations so that cities don't naively invest in green infrastructure that can hurt more than help. I'm including some studies below that outline these limitations. Smith IA, Dearborn VK, Hutyra LR (2019) Live fast, die young: Accelerated growth, mortality, and turnover in street trees. PLoS ONE 14(5): e0215846. https://doi.org/10.1371/journal.pone.0215846 : In Boston, street trees are growing up to 5x as fast, but dying 2x as young as trees in rural Massachusetts. The authors modeled future scenarios with increased planting initiatives and found that Boston will lose street tree carbon storage over time unless the tree mortality issue is addressed. Petri AC, Koeser AK, Lovell ST, Ingram D. How Green Are Trees?,ÂìUsing Life Cycle Assessment Methods to Asses Net Environmental Benefits. J Environ Hort. 2016;34(4):101,Âì110. : With current maintenance standards and practices, an urban tree needs to live at least 33 years to become carbon neutral, but this can be reduced to 26 years if we used less mechanized tree maintenance practices. Roman LA, Scatena FN. Street tree survival rates: Meta-analysis of previous studies and application to a field survey in Philadelphia, PA, USA. Urban For Urban Green. 2011;10(4):269,Âì74. : In Philadelphia, PA, the half-life of urban street trees (the time at which cumulative survivorship is 50%) is 13-20 years. In combination with Petri et al., this shows that just planting street trees alone is not a solution to storing carbon. It's important to understand that while trees are important tools for heat exposure mitigation, they are not surviving long enough in urban areas to also serve as a carbon storage solution. Tree planting MUST be executed in combination with strategies to enhance mature tree survival -- that we currently don't know! Apart from ensuring that healthy mature trees are not cut down to make way for construction and development, we don't know what are the most important factors and strategies for improving urban tree health. The chapter could do a better job of mentioning these unknowns, even in a general sense, so that policymakers are not given the false sense that green infrastructure can be an adaptation "silver	The chapter authors thank the reviewer for their comments and the literature included in their formal submission. The citations have been reviewed and compared to our broader compendium of cited literature within our review of green and blue infrastructure. Please note that existing citations associated with green infrastructure and nature-based solutions were contained in the chapter draft that you reviewed. These citations are generally focused on trees as a basis for climate adaptation. As such, the chapter text has been revised to included a reference for the dual-capacity of green infrastructure to serve both mitigation and adaptation ends. In addition, the text has been revised to notate the intent to support trees to a mature state in their lifecycle. Unfortunately, we do not have sufficient allocated space to dive deeper in the lifecycle dynamics specific to carbon neutrality. We are most appreciative to the reviewer for bringing forward this literature and we hope that these edits have advanced the reviewer's broader intent of highlighting the value of lifecycle anaylsis in urban horticulture and forestry practices. We have additionally incorporated text on the social equity dimensions of green infrastructure related to the commenter's point about 'a false sense that green infrastructure can be an adaptation 'silver bullet''. We have also added one sentence to the paragraph just below Fig 12.9 to more explicitly refer to these complications and to highlight how these investments might be counterproductive if not approached correctly.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Caroline	Fleming	Whole Chapter	12. Built Environment						This chapter did an excellent job at quantifying the economic cost and effect of the built environment on climate change. I was particularly impressed by the consideration of climate change impacts on the different forms of the built environment and the sectors within them. One suggestion I have to improve this section is the consideration of marine urban ecology, particularly the effect of the built environment on marine organisms (oysters, oysters, mussels, whales). The following article, Todd et al. 2019, discusses these issues that I believe should be incorporated. https://onlinelibrary.wiley.com/doi/full/10.1111/oik.05946	The chapter authors thank the reviewer for their comments and the literature included in their formal submission. We have reviewed Todd, et al. (2019) and we find it to be a compelling summary of recent research in this "nascent field," as they cite. Given the relative novelty of this area (i.e., urban marine ecology) to applied fields (i.e., design, planning, and engineering) and the fact that marine ecologies are addressed in another chapter of NCA5 (see Chapters 9 and 10), we believe that there is not sufficient literature to connect to the various existing urban themes, issues and content contained in this draft. Our chapter is also constrained by word count limitations. As such, the authors have elected not to cite this article. However, we have referred the citation to another chapter team that we believe is better suited to assess this literature. Thank you again for highlighting an incredibly insightful area of scholarly inquire that is very likely to mature in the nearterm in a manner that will positively support planning and design considerations in the future.
Bilal	Ayyub	Whole Chapter	12. Built Environment						A key consideration is the impact of a changing climate on the engineering practices, such as standards, e.g., ASCE-7, ASCE24, Atlas14, etc. Engineering practices generally use historic information on hazards, such as temperature, rainfall, wind, storms, etc. The practices include design values, maps, tables etc. that are not suitable for planning and design. There is a need for a sustained assessment of the engineering practices as a result of a changing climate. Presently ASCE-NOAA are engaged in such work and established an ASCE-NOAA Task Force on Climate Resilience in Engineering Practice. It is advisable to include an assessment of the engineering practices in this regard in NCA5.	The chapter authors greatly appreciate the reviewer's insight specific to evolving and emerging professional practice standards in engineering, as well as architecture, landscape architecture and other applied design fields. This has been an active area of assessment for the chapter author team. As you recognize, a close read of the chapter text highlights the observed urgency and inadequacy of existing practices. We therefore highlight emerging engineering practices and standards (see KM12.2) and note how these may not be sufficient to address future climate changes. Beyond that, unfortunately, there has not simply not been published literature that has comprehensively and systematically identified and outlined the challenges that you raise. Our hope is that this literature will grow and mature in a manner to support more coverage in the next National Climate Assessment. Thank you again for your contribution. It has reinforced an important discourse that we have been keen to track in the scientific and applied scientific literature.
Jill	Trepanier	Whole Chapter	12. Built Environment						In NCA4, Chapter 11 "Urban", there was a mention of how climate change threatened "the integrity of personal property, ecosystems, historic landmarks, playgrounds...", but I do not see a mention in the NCA5. We recently received a grant from the Institute of Museum Library Sciences to categorize risk levels for all galleries, libraries, museums, and archives within the contiguous United States. There are many published research articles pointing to the threats caused from a changing climate. We believe these historic landmarks and public resources should be included in the NCA5 document. Some sources that support this claim are found here: https://link.springer.com/article/10.1007/s10584-017-1929-9 https://www.nps.gov/subjects/climatechange/upload/NPS-2016_Cultural-Resoures-Climate-Change-Strategy.pdf https://www.nps.gov/subjects/climatechange/upload/NPS-2016_Cultural-Resoures-Climate-Change-Strategy.pdf.	The chapter authors greatly appreciate the reviewer's taking the time to highlight the diverse range of built environment programs impacted by climate change. The chapter does contain reference to cultural and historic assets that we believe are inclusive of the broader class of assets and resources that you cite. We are also grateful for the NPS gray literature that you cited in your commentary. Due to space limitations and the wide range of topics and issues that we must broadly address in this chapter, we are not able to dive deeper into many key topics and issues. However, we have revised the chapter to note that these cultural and historic assets may also be significant public resources. We hope that this builds on the spirit of your commentary to expand the readers' orientation to the localized nature of climate impacts in the built environment.
Nick	Procopio	Whole Chapter	12. Built Environment						Little mention of passive cooling building designs that better fits local climate, such as orientation to sun, prevailing winds, and windows that allow light in with limited heating impacts.	The chapter authors appreciate your commentary specific to an opportunity to highlight the benefits of passive design in buildings. The chapter text does contain a reference to passive design (see section KM12.3). Due to space limitations and the wide range of topics and issues that we must broadly address in this chapter, we are not able to dive deeper into many key topics and issues. Given the wide proliferation of passive design principles in architectural and engineering practice, the chapter authors believe that a general understanding of the benefits of passive design are widely accessible. Likewise, given the massive scale of the challenge to decarbonize buildings, passive design strategies are just one of many categories associated with operational energy reduction (see illustrative examples in the table embedded within section KM12.3). As such, the chapter authors have elected to highlight other facets from the scientific literature that we believe are more immediately critical to communicate.
Emma	Conrad-Rooney	Whole Chapter	12. Built Environment						All key messages should be revised to follow the Risk-Based Framework	Thank you for the communicating the value of utilizing a risk-based framework for the key messages. However, as you can imagine, not all of the phenomona covered in this chapter are associated with risk, at least as it is conceptualy positioned within a hazard mitigation framework. As such, the chapter authors are sensitive to highlight that climate impacts can be understood as both shocks and stresses. Given the diversity of risks, opportunities, uncertainties and stakeholder orientations, it would be too limiting to orient our findings and conclusions to the context of risk.
Steve	LaDochy	Whole Chapter	12. Built Environment						Excellent coverage of current research, well-balanced approach with comments on weaknesses and gaps in understanding. All this is good. There is no section on outreach and education. Outreach to communities is mentioned though I'm sure most of the public is unaware of much of these findings. How to improve communications with communities and schools? Government and university representation is well established. How about K-16 educational contributions? Schools are buildings as well. Here is an opportunity to spread knowledge and to find mitigation for educational buildings.	The chapter authors appreciate the reviewer's comment with regard to education and outreach. Please note that the NCA5 development process included workshops and public outreach with a variety of university and non-university education stakeholders (completed in January and February 2022). This youth engagement provided a meaningful process for frank dialogue and constructive feedback. The chapter authors have also been sensitive to framing and communication this chapter so that it is widely accessible to a diversity of audiences, including even middle school aged students. Thank you again for your contribution. Also, our chapter takes a broad definition of the built environment. We focus on commericial, residential, and industrial buildings. Education-related buildings are included in this broad definition, although our chapter cannot specifically assess the roles of and impacts on educational buildings given space limitations.
Nadia	Gronkowski	Whole Chapter	12. Built Environment						The Early Years Climate Action Task Force recommends that the authors Increase language about child care centers and other early learning settings and maternal health care as key components of the built environment that foster community resilience to the benefit of infants, children, and families. The Task Force encourages the authors to consider changing all mentions of ‚Äúschool‚Äù throughout the report to ‚Äúearly learning and school environments‚Äù to more fully capture the breadth of built environments where children learn and spend their time.	The chapter authors greatly appreciation the reference commentary to childcare centers and other education and healthcare facilities. The charge of the National Climate Assessment is to evaluate the state of the scientific literature. A review of the literature incidental to this comment suggests that there is a gap in knowledge about the role of these cited facilities in climate mitigation and adaptation. Unfortunately, we are unable to address a wide variety of building programs that may offer valuable opportunities for advancing community resilience, among other goals. Thank you for your citation.
Ariela	Zycherman	Whole Chapter	12. Built Environment						The separation of land use and transportation into silos kind of feels like we're continuing to silo these disciplines when in reality they need to work together. I understand for the need to separate things out, but maybe some call out to their interconnected is important and then make readers aware that transportation will be touched on in more detail in the next chapter.	Thank you for highlighting the value of spatial planning in co-locating urban development with transportation infrastruture as a means for reducing emissions. This was previously referenced in the chapter. However, the chapter has been revised to include an additional reference.
Ariela	Zycherman	Whole Chapter	12. Built Environment						I am surprised not to see discussion of housing needs or gentrification. Many cities with substantial population growth over the last several decades and greater density in the urban core have high rates of inequality with high housing costs as a key factor, which increases the burden on those who work in key city services and can push residents into areas of greater climate risk for example from flooding, as is the case in Miami. While gentrification is not necessarily driven by climate change (although a number of published studies have aruged that it is) it can nonetheless increase climate risks for low-income and marginalized residents. There is also no discussion of environmental justice issues such as neighborhoods with poor air quality which is exacerbated by heat.	Many thanks for this comment. Various dimensions of housing and the housing economy are referenced throughout the chapter, including matters relating to housing vulnerability. Housing vulnerabilities may be exercerbated in maladaptive terms by both mitigation and adaptation actions. There are several places where this has been cited in the chapter. For instance, we have revised the paragraph around the table to reinforce this point and clarify our assessment of climate gentrification. Moving forward, the chapter authors will take into consideration the reviewer's general comment that more intensive urbanization patterns represent trade-offs between decarbonization and economic inequality, among other considerations. Additional discussions of the relationship between air quality and heat can be found in Chapter 14: Air Quality.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Gabrielle	Dreyfus	Whole Chapter	12. Built Environment						COMMENT: One of the most impactful mitigation opportunities that cities can catalyze are reductions in potent non-CO2 pollutants including f-gases (CFCs, HCFCs and HFCs), black carbon, tropospheric ozone, and methane (see Chapter 14.5). For example, in parallel with electrification efforts including promotion of heat pumps, cities can encourage replacement of leaky, outdated refrigeration and air conditioning equipment with energy-efficient equipment that uses climate-friendly refrigerants. This can immediately reduce F-gas emissions and CO2 from energy consumption, while also easing the burden on (often dirty) peaking power plants that contribute to ground-level ozone formation in hot summer months. Likewise, programs that remove older, inefficient internal combustion engines from urban ports, homes, businesses, and roads can reduce CO2 emissions while also slashing emissions of black carbon soot and reduce formation of harmful tropospheric ozone. Cities can also address methane emissions by improving methane capture from municipal landfills, and by reducing leaks of methane gas that currently serves many buildings and industrial facilities in urban environments. CITE: For HFCs, see Theodoridi C., Hillbrand A., Starr C., Mahapatra A., & Taddonio K. (2022) THE 90 BILLION TON OPPORTUNITY: LIFECYCLE REFRIGERANT MANAGEMENT (LRM) - HOW MINIMIZING LEAKS AND MAXIMIZING RECLAIM CAN AVOID UP TO 91 BILLION METRIC TONS CO2-EQ EMISSIONS, 40 https://www.igsd.org/wp-content/uploads/2022/10/Refrigerant-Lifecycle-FullReport-5SinglePages-PRESS.pdf. See also U.S. EPA (2022) Draft Report vC¬Ã¬i Analysis of the U.S. Hydrofluorocarbon Reclamation Market: Stakeholders, Drivers, and Practices, https://www.epa.gov/system/files/documents/2022-10/Draft_HFC-Reclamation-Report_10-13-22%20sxf%20v3.pdf. For methane, ozone and black carbon, see for example, California Short-Lived Climate Pollutant Reduction Strategy https://www.ccacoalition.org/en/resources/california-short-lived-climate-pollutant-reduction-strategy, and Climate and Clean Air Coalition (2017) City waste management strategies, https://www.ccacoalition.org/en/resources/city-waste-management-strategies	Many thanks for these suggestions and for the references. The main focus of KM12.1 is on cities as drivers of climate change, and GHG emissions includes f-gases and non-CO2 emissions. We have also revised KM12.1 to include air pollution. With regards to methane and natural gas, we have added an additional citation associated with (designed) mitigation measures, including electrification of buildings and demand reduction (see Table 12.1). Given the limited space and existing literature, we are unable to elaborate on each one of these chemicals and gases and how they affect the local/regional climate.
Reid	Sherman	Whole Chapter	12. Built Environment						This chapter describes various adaptation strategies and contains a table to connect with other chapters; this crosswalk facilitates consistency.	Many thanks for noting the connection between the chapter's assessment of mitigation/adaptation strategies and Table 12.2. We hope this improves the clarify and readability of the overall chapter.
Rachel	Licker	Whole Chapter	12. Built Environment						In general, the authors need to better integrate the figures into the text - for example I don't see any reference to Figure 12.4 in the text and in other places they are included in a citation ( ) without explaining why.	Thank you for this observation. The chapter revision process has included a particular focus on making sure figures and tables are clearly connected to the chapter text.
Rachel	Licker	Figure	12. Built Environment	Figure 12.2					The text above this figure refers to this Figure but it is unclear what the reader should take away. What does this figure tell us about populations and urban greenhouse gas emissions? Further what does this figure tell us about urbanization trends, if at all.	Many thanks for this comment. The first figure now has two maps showing total emissions and emissions per capita, which vary with urbanization. The second figure has been revised from a map to a line graph to show future population projections within urban and rural areas. We do not have sufficient space or literature to draw on to project emissions from urban and rural areas separately. The caption and surrounding text now reflect these changes.
Rachel	Licker	Figure	12. Built Environment	Figure 12.3					This is an interesting figure that portrays the different built environments. I would suggest adding that the portrayed cities have different LCZs and the shown LCZ is just for illustrative purposes (given that Chicago has different types of neighborhoods/suburban areas that likely span the ten different types of LCZs). The text itself needs to make better use of this figure to explain how cities currently already have local climate zones/microclimates and the decisions we make about land use and land cover will alter those. This connection is not obvious at first.	Many thanks for this comment. In the revised chapter, we have inserted additional text on LCZs. We also say that past urban development patterns and land use decisions can affect local and regional climates. In the revised figure caption, we now also say that cities have different LCZs and the shown LCZs are for illustrative purposes. We believe this connection is now clarified.
Rachel	Licker	Table	12. Built Environment	Table 12.1					It would be great to introduce the table in text and link it to previous arguments and perhaps explain the methodology behind this. Is it a standard methodology? Do the estimates vary across references or are they standard? Are there any gaps in our knowledge of estimating damages? The caption is also missing reference to the scale of the analysis, is this continental US? Does it include AK, HI or PR?	Many thanks for this comment. The table has been removed from the revised chapter and turned into narrative text to better capture the nuances noted by the reviewer. The infrastructure losses are compiled from various references that estimated losses in 2090 according to both intermediate and high end scenarios. There is a significant amount of uncertainty in these estimates so these losses are presented as wide ranges. These losses are also presented in the context of specific geographic areas to clarify the scale of reference. Most numbers pertain to the contiguous US but there are additional numbers for Alaska.
Rachel	Licker	Figure	12. Built Environment	Figure 12.6					Can you incorporate this figure into text and explain the variation between the slopes of the line?	Many thanks for this comment. We have elaborated on the meanining behind the slope of the lines in the figure caption. We have also inserted references to this figure in the text; however, we have elected not to repeat this description in the text itself given word count limitations.
Rachel	Licker	Figure	12. Built Environment	Figure 12.7					The figure is really interesting but unclear how this classification of ecological, social, and technological systems contributes to governance. Without explanation, some labels are unclear - e.g. what does "underserved communities" mean in this context?	Many thanks for this comment. In the revised chapter, we have elaborated in the prior paragraph to highight the figure as an example of infrastructure investment as part of social, ecological and technological systems. We have also better defined underserved communities per this example.
Rachel	Licker	Table	12. Built Environment	Table 12.2					I think it would make sense to make the table in three columns to show adaptation and mitigation - ultimately, they are different types of measures for different purpose and with different political/social/technological implications (that have each a separate chapter in NCA5!). Also, some items in the table are unclear - e.g. "public health" - what specifically about public health, for what purpose?	Many thanks for this comment. We have decided not to have separate columns for mitigation and adaptation in this table because, at this cale, there will be significant overlap. The objective of this table is to highlight a selection of efforts rather than provide a comprehensive lis due to space constraints. With respect to the suggestion regarding clarity in the table, we have looked for opportunities to adjust individual items in the list while operating within character and space constraints. "Public health" was originally meant to refer to a very broad suite of public health programs and initiatives that promote physical fitness, healthy lifestyles, use of healthcare systems and services, health education, and other measures that can ultimately increase people's capacity to manage and recover from stresses and shocks associated with weather events and long-term climate change. To clarify this, the item now reads 'public health services'.
Rachel	Licker	Figure	12. Built Environment	Figure 12.8					Are the limited adaptation benefits of urban gardening accurate? It seems very little even though I would have guessed they have similar co-benefits to other green spaces. I am also curious about improved health as an adaptation co-benefit, is improving health overall considered a climate adaptation? (And is improving air quality an adaptation co-benefit or a co-benefit of fixing another environmental issue, air pollution, which is separate from but connected to climate change)	Many thanks for this comment. The figure highlights the role of urban agriculture and gardens in enhancing thermal comfort (which is categorized under health) and promoting urban biodiversity. Other urban green spaces -- such as forests, greenways, etc. -- are additionally noted to help mitigate flooding and improving air quality. The different ways of attributing adaptation co-benefits can be explained by the way in which green infrastructure is delineated in the figure. This figure is reproduced from the IPCC 6th Assessment Report Working Group 3 chapter on cities (Chapter 8). In it, the figure is based on the following asssessment: "Depending on the context, green and blue infrastructure can also offer considerable economic co-benefits. For example, green roofs and facades and other urban greening efforts such as urban agriculture and greening streets can improve microclimatic conditions and enhance thermal comfort, thereby reducing utility and healthcare costs." The health co-benefit highlighted in this figure is therefore referring specifically to enhanced thermal comfort, which then leads to various other health-related co-benefits. A more extensive assessment of the relationship between health and air quality can be found in other NCA5 chapters, namely Chapter 14 Air Quality and Chapter 15 Human Health.
Rachel	Licker	Figure	12. Built Environment	Figure 12.9					I cannot see Figure 12.9 due to copyright, but in the text you introduce it as a green infrastructure figure yet the caption mentions the nature-tech spectrum (which is really interesting). Can you introduce it in text and discuss the implications of this figure? What approaches are preferable and/or more commonly adopted, what are the consequences of focusing on different parts of the spectrum etc.	Many thanks for this comment. We agree that the eco-techno spectrum is very interesting! In the revised text, we have added text around this figure to better highlight the implication of it. In terms of which options are preferred, this is outside of the scope of our chapter as the question of preference and/or appropriateness of climate actions borders on being policy prescriptive, which we are not asked to do. However, we do highlight some illustrative approaches in Table 12.2, Figure 12.8, and Figure 12.9 (pending copyright permission). We also assess consequences -- including in terms of governance and social equity implications -- in Sections KM12.3 and KM12.4.
Juanita	Constible	Text Region	13. Transportation		3	3	1	22	Please consider strengthening the adaptation message in the introduction. In addition to opportunities to reduce future impacts through reducing GHGs, the transportation sector is critical to minimizing harm associated with gradual changes (e.g., by creating heat-safe public transportation options) and preparing for, responding to, and recovering from climate-related disasters (e.g., by ensuring people can evacuate ahead of a storm and get back to work in the immediate aftermath). Furthermore, badly planned transportation systems and infrastructure can have maladaptive outcomes.	We have revised the first few introductory paragraphs to more clearly setup transportation systems, their contribution to GHG emissions, and their vulnerability to climate hazards. Specific examples of mitigation and adaptation strategies appear throughout.
Ariela	Zycherman	Text Region	13. Transportation		3	3	18	20	Suggest providing an example of what the tradeoffs and negative impacts are. Also, as written the sentence upfront in this chapter is very discouraging and may turn readers away with such a negative framing for something that the pros outweigh cons for, especially when we have counterparts in Western Europe to show the benefits of lower-emission transportation systems, which prioritize saving human lives and the environment over moving vehicles faster.	We've revised the introduction with a different framing. In KM3-4 we provide examples of the potential tradeoffs and co-benefits of mitigation.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Nick	Procopio	Text Region	13. Transportation		4	4	10	12	This covers the increased electricity demand, but should also point to challenges regarding limitations on local energy grids. For example, current local grid systems were not designed to charge thousands of electric vehicles at 220V. In addition, charging electric vehicles is only as green as the energy source. Another common concern worth addressing in this section is safe electric vehicle battery disposal planning/processes.	This is a good observation. We will add a sentence stating that "Although increasing efforts to electrify vehicles will ultimately reduce fossil fuel emissions, consideration must also be given to the challenges posed by this change, such as increased strain on local energy grids; whether electricity used to charge electric vehicles has been generated from renewable resources; and safe disposal of electric vehicle batteries".
Reid	Sherman	Text Region	13. Transportation		4	4	12	12	Suggestion to insert at 13-4, line 12: "In the aviation sector, the federal government's Sustainable Aviation Fuel (SAF) Grand Challenge brings together the efforts of DOE, DOT, USDA, and other federal agencies to reduce the cost, enhance the sustainability, and expand the production of SAF. This effort aims to produce SAF that achieves a minimum of a 50 percent reduction in lifecycle greenhouse gas emissions compared to convention fuels, and has a long-term goal of supplying sufficient SAF to meet 100% of aviation fuel demand by 2050." Citation options: https://www.energy.gov/eere/bioenergy/sustainable-aviation-fuel-grand-challenge https://www.whitehouse.gov/briefing-room/statements-releases/2021/09/09/fact-sheet-biden-administration-advances-the-future-of-sustainable-fuels-in-american-aviation/ https://www.energy.gov/sites/default/files/2021-09/S1-Signed-SAF-MOU-9-08-21_0.pdf	For consideration, CL: There are additional examples for alternative fuels in transit, construction equipment, freight, etc. Could there be a reference back for these by making this statement more general to also include these sectors?
Reid	Sherman	Text Region	13. Transportation		4	4	14	14	What specifically is meant by "air sectors"? Aircraft? Airport ground ops? Other? Please clarify	Text updated to say "aircraft".
Reid	Sherman	Text Region	13. Transportation		4	4	23	23	Add "e.g." to parenthesis with (trains, airplanes, and ships).	Text updated to include "e.g.".
Reid	Sherman	Text Region	13. Transportation		4	4	24	24	This sentence should not begin with "They" -- unclear what is being talked about specifically (non-road sources?) -- in the context of the next two sentences, could this sentence (beginning on line 24 continuing to 13-5 line 1) be deleted?	Noted. Changed "They" to "These modes...".
Reid	Sherman	Figure	13. Transportation		4				We assume this is US Domestic transportation -- it should be clarified in caption and title if that is true.	Text updated in figure title and caption to make clear this is for US domestic transportation.
Juanita	Constible	Table	13. Transportation		6				Please consider adding this citation to the Aviation row: S. Lindbergh, et al. (2022), Cross-sectoral and multiscalar exposure assessment to advance climate adaptation policy: The case of future coastal flooding of California's airports, Climate Risk Management, 38: 100462.	The Lindbergh et al. 2022 citation is added.
Juanita	Constible	Table	13. Transportation		6				In the cell intersecting with the Drought column and Roadways row, please consider adding a bullet about how drought may limit the ability of transportation managers to cool down bridges by spraying water on them, as Seattle and Portland had to do during the 2021 Heat Dome. Furthermore, dust storms associated with drought can also lead to reduced visibility and road closures, as noted in the Wildfire column.	The following is added: - Emergency bridge maintenance, e.g., water spraying for cooling. - Reduced visibility and increased closures from dust storms.
Reid	Sherman	Table	13. Transportation		6				Add links to other chapters where impacts are discussed, similar to 12.2.	We added cross-citations to several other chapter key messages.
Juanita	Constible	Text Region	13. Transportation		8	8	1	8	In addition to examples of tools, it would be helpful to have an example or two of problematic planning assumptions. Furthermore, the first sentence of the paragraph gives the impression that agencies largely are not using existing tools. Is that supported by surveys or other data?	While there is growing awareness of the need for sustainability and climate resilience planning, adoption of these tools and guidelines can vary widely depending on the organization and sector. Some organizations may be more proactive in using these tools and guidelines, while others may lag behind due to resource constraints, competing priorities, or a lack of awareness or understanding of the issues at hand. Therefore, it's important for organizations to stay informed and engaged with the latest research, guidance, and best practices in order to develop effective and sustainable climate resilience strategies. Ref -see GIZ GmbH, 2022 Sustainable Infrastructure Tool Navigator. CL: No changes to text
Juanita	Constible	Text Region	13. Transportation		8	8	12	12	The last phrase of the sentence (i.e., criticality of transportation assets TO extreme weather events) is confusing.	Simplified clause to: "...evaluating the vulnerability of regional transportation assets to extreme weather events"
Ariela	Zycherman	Text Region	13. Transportation		11	11	13	16	In discussing what is lacking in transportation capital programming and project execution, should also tee up equity concerns, which are already further discussed on page 14, line 9.	Equity is implicitly addressed throughout the chapter and therefore no specific change was made to the text.
Juanita	Constible	Text Region	13. Transportation		12	12	17	24	An important workforce challenge missing from this section is the effect of heat and other increasingly severe natural hazards on workers. According to BLS and OSHA data and several independent studies, transportation and warehousing workers have some of the highest rates of heat-related illnesses and injuries. This is a related, but distinct issue from the lack of expertise in adapting to extreme weather mentioned in lines 25-30 on pg 12. It is also an important issue to raise given the context on pg 13 about the aging workforce. Older workers can be more sensitive to heat-related illnesses.	A reference (Karthick et al. 2021) has been added to 13.3 acknowledging the effects of climate hazards on workers.
Reid	Sherman	Text Region	13. Transportation		12	12	25	25	If the authors could go a bit further and describe what expertise and skill sets are needed for transportation professionals (or cite studies that do this), that would help address the gap identified.	This text has been revised and appropriate references provided.
Reid	Sherman	Text Region	13. Transportation		14	14	4	4	Citation needed for "K-Gray" discussion	The NIAC report citation now included with the relevant K-Gray text.
Reid	Sherman	Text Region	13. Transportation		14	14	20	20	Suggest more specificity on what "transforming" means in KM 13.3 header. I know we are word limited, however this is the text what will get picked up verbatim by external audiences.	Transforming has been removed from the header.
Ariela	Zycherman	Text Region	13. Transportation		14	14	21	26	"Accident" is not appropriate terminology. Roadway fatalities have increased in recent years and are caused by human error. The National Highway Traffic Safety Administration uses "crash." See: https://www.nhtsa.gov/research-data/crash-avoidance	Accident no longer is used. We instead use the word crash.
Ariela	Zycherman	Text Region	13. Transportation		14	16	26	14	The Physical Activity Guidelines for Americans, 2nd edition, uses "physical activity" instead of "physical fitness." Physical activity refers to any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level. Physical activity can lead to improved physical ftness as a health outcome.	Thank you for this comment. We believe "physical fitness" is appropriate here because it was stated as the improved outcome (walking and cycling are the activity). Therefore, no change is necessary.
Ariela	Zycherman	Text Region	13. Transportation		15	15	1	3	Please verify the accruracy of the statement in the sentence because health inequities, long commutes, and sedentary lifestyles are also prevalent in rural areas. It can be argued that co-benefits would be powerful across urban, suburban, rural, and frontier communities. See this link for more resources: https://jphmpdirect.com/2019/12/30/walking-physical-activity-built-environment-jeff-whitfield/	The sentence does not imply that benefits in rural areas don't exist, just that they are particularly powerful in urban areas which have a confluence of large populations, dramatic health inequities, high traffic-related air pollution levels, etc.
Reid	Sherman	Text Region	13. Transportation		15	15	1	1	Thie chapter would benefit from a reference to the Built environment chapter here - lots of similar messaging and the Built Environment chapter has good references for statements like this - "These societal co-benefits would be particularly powerful in urban areas, 1 where large numbers of people are experiencing elevated air pollution, health inequities, traffic 2 congestion and long commutes, and the negative health consequences of a sedentary lifestyle"	Authors added cross-references to the Built Environment chapter throughout.
Reid	Sherman	Text Region	13. Transportation		15	15	12	12	Missing a verb related to "continuing benefits"	Text updated to change "continuing" to "continued".
Ariela	Zycherman	Text Region	13. Transportation		15	16	15	3	Recommend highlighting some of the health benefits of physical activity, such as reduced blood pressure, lower risk of heart disease and eight cancers. See: https://www.cdc.gov/physicalactivity/basics/pa-health/index.htm	Thank you for this comment. We agree. We replaced "health" with " reduced cardiovascular health disease, diabetes, and cancer".
Reid	Sherman	Text Region	13. Transportation		15	15	21	21	Suggest "more stringent" instead of "tighter vehicle emission standards"	Text updated to say "more stringent".
Ariela	Zycherman	Text Region	13. Transportation		15	15	25	27	Recommend further stressing the shortsightedness of electrification of our transportation system not only because of the increased dependance on electricity, but the energy intenstive lithium mining process. Some of this is touched later in the chapter, but these are very critical points to stress. In addition, EVs are heavier than their gas-powered counterparts, making them deadlier to people outside of cars. This is a critical opportunity to emphasize the need to create a transportation system with multimodal options (e.g. walking, bicycling, and public transit), which are healthier, less deadly, and less intensive on the environment.	Thank you for pointing this out. We have revised the sentence to include these additional considerations: "increased energy use from demand for electricity, lithium mining, and potentially heavier vehicles,"
Juanita	Constible	Text Region	13. Transportation		15	15	31	32	Voluntary lifestyle changes are certainly important for reaching GHG reduction targets. However, the suggestion that emissions rebounded because of a lack of voluntary lifestyle changes is not convincing. People were not able to avail themselves of a transformed, low-carbon transportation system as they emerged from COVID lockdown. It was the same old system, except worse than pre-pandemic times because many public transportation systems were not operating at full capacity.	Yes, the authors are saying that there needs to be transformative changes to the transportation system in order to have significant impact. This is further discussed in the Focus Paper: Focus on COVID-19 and Climate Change Paper. The word "voluntary" has been removed.
Ariela	Zycherman	Text Region	13. Transportation		16	16	8	8	Accidents is used again and this is inappropriate terminology. Replace with "crashes". https://www.fmcsa.dot.gov/newsroom/crash-not-accident	Accident no longer is used. We instead use the word crash.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Juanita	Constible	Figure	13. Transportation		16				Instead of including a COVID-related factoid for NOx, please consider a factoid related to health outcomes. I.e., the benefits of lower NOx emissions vs. just that the emissions dropped. That would be more in keeping with the rest of the figure. Also, are all the statistics in this graphic national? If not, it would be good to indicate the different geographic scales.	Thank you for the comment. We are unaware of ample evidence linking COVID NOx changes and sustained health benefits. As such we have kept the text and figure unchanged.
Juanita	Constible	Text Region	13. Transportation		18	19	1	7	Please consider providing examples of drawbacks or trade-offs associated with adaptation. This section only appears to offer mitigation examples.	Text referencing adaptation added immediately after the figure 13.7 caption.
Juanita	Constible	Text Region	13. Transportation		18	18	11	11	Consider saying equitable distribution of BENEFITS instead of equitable distribution of TRADE-OFFS.	Thank you for this comment. We believe "trade-offs" is appropriate here because both benefits and costs, or positives and negatives, need to be kept in mind in transporation decision making, and "trade-offs" is an adequate term to describe all of those factors.
Juanita	Constible	Figure	13. Transportation		18				This figure is hard to understand. Are the opposing tabs on the spokes of the wheel supposed to be trade offs with one another? How do those tabs interact with the central circle representing EJ and self-determination? Finally, the title and caption indicate that the figure shows something about adaptation, but it is not clear what that something is.	Text clarifying figure design and highlighting adaptation added to the figure 13.7 caption. Text referencing adaptation added immediately after the figure 13.7 caption.
Juanita	Constible	Text Region	13. Transportation		19	19	2	3	The mention of emissions inventories is useful. However, please consider taking this paragraph a step further by also offering examples of how decisionmakers can act to minimize or respond to the inequities revealed by those inventories.	Thank you for this comment. A detailed discussion of how emissions inventories can feed into transportation planning and emissions reduction strategies is beyond the scope of this discussion. However, we did revise the chapter text to clarify that emissions inventories can enable the analysis of emission reduction strategies.
Bilal	Ayyub	Whole Chapter	13. Transportation						A key consideration is the impact of a changing climate on the engineering practices, such as standards, e.g., ASCE-7, ASCE24, Atlas14, etc. Engineering practices generally use historic information on hazards, such as temperature, rainfall, wind, storms, etc. The practices include design values, maps, tables etc. that are not suitable for planning and design. There is a need for a sustained assessment of the engineering practices as a result of a changing climate. Presently ASCE-NOAA are engaged in such work and established an ASCE-NOAA Task Force on Climate Resilience in Engineering Practice. It is advisable to include an assessment of the engineering practices in this regard in NCA5.	Comment is well addressed in the 30D, namely: • 13-10, lines 16-17 ("Integrating climate data into engineering science is an emerging practice" (cites ASCE 2021b/c/d, 2020, and 2018) • 13-11, lines 9-16 ("Progress in tools used for the planning, design, and construction of transportation ....") and • 13-12, lines 1-7 ("The need to address climate uncertainty in project design has become critical ... with future weather patterns less likely to match past ones, it is necessary to assess projected changes to precipitation and resulting flooding in project designs." Only one suggested addition: cite the ASCE-NOAA Taskforce named by the commenter (https://www.asce.org/initiatives/asce-noaa-taskforce) to 13-10 (lines 16-17)
Emma	Conrad-Rooney	Whole Chapter	13. Transportation						Key Messages 13.3 and 13.4 should be revised to follow the Risk-Based Framework.	The chapter already uses the risk-based framework for KM 1 and 2. 3 and 4 don't discuss the risk-based approach because they focus on other challenges.
Ariela	Zycherman	Whole Chapter	13. Transportation						While 'access' to transportation is mentioned in terms of equity, 'affordability' is not. It's one thing to have options available, but 'access' can be limited if they are not affordable.	Thank you for this comment. Authors agree. Authors revised the caption to Figure 13.7 to indicate "availability" encompasses both geographical location and affordability.
Reid	Sherman	Whole Chapter	13. Transportation						Overall, there is too much focus on non-climate topics (e.g., cyber, ageing workforce) which may be best suited to a different report, and could leave more space to include greater attention on climate impacts and response.	In order for the transportation system to evolve towards a decarbonized and climate-adapted future, there is a need to explore future disruption as a constellation of several game-changing conditions. We've revised this section streamlining the content with clearer logic: 1) that climate adaptation is happening concurrently with other disruptors, 2) that new frameworks and tools are emerging, and 3) that new competencies are needed in the workforce to engage with these challenges. The text is rooted throughout in climate mitigation and adaptation, and describing how future workforce competencies (and training) need to be present to navigate these concurrent disruptions.
Reid	Sherman	Whole Chapter	13. Transportation						Use of adaptation is limited and always linked with mitigation. Focus is on mitigation and decarbonization. Suggest noting more adaptation actions.	Adaptation actions are discussed in 13.4 and several new actions have been added to 13.2.
Reid	Sherman	Whole Chapter	13. Transportation						Linking transportation to other integrated systems, water/ wastewater, broadband, etc. would be helpful. Discussions of managed retreat/ community relocation is limited, especially where this will be critical. This is an opportunity to tie to the coastal chapter, although limited marine and coastal transportation elements are discussed. Connect with Ocean and coastal chapter references to transportation.	Cross-referencing has been added to the SLR, nature-based solutions, managed retreat, and other related chapters. Wastewater and broadband are out of scope.
Juanita	Constible	Text Region	14. Air Quality		3	3	2	13	The introduction paragraph could be improved by emphasizing the importance of managing tropospheric ozone (vs. stratospheric ozone) given its relevance to health at this level of the atmosphere. Ozone is a tricky term for the public to understand because it is beneficial in the stratosphere but not in the troposhere.	Thank you for this comment. We agree that the public may confuse ozone air pollution with stratospheric ozone. We have added "At ground level" to clarify that we are talking about ozone air pollution in the lower troposphere.
Juanita	Constible	Text Region	14. Air Quality		3	3	6	6	PM2.5 should be defined here, the first mention in the chapter, as fine particulate matter.	Thank you for this comment. The chapter has ben revised and PM2.5 is defined as fine particulate matter at its first mention, along with a fuller definition later in the same paragraph.
Juanita	Constible	Text Region	14. Air Quality		3	3	8	8	PM2.5 includes not only solid particles but condensed liquid droplets.	Thank you for this comment. We have added "solid and liquid" to the text to help the reader understand the physical forms of particles that compose PM2.5
Juanita	Constible	Text Region	14. Air Quality		3	3	20	20	This is first instance of "ambient" before ozone. Please consider including that term earlier in the chapter.	Thank you for this comment. "Ambient" appears for the first time in the 2nd paragraph of the introduction. Upon re-reading we have chosen not to use the word ambient in the first paragraph - instead referring to ground-level air pollution - since ambient is not necessarily a word that the general public will understand. To avoid possible confusion around ambient we have chosen not to revise the first paragraph to include "ambient".
Juanita	Constible	Text Region	14. Air Quality		3	3	23	23	Health-related economic damages from ozone air pollution have also been quantified, and these damages should be presented alongside the evidence on economic damage to crops. See the article below, which estimated $898 million in health-related costs from ozone exposure in one U.S. state (Nevada) in 2012: Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2019). Estimating the Health?Related Costs of 10 Climate?Sensitive U.S. Events During 2012. GeoHealth, 3(9), 245-265. https://doi.org/10.1029/2019GH000202.	Thank you for this comment. We have now added the economic valuation associated with premature deaths from exposure to PM2.5 and ozone annually in the US, by multiplying the deaths we report by a unit Value of a Statistical Life (VSL). We ensured to use the right value currently recommended by the EPA. We have not added this reference to this section, but have added it later in our chapter (KM14.5) when discussing the value of impacts other than mortality, since this study included other morbidity impacts.
Juanita	Constible	Text Region	14. Air Quality		3	3	36	37	Climate change will worsen ozone and PM2.5 pollution to different degrees and via distinct mechanisms. This complexity should be considered in shaping this text and the key message it is linked to.	We thank the reviewer for this comment. We describe the complexity of the response of ozone and PM2.5 to climate change later in this section. The first sentence of the relevant paragraph, amended in respose to this comment, is: "The response of ozone and PM2.5 to climate change—and associated health impacts—will vary regionally, reflecting the net balance of a complex suite of chemical, meteorological, and small-scale processes, which vary regionally and over time..."
Juanita	Constible	Text Region	14. Air Quality		4	4	6	7	Is it "changing population" or "increasing population"?	The reviewer is correct. The text has been revised in response to the reviewer's comment.
Risper	Nyairo	Text Region	14. Air Quality		4	4	25	26	I think the statement can be more explicit in elaborating how methane is a source of background ozone (e.g through oxidation?), without necessitating the reader to look up the reference. A similar statement was made in lines 5-6 of page 19; if this is explained in the earlier statement, then it makes it easier to understand.	We thank the reviewer for this comment. We have added text to KM1 to explain in more detail how methane influences background ozone.
Juanita	Constible	Text Region	14. Air Quality		4	4	25	28	The implications of rising background ozone levels for the ozone season duration should be included.	We thank the reviewer for this comment. The text has been revised to include this information.
Gabrielle	Dreyfus	Text Region	14. Air Quality		4	4	25	28	v¢~Ã~úMethane, a key greenhouse gas (GHG) that contributes to near-term warming (KM 14.5)., is a source of background ozone (Fiore et al. 2002). Continued growth in methane emissions from wetlands and human activities will raise background ozone levels, including in winter (KM 3.1; Gao et al. 2013; Clifton et al. 2014).v¢~Ã~ù COMMENT v¢~Ã¬i Note that recent studies estimate that methane contributes about 35% of present-day tropospheric ozone burden. CITE v¢~Ã¬i Butler T., Lupascu A., & Nalam A. (2020) Attribution of ground-level ozone to anthropogenic and natural sources of nitrogen oxides and reactive carbon in a global chemical transport model, ATMOS. CHEM. PHYS. 20(17): 10707v¢~Ã~i31 https://acp.copernicus.org/articles/20/10707/2020/ (v¢~Ã~úMethane and biogenic emissions clearly stand out as major reactive carbon precursors to tropospheric ozone, contributing 35 % and 24 % to the tropospheric ozone burden in our simulation, respectively. Anthropogenic emissions of reactive carbon (excluding biomass burning) together contribute about 14 % to the tropospheric ozone burden. The relatively low influence of anthropogenic reactive carbon emissions on ground-level ozone has been noted elsewhere (e.g. HTAP, 2010; Butler et al., 2018); however, despite this low overall ozone productivity, anthropogenic reactive carbon emissions from source regions in higher northern latitudes still have disproportionately high contributions to surface ozone in the Northern Hemisphere (Table 3).v¢~Ã~ù). See also Mar K. A., Unger C., Walderdorff L., & Butler T. (2022) Beyond CO2 equivalence: The impacts of methane on climate, ecosystems, and health, ENVIRONMENTAL SCIENCE & POLICY 134 127v¢~Ã~i36 https://www.sciencedirect.com/science/article/pii/S1462901122001204.	Thank you for this comment and the citations provided. We agree that methane is important for global tropospheric background ozone concentrations. We have decided not to include the 35% number that the commenter references, since this is for the global tropospheric ozone burden. This chapter focuses on ozone air quality, and so it would be better to highlight the contribution of methane to ozone ground level concentrations, which is variable and we are not aware can be captured simply in a single indicator. We have added a reference to the Butler et al. (2020) paper so that interested readers can find more information on the quantitative contributions of methane to global ozone.
Reid	Sherman	Text Region	14. Air Quality		4	4	25	25	Remove '.' following (KM 14.5)	We thank the reviewer for spotting this error and have fixed the text.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Risper	Nyairo	Text Region	14. Air Quality		4	4	31	32	This statement could benefit from noting under which scenario ozone increases are expected to be significant. You could borrow from the example in lines 30-33 of page 15, chapter 24: Midwest.	We thank the reviewer for this comment and now specify the scenario.
Juanita	Constible	Text Region	14. Air Quality		4	4	32	32	Use of the word SIGNIFICANTLY is vague here. It would be better to indicate a percent increase or a parts per billion increase in the year-round ozone level in these regions.	We appreciate the reviewer's comment. Due to the page limit, we have focused here on broad trends rather than specific increases, which vary by season and region. We have removed the word "signficantly" to avoid vagueness about the statistical significance of these modeled trends.
Juanita	Constible	Text Region	14. Air Quality		4	4	35	35	SUMMER MEAN OZONE levels are described here but there is no corresponding of the long-term ozone exposure risks (e.g., as distinct from short-term exposures, which are regulated by the National Ambient Air Quality Standards. The air quality chapter should discuss the growing evidence base of health harms related to longer-term ozone exposures. See, for example: Limaye, V. S., & Knowlton, K. (2019). Shining New Light on Long-term Ozone Harms. JAMA Internal Medicine, 2. https://doi.org/10.1001/jamainternmed.2019.5967	We thank the reviewer for this comment and citations. The text now includes references that describe the health impacts of both short- and long-term exposure to ozone (Bell et al., 2004; Jerrett et al., 2009; Turner et al., 2016). The Limaye et al. (2019) reference suggested by the reviewer is a commentary on the health response in a population of heavy smokers, which is too specific for this chapter.
Bharat	Balyan	Text Region	14. Air Quality		4	5	37	5	In Minnesota on the week of January 9th, 2023, a significant air pollution event occurred in which the warm winter temperatures and stagnant air causes the AQI to reach Unhealthy levels for multiple hours. These warmer temperatures are an impact of climate change, and this type of air pollution event should be highlighted as something that can happen in cold weather regions of the United States. Here are some relevant links https://www.mprnews.org/story/2023/01/09/its-50-degrees-just-above-us-air-quality-alert-through-noon-tuesday https://www.pca.state.mn.us/air-water-land-climate/condition-details-and-past-aqi-data	We thank the reviewer for pointing this out. Due to the breadth of the topic and the page limit for the chapter, we focus on broad trends rather than specific examples. We include this text: "Local air pollution events are also strongly tied to large-scale weather patterns (Kerr et al. 2019, 2020; Previdi and Fiore 2019; Sun et al. 2019). For example, cold fronts sweep clean air across the eastern US, clearing the air of pollution (Leibensperger et al. 2008). How climate change will affect these large-scale patterns is not well known."
Nick	Procopio	Text Region	14. Air Quality		5	5	4	4	There is a blue underscore that should be deleted between the words "Northeast" and "Trail".	We thank the reviewer and have fixed the text.
Reid	Sherman	Text Region	14. Air Quality		5	5	4	4	Remove '_' following Northeast	We thank the reviewer for spotting this error and have fixed the text.
Juanita	Constible	Figure	14. Air Quality		5				Figure includes vague terms like INCREASING WILDFIRES rather than more specific terms like wildfire intensity, frequency, duration are increasing. Consider use of multiple + icons to represent different degrees of increase between ozone and PM2.5. Right now, the magnitude of increases is implied as similar for these pollutants, when the evidence may not back that up. For example, the effect of heatwaves and warmer temperatures is stronger on ozone formation than it is for PM2.5 formation, but the use of the same single + icon for both pollutants makes it seem that the effect of temperature is broadly similar for ozone and PM2.5. The figure is titled Climate Change Impacts on Air Quality but only ozone and PM2.5 are considered in detail; consider either adding other air quality indicators (e.g., allergenic pollen) or changing the title to refer only to these pollutants.	We thank the reviewer for these comments. The boldface text above each icon has been shortened to just the name of the process -- e.g., "Wildfires" instead of "Increasing wildfires." Text below each process succinctly describes the expected change in the process and the effect on pollution. Given the uncertainties, the text does not specify the magnitude of the effects with, for example, multiple plus signs. For more information on the mechanisms involved, we refer the reader to KM1 and KM2. For example, KM2 states that pollution will increase in response to the increased frequency of large wildfires. The Traceable Accounts text also now includes detailed description of the evidence that informed the making of this Figure.
Juanita	Constible	Figure	14. Air Quality		6				Both figure panels, a and b, include a number of climate modeling scenarios (SSPs) that are not defined or explained in the figure caption. Consider simplifying the figure by only showing model averages. As it is now, the figure is difficult to read because of the number of modeling outputs represented. The figure source mentions institutions but does not indicate any publication. The source of this figure should be more clearly indicated in the caption.	We thank the reviewer for this comment and now include some additional details regarding this figure in the Traceable Accounts. The metadata for this figure will be published with the final report and will include details on the datasets and methods needed to reproduce the figure. Also, rather than state the source of the figure, we use the term "Figure credit," where we are giving credit to authors' institutions for work done to create original figures. Finally, after due consideration, we have chosen to keep the thin lines to demonstrate the variability among models and to show natural interannual variability.
Reid	Sherman	Figure	14. Air Quality		6				An error in the legend: SSP5-8 (model average) misses .5	We thank the reviewer for catching this error. We have now simplified the figure and include information about scenario and model name in the Traceable Accounts.
Juanita	Constible	Text Region	14. Air Quality		7	7	22	22	Use of the term "gases" is vague - better to be specific about which pollutants are directly generated by wildfires and which form secondarily in the atmosphere during wildfire events.	We thank the reviewer for this comment. The sentence starts with "Wildfires emit", so it is explicit that we are discussing primary species. To be more explict about the species, we have modified the sentence (along with addressing the next comment) to: "Wildfires emit PM2.5 and other air pollutants, including volatile organic compounds and nitrogen oxides (which contribute to ozone generation in plumes) as well as toxic gaseous and particulate species (Jaffe et al. 2020; O'Dell et al. 2020)."
Juanita	Constible	Text Region	14. Air Quality		7	7	22	32	This passage should also include mention of airborne toxic compounds, such as lead and manganese, that are generated by wildfire events. See this report from the California Air Resources Board on toxic metals emitted during the 2018 Camp Fire event: https://ww2.arb.ca.gov/sites/default/files/2021-07/Camp_Fire_report_July2021.pdf. Unfortunately the U.S. currently lacks robust air toxics monitoring, including in wildfire-prone areas, so this is an important area to highlight in the air quality chapter.	We appreciate the reviewer's comment. We have modified the sentence to: "Wildfires emit PM2.5 and other air pollutants, including volatile organic compounds and nitrogen oxides (which contribute to ozone generation in plumes) as well as toxic gaseous and particulate species (Jaffe et al. 2020; O'Dell et al. 2020)."
Risper	Nyairo	Text Region	14. Air Quality		8	8	9	10	This is just a resource recommendation on people and fire: https://doi.org/10.1080/24694452.2020.1768042 (Larson et al., 2021)	We thank the reviewer for this citation, and we have added it to this sentence.
Reid	Sherman	Text Region	14. Air Quality		10	10	4	4	Suggestion to replace "Racist" with "Racism in" to note that there was racism in the outcomes of (e.g.) highway construction even if highway construction is not an inherently racist practice.	Thank you for this comment. We have made the suggested change
Jim	Titus	Text Region	14. Air Quality		10			5	Strike "redlining". Redlining contributed to inequities, but not the ones discussed in the previous sentence so the sentence as written is false. Redlining refers to the maps by the Home Owners Loan Corporation, which colored areas with minorities (among other things) in red. Those maps were used to make loans harder to get, but they they reflected pre-existing segregation rather than causing it.	Thank you for this comment. We have revised the text so as to separate the content in these two sentences. We have also rewritten the sentence so as clarify that redlining coupled with housing segregation were among the practices that disinvested in communities of color and allowed environmental cost to be off-loaded in those areas.
Emma	Conrad-Rooney	Text Region	14. Air Quality		12	12	13	17	To follow the Risk-Based Framework, Key Message 4 should include what can be done about these highlighted problems.	Thank you for this comment. We have revised our KM 14.4 to add a sentence on societal responses that might reduce health impacts associated with increasing pollen exposure. With this, we have also added text to the main document in support of this KM statement, and discussion of confidence in the traceable accounts.
Nick	Procopio	Figure	14. Air Quality		14				Even though the caption explains the pie charts, it would be helpful to label each chart as historical or future, perhaps in a smaller font under each pie chart.	Thank you for this comment. Upon reviewing this figure again, we thought that it was complex and hard to understand. We also received comments that KM 14.4 is out of balance with more figures than the other KMs. Consequently, this figure has been deleted.
Juanita	Constible	Figure	14. Air Quality		14				The trend metric is difficult to interpret in the figure legend. Consider revising this figure to make legend scale more clear.	Thank you for this comment. Based on this and similar comments from the NASEM review, we have revised this figure to present percent changes rather than absolute units.
Reid	Sherman	Figure	14. Air Quality		15				The first phrase in the caption: Annual mean pollen emissions for historical (measured for 1995-2014) and future periods (modeled for 2081-2100).	Thank you for this comment. This complex and highly technical figure has been deleted.
Emma	Conrad-Rooney	Text Region	14. Air Quality		16	16	6	12	Key message 14.5 should be revised to follow the Risk-Based Framework.	We thank the reviewer for this comment. The comment does not say exactly in what ways we do not follow the Risk-Based Framework, but after reviewing it again, we see that we do not explicitly state what is at stake or what assets are threatened in the Key Message 14.5 text. In this case, health and ecosystems are threatened by poor air quality. At this point in the chapter, these impacts have been introduced in the chapter Introduction, and are discussed again in each successive Key Message. For KM5, the health impacts of air quality are implicit, allowing us to focus this text on the intersection of climate and air quality mitigation. Consequently, we have chosen not to revise the Key Message text.
Juanita	Constible	Text Region	14. Air Quality		18	19	1	14	Co-benefits of GHG reductions on air pollution concentrations also include reductions in health-related costs from climate-sensitive air pollutants. This economic benefit stemming from reduced health burdens is often overlooked, but adds an important component to the economic dimension of GHG cost-benefit analyses. See this article for consideration of health-related costs linked to U.S. ozone exposures, for example: Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2019). Estimating the Health?Related Costs of 10 Climate?Sensitive U.S. Events During 2012. GeoHealth, 3(9), 245--265. https://doi.org/10.1029/2019GH000202. This article discusses the U.S. economic burden of health problems linked to wildfire smoke: Fann, N., Alman, B., Broome, R. A., Morgan, G. G., Johnston, F. H., Pouliot, G., & Rappold, A. G. (2018). The health impacts and economic value of wildland fire episodes in the U.S.: 2008--2012. Science of The Total Environment, 610--611, 802--809. https://doi.org/10.1016/j.scitotenv.2017.08.024	Thank you for this comment. We agree that co-benefits of GHG reductions for reduced air pollution and improved human health is very important, and we have made this a Key Message. Figure 14.10 emphasizes how the monetized air quality co-benefits of reductions often exceed the costs. We have revised the text to clarify and acknowledge that air quality benefits via slowing climate change can be thought of as separate from co-benefits from reductions in co-emitted pollutants. We have added the first reference mentioned (Limaye et al., 2019) to discussion of monetized co-benefits, since this study includes monetization of morbidity. The second reference mentioned (Fann et al., 2018) focuses on impacts of wildfire smoke and is discussed in the wildfire section (KM 14.2).

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Gabrielle	Dreyfus	Text Region	14. Air Quality		19	19	13	25	vc¬Ã¬úMost forms of PM2.5 cool the climate, and removing them exacerbates climate warming (Chs. 2 13 and 3), as seen from historic sulfur dioxide reductions to improve air quality (Leibensperger et 14 al. 2012; Zheng et al. 2020; Westervelt et al. 2021; Dvorak et al. 2022). If PM2.5 reductions are 15 undertaken together with CO2 reductions, the warming may be modest (Shindell and Smith 16 2019). Organic carbon particles, mostly from fires and burning fossil fuels, cause a mix of 17 warming and cooling effects (Szopa et al. 2021). Black carbon is the component that contributes 18 most to warming, and actions targeting sources that emit relatively higher amounts of black 19 carbon, like diesel engines, are expected to best reduce warming while improving air quality. 20 Lastly, ammonia, which contributes to PM2.5, comes mostly from agriculture and is growing in 21 importance (Domingo et al. 2021). Growing grains and legumes emits less ammonia and 22 methane than raising livestock, so these pollutants can be reduced by more efficient farming 23 (Robertson and Vitousek 2009; Powell et al. 2010) and adopting healthier plant-based diets 24 (Hitaj et al. 2019; UNEP and CCAC 2021).vc¬Ã¬ù COMMENT vc¬Ã¬ì This paragraph is not as clear as it could be on the linkages between unmasking of cooling aerosols and mitigation strategies targeting CO2 emissions. While air pollution controls such as use of scrubbers on power plants has historically reduced sulfate emissions without reducing CO2 emissions, policies that target reduction in CO2 emissions by phasing out fossil fuel combustion will reduce both CO2 and sulfates. The only way to limit the warming that results from this unmasking as discussed by Shindell and Smith (2019) is to make deep and targeted reductions in emissions of methane (decarbonization only gets 30% of potential reductions), black carbon, and hydrofluorocarbons. CITE vc¬Ã¬ì Shindell D. & Smith C. J. (2019) Climate and air-quality benefits of a realistic phase-out of fossil fuels, Nature 573: 408vc¬Ã¬ì411, Addendum vc¬Ã¬úMethodsvc¬Ã¬ù (vc¬Ã¬úWe note that, although this study focuses on the effects of fossil-fuel related emissions, accounting for the effects of reductions in greenhouse gases from non-fossil sourcesvc¬Ã¬îincluding fluorinated gases and both methane and nitrous oxide from agriculturevc¬Ã¬ãalong with biofuels that are a large source of warming black carbon, could eliminate any near-term penalty entirely. In fact, given that the net effect of the fossil-fuel phase-out on temperature is minimal during the first 20 years (Fig. 2), reducing these other	Thank for your this comment and for the references provided. We have modified this text to more strongly state that a short-term warming from removal of cooling aerosols can be outweighed by concurrent actions to reduce CO2 emissions and short-lived climate pollutants (SLCPs). We have added a reference to Dreyfus et al. (2022) which gives more detail on the SLCP options than the Shindell and Smith (2019) paper. This together with changes in the previous paragraph to highlight the warming from SLCPs should clarify the choices available.
Nick	Procopio	Text Region	14. Air Quality		26	26	34	34	A period is missing between the following two words, ¬ichange conclusions".	We thank the reviewer for this comment. We have revised to correct this error.
Reid	Sherman	Text Region	14. Air Quality		26	26	34	34	Conclusions is incorrectly capitalized.	Thank you for this comment. We have corrected this error in the revised text.
Reid	Sherman	Text Region	14. Air Quality		27	27	5	5	"emissions reduction potentials" should be edited to read "potential reduction of emissions"	Thank you for this comment. We have revised as suggested so that this sentence reads more clearly.
Gabrielle	Dreyfus	Whole Chapter	14. Air Quality						vc¬Ã¬úKey Message 14.5. Improving Air Quality While Addressing Climate Change Reducing greenhouse gas emissions results in improved air quality and significant public health benefits (high confidence). In many cases these benefits exceed the cost of greenhouse gas emission controls (likely, high confidence). Through coordinated actions emphasizing reduced fossil fuel use, improved energy efficiency, and reductions in short-lived climate pollutants, the US has an opportunity to greatly improve air quality while substantially mitigating climate change, approaching net-zero CO2 emissions (high confidence).vc¬Ã¬ù COMMENT vc¬Ã¬ì Since this is a national climate assessment, consider moving Key Message 14.5 to the top of the chapter and key messages section. Many air pollutants are potent greenhouse gases or precursors. Methane and tropospheric ozone account for over a quarter of GHG radiative forcing globally according to AR6. What is the share for the US? This key paragraph appears buried on page 14-19, lines 3-12: vc¬Ã¬úReducing short-lived climate pollutants, including methane, black carbon, and ozone, directly improves air quality and reduces the near-term rate of warming, affecting climate change more quickly than long-lived GHGs like CO2 (Shindell et al. 2012; Szopa et al. 2021). Methane directly contributes to warming and increases ozone air pollution globally (West and Fiore 2005). The social cost of methane is estimated around $4,000 to $8,000 per metric ton (in 2018 dollars), over half of that from ozone health impacts (Shindell et al. 2017; UNEP and CCAC 2021). Volatile organic compounds and carbon monoxide form ozone in the atmosphere, and reducing their emissions benefits both climate and air quality. Nitrogen oxides also contribute to ozone but have a net cooling influence by shortening methanevc¬Ã¬ôs lifetime and forming PM2.5 (Fry et al. 2012; Szopa et al. 2021).vc¬Ã¬ù	Thank you for this insightful comment. Although the comment doesn't explain the logic of moving KM14.5 to the top of the chapter, we inferred that the commenter wanted to raise the visibility of this Key Message. We discussed this idea among chapter authors. Some liked the idea of putting KM14.5 first because it is the most policy-actionable KM in our chapter. Others liked keeping it last because of the logic of discussing air pollution impacts before the benefits of reducing air pollution and GHGs. We decided to keep the order of the Key Messages unchanged, allowing us to end with a bang. On the other points raised, we have revised the text on short-lived climate pollutants to make it more substantial, but we have chosen to keep it located at the end of this Key Message, allowing us to focus on the opportunity to address air pollution and climate change simultaneously. In these revisions, we have added a sentence that quantifies the temperature change from SLCPs globally, which strengthens the section by showing the importance of SLCPs. We do not focus on the share that is the US, as the commenter suggests, because the fraction of SLCPs over the US is not a good indicator of the temperature change the US will experience, which is driven by global concentrations.
Jessica	Hinshaw	Text Region	15. Human Health		3	3	2	2	The phrase "Climate change is already... " may result in misunderstanding around time scale and urgency. Anthropogenic Climate change has been happening at least since the beginning of the Industrial Revolution with health effects first observed for decades, and certainly clearly by the 1980's with the Toronto Conference. It seems framing the time scale to align with this knowledge rather than using "already" may help clarify the urgency (and late start) of the issue.	Thank you for your suggestion. After consideration, we have decided to keep the text as is because we feel it conveys our sense of urgency and scale.
Lucy	Peterson	Figure	15. Human Health		3		4		The sentence "all are expected to increase in frequency, intensity, and extent" should have a citation.	Thank you for your suggestion. We have added a reference to KM 2.2.
Juanita	Constible	Text Region	15. Human Health		3	3	4	8	The listing of health outcomes of climate change is incomplete. By inserting this, the listing will be more complete: episodic increases in heat-related morbidity and mortality (Ebi et al. 2021).	Thank you for your suggestion. We have included a brief description of impacts as space allowed. Heat is covered extensively in all three Key Messages.
Rachel	Licker	Text Region	15. Human Health	3	3	4	8	"Health outcomes of climate change" is a bit of odd wording as it is more specifically "Health outcomes associated with climate-related extreme events." Also "exposure to infectious	Thank you for your comment. The authors prefer not to use "climate-related extreme events," since not all health outcomes are associated with extreme events. For example, ambient temperature increases cause negative health outcomes, but are not extreme events. We have adjusted the language as you suggested, so that we are not referencing outcomes, but rather risks. The sentence now reads, "The potential health risks from a changing climate include higher rates of heat-related morbidity and mortality, increases in the geographic range of some infectious diseases, greater exposure to poor air quality, increases in select..."	

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Licker	Text Region	15. Human Health	3	3	10	10	If "overburdened" is not otherwise defined, it should be explained here for readers who may not be aware of what this means. Overburdened by what?	Thank you for your suggestion. We are suggesting that a definition of this term be included in the overall glossary since it appears in multiple chapters in the NCA5.	
Brittany	Gutermuth	Text Region	15. Human Health		3	3	12	14	addition of ‚Äúclimate change education‚Äù	Thank you for your suggestion. We have included the need for climate change education in Traceable Accounts.
Emma	Conrad-Rooney	Text Region	15. Human Health		3	3	16	20	To follow the Risk-Based Framework, Key Message 1 should include what can be done about these highlighted problems.	Thank you for your suggestion. KM 1 focuses on documenting climate change/health issues. We have described adaptation and mitigation efforts, including risk reduction, in KM3.
Jessica	Hinshaw	Text Region	15. Human Health		3	3	17	17	Consider adding in "climate" before events to improve clarity. For example, "increasing frequency and intensity of extreme climate events"	Thank you for your suggestion. We feel that our message is clear with the inclusion of climate at the beginning of the sentence because extreme events are often weather events, not exclusively climate events.
Rachel	Licker	Text Region	15. Human Health	3	3	22	25	Unclear why the title is "Temperature Extremes" when the evidence largely discusses Extreme Heat. Possible to change section title to Extreme Heat? In line 24, change "causes" to "can cause"	Thank you for these suggestions, which have been incorporated into the text.	
Robin	Cooper	Text Region	15. Human Health		3		26		Section Temperature Extremes: High temperatures and extreme heat have a range of adverse impacts on behavior and mental health. (Mullins, et al 2019; Thompson, et al. 2018)These include but are not limited to increased aggression and violence (Carlton, et al, 2016) , suicide (Burke, M, et al 2018, Dumont, et al 2020; Gao, et al. 2019), impaired sleep (Obradovich, et al. 2017), impaired cognitive functioning (Cendev‡o Laurent, et al 2018, Hancock, et al 2003) and mood impacts. General emotional well-being is also adversely impacted by increased temperatures. (Noelke, C , et al. 2016) References: Burke M, Gonzv"lez F, Baylis P, Heft-Neal S, Baysan C, Basu S, Hsiang S. (2018) Higher Temperatures increase suicide rate in United States and Mexico. Nature Climate Change. 8, pages723,Äi729 https://www.nature.com/articles/s41558-018-0222-x Carlton, T, Hsiang, SM, Burke, M. Conflict in a Changing Climate (2016), The European Physical Journal Special 225, pages489-511. DOI: 10.1140/epjst/e2015-50100-5 Cendev‡o Laurent, JG, Oulhote, WA, Zanobetti, A, Allen JG, Spengler, JD. (2018). Reduced cognitive function during a heat wave among residents of non-airconditioned buildings: An observational study of young adults in the summer of 2016. PLoS Med 15(7) doi: 10.1371/journal.pmed.1002605 Dumont, C, Haase, E, Dolber, T, Lewis, J, & Coverdale, J(2020). Climate Change and Risk of Completed Suicide. The Journal of nervous and mental disease, 208(7), 559,Äi565. https://doi.org/10.1097/NMD.0000000000001162 Gao, J., Cheng, Q., Duan, J., Xu, Z., Bai, L., Zhang, Y., Zhang, H., Wang, S., Zhang, Z., & Su, H. (2019). Ambient temperature, sunlight duration, and suicide: A systematic review and meta-analysis. The Science of the total environment, 646, 1021-1029. DOI: 10.1016/j.scitotenv.2018.07.098 Hancock PA, Vasmatzidiis I. (2003) Effects of heat stress on cognitive performance: the current state of knowledge. Int J Hyperthermia. 19:355-372. doi: 10.1080/02656730310001642420	Thank you for this comment. We agree with your assessment of the mental health sequelae from heat exposure. Unfortunately, we do not have space here to expand and also point to NCA 4 where mental health topics were previously covered. In this assessment we have focused on youth mental health.
Jessica	Hinshaw	Text Region	15. Human Health		3	3	27	30	Consider including that people with certain chronic diseases like asthma, heart disease, diabetes, etc. One resource: https://northtexasheatresearchproject.com/	Thank you for your suggestion. After consideration, we have decided to keep the text in this section as-is because be already mention that hot weather worsens chronic health conditions.
Robin	Cooper	Text Region	15. Human Health		3		29		Children, who have immature heat regularly function, faster metabolic rates and greater ratio of surface area to body mass are particularly vulnerable to extreme heat. (Van Nieuwenhuizen, A, et al (2021). At the other end of the age spectrum, elderly are particularly risk group especially those with chronic illnesses and medication use. (Kaltsatour, et al. 2018) References; Kaltsatou A, Kenny GP, Flouris AD (2018) The Impact of Heat Waves on Mortality among the Elderly: A Mini Systematic Review. J Geriatr Med Gerontol 4:053. doi.org/10.23937/2469-5858/1510053 Van Nieuwenhuizen, A, Hudson, K., Chen, X, Hwong, A. (2021) The Effects of Climate Change on Child and Adolescent Mental Health: Clinical Considerations. Current Psychiatry Reports. 23(88) Doi. 10.1007/s11920-021-01296-y	Thank you for this comment. Given limited space, we are unable to include further detail here but the references provided do speak to these matters. We have included a specific reference focused on children (Bernstein et al 2022)

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jessica	Hinshaw	Text Region	15. Human Health		3	3	30	32	Consider elaborating on heat-island effects and how historically redlined communities are at much greater risk of being hotter than areas that did not experience redlining. Resource: https://www.scientificamerican.com/article/past-racist-redlining-practices-increased-climate-burden-on-minority-neighborhoods/ Further, we recommend including details people experiencing homelessness, outdoor workers, and agricultural workers who have greater exposure to heat.	Thank you for your suggestion. We have now included historically redlined communities in this sentence, which is supported by the existing references.
Rachel	Licker	Text Region	15. Human Health	3	3	27	30	"Pregnant people" and "people with disabilities" should be explicitly included in the list of people who are more vulnerable to the effects of extreme heat. In addition,	Thank you for these suggestions. We have revised these sentences to now refer to people with disabilities, who are pregnant, and those engaged in outdoor labor. We have also rephrased the word "minority" to now refer to the specific Black, Latinx, and Asian communities covered in the cited references.
Robin	Cooper	Text Region	15. Human Health		3		32		Those with pre-existing psychiatric illnesses and substance users are also particularly vulnerable with those with severe mental illness have an increased morbidity and mortality rates (Bouchama, etal 2007, Liu, et al. 2021, Page, et al 2016). The mentally ill have greater use of ED services (Basu, et al 2018, Nori-Sarma, et al 2020) and hospitalizations (Schmelt ,et al 2017) than those with no psychiatric diagnosis. The psychiatric medications that are used in patients with mental illnesses can have an adverse impact on thermoregulation placing them at increased risk during extreme heat. (Martin-Latry, et al 2007) References: Basu R, Gavin L, Pearson D, Ebisu K, Baliq B: (2018) Examining the association between apparent temperature and mental health-related emergency room visits in California. Am J Epidemiol 187:726-735 http://dx.doi.org/10.1093/aje/ kwx295. Bouchama A, Dehbi M, Mohamed G, et al.: Prognostic factors in heat wave related deaths: a meta-analysis. Archives of Internal Medicine 167:2170,Äi2176, 2007 Liu, J, Varghese, A, Xiang, J, Zhang, Y, Dear, K., Grouley, M.,Driscoll, T. Morgan,G., Capon, A., Bi, P., (2021). Is there an association between hot weather and poormentalhealth outcomes? A systematic review and meta-analysis. Environment International. Vol 153 https://doi.org/10.1016/j.envint.2021.106533 Martin-Latry K, Goumy MP, Latry P, Gabinski C, Begaud B, Faure I, Verdoux H. Psychotropic Drugs use and risk of heat-related hospitalisations. Eur Psychiatry. 2007 Sept; 22(6): 335-8. Nori-Sarma, A., Sun,S, Sun, Y, Spangler, R, Oblath, R, Galea, S, Gradus, J,Wellenius, G. (2022). Association Between Ambient Heat and Risk of Emergency Department Visits for Mental Health Among US Adults, 2010 to 2019. JAMA Psychiatry. 2022;79(4):341-349. doi:10.1001/jamapsychiatry.2021.4369 Page, LA,Shakoor H, Kovats RS, Howard LM. Temperature-related deaths in people with psychosis, dementia and substance abuse. BJP, 2012;200 485-511(2016) Schmeltz MT, Gamble JL: (2017) Risk characterization of hospitalizations for mental illness and/or behavioral disorders with concurrent heat-related illness. PLoS One, 12: e0186509	Thank you for this comment. We have added text to underscore risks of heat to those with mental health disorders as well as from psychotropic medications.
William	Licopoli	Text Region	15. Human Health		4	6	1		An additional chapter should be added that focuses on education of climate change at the high school level can directly effect choices we make as informed citizens. Environmental science, including climate change, should be required for all students for secondary education.	Thank you for your suggestion. We will definitely share this suggestion with NCA5 leadership. And, we have added the gaps in climate and health education to our Traceable Accounts.
Beth	Haley	Figure	15. Human Health		4		2		We feel the description for Compound Risks could be broader to include other disasters besides COVID-19. For example, it could read: "COVID-19 protocols, extreme weather events, and other disasters reduce the accessibility and effectiveness of cooling centers."	Thank you for your suggestion. We have included high level examples for the figure, but the "Focus on COVID 19" provides greater details of compounding risks.
Juanita	Constible	Text Region	15. Human Health		4	4	4	5	In caption for Figure 1, to be more specific about racial inequities in heat exposures, suggest adding AND RACIAL after social.	Thank you for your suggestion. We are changing the figure label to read social and racial and have added context in the caption.
Rachel	Licker	Text Region	15. Human Health	4	4	9	9	Is "billion-dollar weather disasters" referring to disasters that have yielded billions of dollars worth of damage? Please clarify what this means.	Thank you for the this suggestion. We have revised the terminology to improve clarity.	

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Licker	Text Region	15. Human Health	4	4	12	14	The sentence only cites one paper explicitly associated with arsenic exposure in private wells, whereas the rest of the articles appear to be more explicitly associat	Thank you for this suggestion, which has been incorporated into the text. We have rephrased the wording to say, "Drought can worsen air and water quality, resulting in adverse health outcomes such as increased cardiovascular and pulmonary disease and premature death (Bell et al. 2018; Achakulwisut et al. 2018). It can also decrease water quantity and quality that can cause increased exposure to heavy metals, bacteria, and other harmful contaminants (Bell et al. 2018; Achakulwisut et al. 2018; Sugg et al. 2020; Lombard et al. 2021; New-Aaron et al. 2021; KM 30.2)."	
Nick	Procopio	Text Region	15. Human Health		4	4	15	16	Expand on why drought could be associated with worsening mental health of farms (e.g., economic stress of poor crop yields or inadequate resources to support livestock) to parallel the previous sentence generalized description of how drought affects human health. Also, this section could include a mention of how agricultural deficits under drought conditions contribute to resource insecurity within the local population and more broadly.	Thank you for the suggestion. We have changed the terminology to illustrate the findings of the study. Since this section is focused on health, we decided to not incorporate the agricultural impacts, but recommend readers to visit the ag chapter to learn more.
Robin	Cooper	Text Region	15. Human Health		4		16		SECTION: Drought Drought is considered a ‚Äúslow moving disaster,‚Äù with numerous health and mental health impacts which are mediated thru complex social, environmental, economic and emotional pathways. Mental health impacts can be significant. (Vins, et al 2015) Australian Indigenous populations have been particularly hard struck by drought conditions with adverse socio-emotional and spiritual impacts. The Aboriginal groups in New South Wales are only one example of how prolonged drought conditions have multiplied pre-existing disadvantages and adversely affected social and emotional well-being. Some reported despair at not being able to fulfil cultural obligations, disrupted ties to their land threatening cultural identity as well as forced displacement from traditional lands creating fragmentation to their community and profound sense of loss. However, these challenges also contributed to an increased sense of love and attachment to land and a heightened commitment to caring for the land. Artistic expression, traditional Aboriginal dreaming and specific well-being programs helped with coping and adaptation. (Rigley, et al. 2011) Australia has also seen increases in suicides in farmers associated with droughts. Researchers have found a 15% increase in suicide among men ages 30-49 during periods of drought. (Hanigan, et al. 2012). These same researchers used modeling to estimate future suicides attributed to droughts and have projected increases in rural men aged 10‚Äì29 and 30‚Äì49 yrs. (Hanigan, et al 2022) Drought conditions have contributed to an epidemic of suicides in Indian farmers with warming temperatures and loss of arable farmland in India was associated with approximately 59,000 additional suicides, accounting for ~7% of the total upward trend. (Carlton, 2017, Parida, et, al 2018) References: Carleton, T.A. (2017) Crop-damaging temperatures increase suicide rates in India Proceedings of the National Academy of Sciences United States of America, 114 (33) (2017), pp. 8746-8751 Hanigan, IC, Butler,CD, Kokic, PN, Hutchinson, MF. (2012) Suicide and drought in New South Wales, Australia, 1970‚Äì2007. Proc Natl Acad Sci U S A. 109(35): 13950‚Äì13955	Thank you so much for the recommendations. These are wonderful resources. Unfortunately, the articles selected are not focused on the United States or are outside the timeframe that we are using for our study period.
Julie	Becker	Text Region	15. Human Health		4	4	23	26	It would be helpful to add in a comment about pharmaceuticals- how a life cycle approach from development to distribution and pricing is essential for health resilience and emerging new diseases caused or exacerbated by climate change.	Thank you for this suggestion. We added in the development and stockpiling of pharmaceuticals as a positive outcome that can come from enhanced disease surveillance and identifying new and emerging climate-sensitive infectious disease threats.
Juanita	Constible	Figure	15. Human Health		4				The text in this figure seems to be avoiding terms relating to race, and could include more specific information in several places: in upper left panel, Historically redlined communities are largely communities of color, which could be specified; in upper right panel, the statement that Certain populations are more vulnerable to extreme heat needs more specificity; and in lower right panel, please include modifiers to describe how Disadvantaged populations in second bullet are disadvantaged (economically, socially, politically?).	Thank you for your suggestion. We are changing the figure label to read social and racial and have added more context in the caption.
Samantha	Hall	Text Region	15. Human Health		5	5	1	10	The wildfire section is important, and I appreciate that it is included in the text. However, this section does not include any information on human displacement during and after fires. This is an important aspect that relates to long-term consequences of fiscal, social, and likely physical health (esp. if medications/medical equipment are destroyed in fires).	Thanks for your suggestion. We have indicated that wildfires and poor air quality can result in disruptions to person's life, including loss of livelihood and displacement.
Skye	Wheeler	Text Region	15. Human Health		5	5	1	10	Wildfires, page 5 Please consider including adverse birth outcomes, including preterm birth and low birth weight, in the list of harms from wildfire exposure. References: Holstius DM, Reid CE, Jesdale BM, Morello-Frosch R. Birth weight following pregnancy during the 2003 Southern California wildfires. Environ Health Perspect. 2012 Sep;120(9):1340-5. doi: 10.1289/ehp.1104515. Epub 2012 May 29. PMID: 22645279; PMCID: PMC3440113. Sam Heft-Neal, Anne Driscoll, Wei Yang, Gary Shaw, Marshall Burke, Associations between wildfire smoke exposure during pregnancy and risk of preterm birth in California, Environmental Research, Volume 203, 2022, 111872, ISSN 0013-9351, https://doi.org/10.1016/j.envres.2021.111872. Park, BY, Boles, I, Monavvari, S, et al. The association between wildfire exposure in pregnancy and foetal gastroschisis: A population-based cohort study. Paediatr Perinat Epidemiol. 2022; 36: 45‚Äì53. https://doi.org/10.1111/ppe.12823 Abdo M, Ward I, O'Dell K, Ford B, Pierce JR, Fischer EV, Crooks JL. Impact of Wildfire Smoke on Adverse Pregnancy Outcomes in Colorado, 2007-2015. Int J Environ Res Public Health. 2019 Oct 2;16(19):3720. doi: 10.3390/ijerph16193720. PMID: 31581673; PMCID: PMC6801422. Amjad S, Chojecki D, Osornio-Vargas A, Ospina MB. Wildfire exposure during pregnancy and the risk of adverse birth outcomes: A systematic review. Environ Int. 2021 Nov;156:106644. doi: 10.1016/j.envint.2021.106644. Epub 2021 May 21. PMID: 34030071. Applied Economics Letters: Vol 29, No 14 (tandfonline.com) Benjamin A. Jones & Shana McDermott (2022) Infant health outcomes in mega-fire affected communities, Applied Economics Letters, 29:14, 1325-1335, DOI: 10.1080/13504851.2021.1927959 Weeberb J. Requia, Stefania Papatheodorou, Petros Koutrakis, Rajarshi Mukherjee, Henrique L. Roig, Increased preterm birth following maternal wildfire smoke exposure in Brazil, International Journal of Hygiene and Environmental Health, Volume 240, 2022, 113901, ISSN 1438-4639, https://doi.org/10.1016/j.ijheh.2021.113901	Thanks for that suggestion. I have identified adverse reproductive outcomes to the list of adverse health effects resulting from wildfires.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Licker	Text Region	15. Human Health	5	5	3	7	The sentence is a bit oddly worded. I would suggested changing to, "Roughly half of the increase in burned areas can be attributed to a warming climate (Burke et al. 2021)." Further	Thanks for the suggestion. We have revised the text to read: Roughly half of the increases in burned areas in the United States can be attributed to a warming climate. And also: Exposure to Ssmoke from wildfires is associated with cardiovascular-, cerebrovascular-, and respiratory-related emergency department visits, hospitalizations, and deaths	
Robin	Cooper	Text Region	15. Human Health		5		10		Section : Wildfires Wildfires represent only one form of acute disaster with enormous impacts of mental health. More generally, acute disasters (floods, severe storms, wildfires, etc) have significant impacts on mental and behavioral wellbeing. Although many who experience acute disasters will have only transitory emotional distress responses, some with go on to have more significant and enduring mental health consequences including post-traumatic stress, depression, anxiety and increased alcohol and substance abuse. (Goldman & Galea, 2014; Morgenstein & Ursano, 2020) References: Goldmann, E., & Galea, S. (2014). Mental Health Consequences of Disasters. Annual Review of Public Health, 35(1), 169-183. doi:10.1146/annurev-publhealth-032013-182435 Morganstein, J., and Ursano, R. (2020). Ecological disasters and mental health: Causes, consequences, and interventions. Front Psych, 11, 1. doi.org/10.3389/fpsyt.2020.00001	Thanks for your suggestion. We are addresssing all-encompassing impacts and not necessarily distinguishing between impacts from acute vs. chronic exposures.And we have made the following edit: Wildfires and resulting poor air quality can cause disruptions to a person's life, including loss of livelihood and displacement, and can lead multipleto multiple adverse health effects, including death, illnesses, injuries, adverse reproductive outcomes, poor mental health consequences, and declines in psychosocial well-being. We have also added the suggested citations.
Juanita	Constible	Text Region	15. Human Health		5	5	17	17	To better clarify how valley fever is transmitted, suggest adding this after living in arid soils: AND TRANSMITTED IN AIRBORNE DUST.	Thank you for this suggestion. This section has been edited in response to other comments and shortening the text, and this text no longer exists.
Juanita	Constible	Text Region	15. Human Health		5	5	26	27	Please specify to what year(s) this 80% statistic pertains.	Thank you for your comment. We have changed the sentence so that it now reads "Currently and over the last 20 years, tick-borne diseases account for approximately 80% of all reported cases of vector-borne diseases in the US (CDC 2021)."
Juanita	Constible	Text Region	15. Human Health		5	5	27	29	Please specify over what years incidence and distribution have steadily increased, and substitute HAVE for HAS.	Thank you for your suggestions. We have changed the sentence so it now reads: 'Lyme disease incidence and geographic distribution have steadily increased over the last 20 years due to climate change, changes in land use and human behavior, and increased tick and host populations (Bisanzio et al. 2020; Kugeler et al. 2021; Beard et al. 2019). '
Juanita	Constible	Text Region	15. Human Health		5	5	30	31	Please specify by what year or over what future period this statement pertains.	Thank you for your suggestion. We have changed the sentence so now it reads :Geographic distribution projections include poleward range expansion and upslope spread in mountainous regions, as well as increased abundance of ticks in many current endemic regions for the periods 2011-2040 and 2041-2070.'
Reid	Sherman	Text Region	15. Human Health		5	5	30	30	Geographic distribution of what? Does it mean 'Projections of geographic tick distributions'?	Thank you for your comment. We have amended the sentence to read geographic distribution projections of ticks include poleward expansion...
Juanita	Constible	Text Region	15. Human Health		5	5	33	35	Please specify over what time period these changes have occurred.	Thank you for your suggestion. We have changed the sentence and now it reads: 'Climate change has contributed to the northerly expansion of both the lone star tick (Lippi et al. 2021; Ma et al. 2021; Molaei et al. 2019; Raghavan et al. 2019; Sagurova et al. 2019) and the Gulf Coast tick, which transmit multiple pathogens (Molaei et al. 2021) in the last 20-30 years.
Juanita	Constible	Text Region	15. Human Health		6	6	6	11	Please specify over what time period these changes have occurred, or are projected to increase.	Thank you for your suggestion. We have changed the sentence so that it now reads, "Mosquito-borne transmission of viruses including St. Louis encephalitis, eastern equine encephalitis, and La Crosse viruses has been sporadic in the last decade and may increase as climate change expands habitat suitability for competent mosquito species." Corrin et. al. 2021; Diaz et. al. 2018; and Harding et. al. 2018 have been added as references.
Rachel	Licker	Text Region	15. Human Health	5	6	25	11	The "Vector-Borne Diseases" section thoroughly discusses the predicted expansion of tick and mosquito seasons and range, but provides little information on the	Thank you for your comment; we have clarified our statement on WNV. Regional West Nile virus projections indicate geographic expansion in the northeast over the next fifty years due to climate-related changes in mosquito population distribution.	
Juanita	Constible	Text Region	15. Human Health		6	6	14	14	In the caption to Figure 2, the icons on the map seems to convey increases or the presence of different infectious diseases. If these are select examples, were they selected because they are important or major diseases in the regions? If so, please speciy in the caption.	Thank you for your suggestion. The select examples were identified based on changes in risk distribution or incidence, and the caption now reads, "Map of select examples of current regional variability in climate-sensitive infectious diseases, (select examples based on recent changes in risk distribution or incidence in the specified region). Some regions will experience increases in tick- and mosquito-borne diseases, zoonotic diseases, and pathogens, both in geographic area and extended seasonality. Figure sSources: Los Alamos National Laboratory, CDC, Columbia University, University of Arizona, and University of Colorado."

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Robin	Cooper	Text Region	15. Human Health		6	7	18	9	Section: Food and Water there is no mention of the mental health impacts of food scarcity. Some additional impacts: FOOD INSECURITY: Food insecurity and lack of adequate nutrition contribute to life-long impairments in physical and brain development with resultant cognitive, intellectual, emotional, and academic impairments over the life span especially for children. (Shanker, et al. 2017). Beyond the adverse development impacts, food insecurity contributes to mental health difficulties including stress from uncertainty, anxiety, depression and shame and guilt in efforts to obtain food in socially sanctioned ways (Jones, et al 2017) and is associated with increased psychiatric disorders (Muldoon, et al 2013) References: Jones A. D. (2017). Food insecurity and mental health status: A global analysis of 149 countries. American journal of preventive medicine, 53(2), 264,Äì273. https://doi.org/10.1016/j.amepre.2017.04.008 Muldoon, K. A., Duff, P. K., Fielden, S., & Anema, A. (2013). Food insufficiency is associated with psychiatric morbidity in a nationally representative study of mental illness among food insecure Canadians. Social psychiatry and psychiatric epidemiology, 48(5), 795,Äì803. https://doi.org/10.1007/s00127-012-0597-3 Shankar, P., Chung, R., & Frank, D. A. (2017). Association of Food Insecurity with Children's Behavioral, Emotional, and Academic Outcomes: A Systematic Review. Journal of developmental and behavioral pediatrics : JDBP, 38(2), 135,Äì150.	Thank you for your comments. We appreciate your calling attention to mental health impacts. We have stated that health is negatively impacted by food insecurity, but we are space restricted and cannot list all the impacts.
Jessica	Hinshaw	Text Region	15. Human Health		6	7	18	9	The food and water section could also include information about crop viability/changes. For example, rising sea levels increase salinity of water which impacts which crops can be grown and eaten, as well as water use. There is also evidence that CO2 levels decrease nutritious value of food.	Thank you for your suggestion. We link to KM 25.3 and KM 11.2 where these concepts of salinity and rising seal level are covered in detail. Micronutrient contents is covered extensively in NCA4, and we are not aware of new, groundbraking research in this arena.
Nick	Procopio	Figure	15. Human Health		6				The figure mentions histoplasmosis, cyrotococcosis, and amebic meningoencephalitis, but those diseases are not mentioned in the text. The figure is great. It is suggested that the text at least mention the all the pathogens/diseases described in the figure.	Thank you for this suggestion. We have edited the text to address the diseases included in the figure. We added in a sentence on the risk of dengue in the US-affiliated Pacific Islands, Hawai'i, the US Caribbean. We also added in text about the other diseases mentioned: "In the eastern US, the range of exposure to the amoeba (Naegleria fowleri) that causes the rare and typically fatal primary amebic meningoencephalitis has been documented further north indicating a possible geographic expansion, though there are few total documented cases (Gharpure et al. 2021). Environmental fungal diseases like blastomycosis, coccidioidomycosis (Valley fever), cryptococcosis, and histoplasmosis are also expectedwill likely to be impacted by climate change, though defining the current geographical extent of most fungal pathogens and how they relate to their surrounding environment is ongoing (Hepler et al. 2022; Jackson et al. 2021; Uejio et al. 2015)."
Rachel	Licker	Text Region	15. Human Health	6	7	18	9	It would be helpful if the first sentence of the Food and Water section provided more specific detail on how climate change impacts food security and nutrition, for example	Thank you for your suggestion. We have provided a link to KMs 4.1, 11.2, and 25.3 which focus on water quality, food security, and the impacts on communities that rely on the land. We have added water quality to the first sentence in addtion to the reference to KM 4.1. Because we are space restricted, we have tried to include evidence that is new and was not highlighted in NCA4.	
Nick	Procopio	Text Region	15. Human Health		7	7	11	21	It should be noted that PTSD occurs not only in survivors but also in first responders to traumatic climate related events.	Thank you for your suggestion. We have added a sentence to the Occupational Health section providing additional examples of occupational health and safety impacts of climate change, including a reference to mental health impacts due to occupational exposure to climate impacts experienced by workers. Due to space limitations and scope of this section we are focusing on broader impacts rather than detailing impacts for specific populations.
Juanita	Constible	Text Region	15. Human Health		7	7	15	15	Please change the word HAS to the plural HAVE, after rates of anxiety.	Thank you for your suggestion. We have made your suggested change.
Juanita	Constible	Text Region	15. Human Health		7	7	18	21	In describing the community effects of the Camp Fire, the mental health harms of losing one's home and the disruption of one's community could be mentioned to provide more context.	Thank you for your suggestion. We have added language in the sentences about the Camp Fire about the mental health harms related to the context of losing one's home and the disruption to one's community.
Robin	Cooper	Text Region	15. Human Health		7	7	21	22	Section : Mental and Spiritual Health One of the significant impacts of slow (drought, sea level rise, gradual destruction to environment) and acute disasters (wildfires, hurricanes, floods, superstorms, etc) is the reduction in habitable paces for living and the pressure for migration and displacement. The emotional and psychic toll and behavioral health impacts are enormous including psychic confusion, loss of sense of place/belonging and cultural history, loss of spiritual connection, fragmentation of community, loss social supports, hostility by host communities with associated unleashing of racism and scapegoating, violence and civic unrest and is a risk multiplier of poverty and other social determinants of health. References: Siriwardhana, C., & Stewart, R. (2013). Forced migration and mental health: prolonged internal displacement, return migration and resilience. International health, 5(1), 19,Äì23. https://doi.org/10.1093/inthealth/ihs014 Shultz JM, Rechkemmer A, Rai A, McManus KT: Public health and mental health implications of environmentally induced forced migration. Disaster Med Public Health Prep 2019, 13:116- 122 http://dx.doi.org/10.1017/dmp.2018.27	Thank you for the suggestions. We have added language to the Mental and Spiritual Health section about the consequences of acute (e.g., wildfires, floods) and slow-onset disasters (e.g., drought, sea level rise) resulting from forced displacement and migration, traumatic experiences, loss of sense of place and belonging, and disruption of livelihoods, lifeways, and social support systems, among other impacts. We added the Shultz et al. 2019 reference; the focus is predominantly on references since the prior NCA. We also added wording in the Drought section to discuss the connection between mental health outccomes with farmers to mention their reliance to the land for their livelihoods.
Nick	Procopio	Text Region	15. Human Health		7	7	26	27	This section could also include a discussion of how population displacement disrupts community centers which offers the services described ¬ñ this includes places of worship, so it contributes to the ¬ìloss of spiritual health" discussed in this section.	Thank you for your suggestion. This section is focused on mental and spiritual health. We added language about the mental and spiritual health consequences from forced displacement and migration, traumatic experiences, loss of sense of place and belonging, and disruption of livelihoods, lifeways, and social support systems, among other impacts.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Licker	Text Region	15. Human Health	7	7	22	26	This section appears to discuss Indigenous communities but does not explicitly say so. Recommend explicitly stating the implications for Indigenous communities.	Thank you for suggestions. We have made the suggested changes to explicitly state the implications for Indigenous communities.	
Rachel	Licker	Text Region	15. Human Health	7	7	27	30	I believe "afford" is used incorrectly here -- what about "provide" or "offer"? This section would also benefit from references.	Thank you for your suggestion. We have changed from the word afford to provide as you suggested.	
Charles	Keeling	Text Region	15. Human Health		8	9	1	30	One or more references to climate change education could be appropriately added to chapter 15, pp. 8-9: "Children and Adolescent Mental Health".	Thank you for your suggestion. The section on child and adolescent mental health is part of KM1 which describes how climate change is harming human health. The authors feel this section is well-referenced; it includes 7 references and 4 citations from other chapters. A sentence and a reference have added that specifically address youth/climate programs.
Nadia	Gronkowski	Figure	15. Human Health		8	8	1	9	The Early Years Climate Action Task Force appreciates the authors,Äô inclusion of both mental and physical health impacts on children. As a complement to the information in box 15.1 (page 15-8, lines 1-9), the Task Force offers the recent report ‚ÄúThink of the Children: The Young ‚Äì and Future Generations ‚Äì Drive U.S. Climate Concern,Äù from Capita and the Aspen Institute, which includes 2022 Siena College survey data sharing the perspectives of parents of children ages 0-8 on climate change. Parental attitudes provide an additional relevant indicator of how climate change is affecting the behaviors and mental health of families. Suggestion for Improvement: The Task Force recommends that the authors further explore the links between the negative impacts of climate change and children,Äôs preparedness and opportunities to learn. This important connection was named in the report,Äôs case study on the Arizona Department of Health Services heat policy guidance, and should be emphasized further throughout as a major short- and long-term challenge for children,Äôs mental health and cognitive development.	Thank you for this comment. We agree that these are important pieces of information but unfortunately we do not have additional space to include these additional pieces of content in the chapter.
Nick	Procopio	Figure	15. Human Health		8				This graphic is unclear ¬ñ please consider a traditional pie chart or even a bar graph to display these data. The percentages do not add up to 100% and, as it is displayed currently, it is unclear how the ¬ì26% of participants" statement below the survey box results relates to the previous data.	Thank you for this suggestion. The figure is being revised to clarify the percentages displayed.
Elizabeth	Wilkening	Whole Page	15. Human Health		8				Climate Change Education that elevates youth voices and provides opportunities for action should be included in the mental health section. NOAA Community Resilience projects highlight some of this work and it is very effective in empowering youth, improving mental health, and providing a multitude of skills.	Thank you for this comment. We have added text to emphasize the need for youth empowerment through educational opportuities.
Juanita	Constible	Figure	15. Human Health		8				In the large text above the graphic, please include the year of the survey.	We have added the citation in the caption which includes the year of the survey.
Juanita	Constible	Text Region	15. Human Health		9	9	1	3	This statement about improved access to community mental health services helping to counter individual cilmate anxiety makes an abrupt leap to encouraging mitigation and adaptation, which aread as larger-scale, community-level outcomes. If appropriate to the material, please consider adding a phrase to match the statement more to the individual scale, for example adding the phrase MORE ACTIVE ENGAGEMENT IN after encourages.	Thank you for this comment. We have edited the text to address programs aimed at youth mental health concerns around climate change.
Nick	Procopio	Text Region	15. Human Health		9	9	14	15	The sentence that begins ¬ìWindstorms during 2005-2013..." is awkward to read. Consider adding a few clarifying words, i.e., ¬ìWindstorms during [the years of/the period from] 2005-2013..."	Thank you for your suggestion. We have edited as you suggested.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Robin	Cooper	Text Region	15. Human Health		9	9	17	18	Section: Compounding and Cascading Hazards Despite the broad awareness that air pollution (AP) has significant impacts on pulmonary and cardiovascular health and is a leading cause of illness worldwide, there is less recognition of the significant impacts on brain and neuropsychiatric functioning. There is evidence of significant association between particulate matter exposure and wide range of neurodevelopmental and neurodegenerative illnesses. (Fu, et al 2019) Air pollutants, Particular Matter (PM) 2.5 and ultrafine particles can have direct access to the brain thru the olfactory apparatus and, therefore, can specifically target the brain with mechanisms of oxidative stress and inflammation postulated as causal drivers. (Hahad, et al. 2020, Underwood, 2017). Short term exposure to nitrous oxide has been found to be associated with increased depression (Fan, et al 2020). Longer term exposures are associated with significant higher rates psychiatric conditions, particularly depression and bipolar disorder. Khan, et al 2019) Particularly concerning is the impact of air pollution on the developing fetus and children since impacts at these crucial early stages of development have long lasting implications for life-long functioning. Air pollution has been linked to a wide range of neurodevelopmental disorders in children including developmental delay, reduced IQ, disorders of attention. anxiety and depression (Perrara, 2017). Pathological findings have been found in children,Äôs brains of those with significant exposure to air pollution. (CalderV2n-GarciduevÂ±as, et al 2016 and 2012). References: CalderV2n-GarciduevÂ±as L, Reynoso-Robles R, Vargas-MartV¥nez J, GV≥mez-Maqueo-Chew A, PV©rez-GuillV© B, Mukherjee PS, Torres-JardV2n R, Perry G, GV≥nzalez-Maciel A. (2016) Prefrontal white matter pathology in air pollution exposed Mexico City young urbanites and their potential impact on neurovascular unit dysfunction and the development of Alzheimer's disease. Environ Res 146:404-417. DOI: 10.1016/j.envres.2015.12.031 CalderV2n-GarciduevÂ±as L., Kavanaugh M., Block M., D'Angiulli A., Delgado-ChV"vez R., Torres-JardV2n R.,	Thank you for highlighting the neurologial consequences of air pollution. We have now highlighted this in the opening paragraph in association with continued poor air quality. We have also added a new sentence on mitigation in the healthcare section.
Juanita	Constible	Text Region	15. Human Health		9	9	17	17	This section and Compounding and Cascading Impacts would benefit by inclusion of the data limitations that make a full accounting of U.S. climate-health impacts and their compounding and cascading health effects very challenging at this time. Please consider inserting, at the end of this paragraph: Furthermore, data limitations and a lack of centralized, integrated datasets hamper a fuller accounting of of U.S. climate-health harms, their compounding, cascading hazards and associated health costs, and the sustained duration and areal extent of these harms.	Thank you for pointing out a critical research gap. As suggested, a sentence was added to the end of the paragraph.
Emma	Conrad-Rooney	Text Region	15. Human Health		9	9	19	20	For the sentence "Climate-related increases…illness or death," Key Message 11.2 from the Agriculture chapter should be cited, since it covers farm workers' exposure to heat stress.	Thank you for your suggestion. We have edited as you suggested.
Juanita	Constible	Text Region	15. Human Health		9	9	26	26	In order to clarify the time horizon of the projected lost wage estimate, please add ANNUAL, or whatever appropriate timeframe pertains to the $15.8 to $39 billion dollar estimate, to clarify whether those are annual or cumulative midcentury estimates.	Thank you for pointing out this omission. The figures are indeed estimates annual lost wages. We have added this clarification in the text with the addition of "annual" in the sentence describing the estimates.
Rachel	Licker	Text Region	15. Human Health	9	9	18	31	The Occupational Health and Safety Implications section would benefit from more detail on specific occupations that are at risk, for example farmworkers. Can you include	Thank you for your suggestion. We have referenced Key Message 11.2 which relates to farmworker health and added several examples of specific industries where workers face increased risk of heat-related mortality.	
Robin	Cooper	Text Region	15. Human Health		9		32		Section: Occupational Safety and Health First responders to climate driven disasters are vulnerable to wide range of stress symptoms and mental health sequala. Wildland firefighters who are often viewed as ‚Äúheroes‚Äù are a group that is particularly at risk for both physical and mental health difficulties. There has been very little research and no peer reviewed published literature on the mental health impacts for wildland firefighters. Preliminary survey (O‚ÄôBrian, Campbell, 2021) showed rates of anxiety, depression, PTSD, suicidal ideation, binge drinking, heavy alcohol and substance use and smokeless tobacco use ranging from two to ten times the general public. More wildland firefighters die of suicide than from risks in line of duty. One recent survey of wildland firefighters (Pelletier et al, 2022) ranked their concerns and research priorities. Results indicated that the 2nd, 3rd, 4th ranks addressed variables associated with wellbeing and mental health falling, The combined ranking of these concerns (fatigue and sleep, mental health, stress) out-ranked the first response of concerns of smoke inhalation on respiratory health. Wildland firefighters have unique and challenges and barriers to access to adequate mental health services including paucity of trained mental health providers in accessible areas, lack of health care insurance during off seasons for the largely seasonable workers, and a culture that References; Johnson, CC, Vega, L, Kohalmi, A, Roth, JC, Howell, B, Van Hasselt, VB. (2020) Enhancing Mental Health Treatment for the Firefighter Population: Understanding Fire Culture, Treatment Barriers, Practice Implications, and Research Directions. Professional Psychology: Research and Practice, 51 3), 304,Äi311 doi.org/10.1037/pro0000266 O‚Äô Brian, P., Campbell, D. (2021) Wildland Firefighter Psychological and Behavioral Health: Preliminary Data from a National Sample of Current and Former Wildland Firefighters in the United States. Conference Session: International Association of Wildland Fire 6th Annual Human Dimensions Conference. https://www.researchgate.net/publication/352466544_Wildland_Firefighter_Psychological_and_Behavioral_Health_Preliminary_Data_from_a_National_Sample_of_Current_and_Former_Wildland_Firefighters	Thanks for your suggestion. The Focus on Western Wildfires section of the report discusses wildland firefighters. We will include some of these references in the Wildfires Cross-cutting box.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jessica	Hinshaw	Text Region	15. Human Health		10	13	1	26	The connection to racism is an important one. The previous Key Message 15.1 referenced "Human Health" and then Key Message 15.2 used the term "community health." We kindly suggest reconsidering the title of Key Message 15.2 to read "Climate Change Harms Marginalized People and that Harm is Exacerbated By Systemic Racism and Discrimination." The current title seems to collectivize racial, ethnic, and gender groups as a "community," which is not the case. Overall, people with disabilties and chronic diseases are not included in this section, but we recommend that they should be.	Thank you for your suggestion. This section extensively decribes how some certain communities are disproportionately affected. We feel that the use of community health is a term that encompasses all who are affected by climate change. We appreciate your suggestion to include people with disabilities; we have added people with disabilities to our key message and a paragraph is now included in KM2 and traceable accounts. The paragraph in KM 2 now reads, "Climate change disproportionately and differentially adversely impacts the health of persons with disabilities, magnifies existing health and socioeconomic inequalities, creates unique challenges, and compounds disparities due to multiple discrimination (Stein and Stein, 2021; Stein and Stein 2022). In the aftermath of climate disasters, persons with disabilities are at heightened risk of mortality and injury, experience disruptions accessing assistive devices, medication, dialysis, other health services, and social support (Engelman et al. 2022; Stein and Stein, 2021). During higher ambient temperatures and heat waves, persons with physical and mental disabilities experience adverse health impacts, elevated risk of emergency room visits, and mortality; cooling measures may be physically or financially inaccessible (Elser et al. 2021; Stein and Stein, 2021). Persons with disabilities are also at elevated risk of exposure to chronic air pollution as they disproportionately live in neighborhoods with heightened exposure to fine particulate matter due to lower wealth, higher unemployment, and undereducation relative to nondisabled peers (Chakraborty, 2022). " We have amended our key message 2, and it now reads, "Systemic Racism and Discrimination Exacerbate Climate Impacts on Human Health".
Emma	Conrad-Rooney	Text Region	15. Human Health		10	10	3	8	To follow the Risk-Based Framework, Key Message 2 should include what can be done about these highlighted problems.	Thank you for your suggestion. KM2 focuses on disproportionately affected groups. We have described adaptation and mitigation, which includes steps toward risk reduction, in KM3.
Juanita	Constible	Text Region	15. Human Health		10	10	4	4	To clarify the statement about reducing access to quality food, please insert HIGH- or ADEQUATE- as appropriate before the word food.	Thank you for your suggestion. The Key Messages are required to be succinct, so we have decided to retain the message as is.
Juanita	Constible	Text Region	15. Human Health		10	10	6	6	If the mention of communities that have been marginalized includes communities of color, please consider stating that explicitly, rather than avoiding mention of race as a key dimension of inequities, especially in this section.	Thank you for your suggestion. We have added in communities of color to this section.
Rachel	Licker	Text Region	15. Human Health		10	10	18	18	I think the Flores citations are mixed up. The "Flores 2020" citation in the chapter references (page 26, line 24) is not quoted in the chapter, though I believe should be cited somewh	Correct, the proper citation should be: Flores, David. Preventing Double Disasters: How the U.S. Environmental Protection Agency Can Protect the Public from Hazardous Chemical Releases Worsened by Natural Disasters. July 2021, https://cpr-assets.s3.amazonaws.com/documents/preventing-double-disasters-final.pdf.	
Rachel	Licker	Text Region	15. Human Health		10	10	23	23	The definition of Superfund sites should be expanded to, "locations contaminated by hazardous materials designated for clean-up"	Thank you for your comment. We have revised the text to include your suggestion, and it now reads, "Additionally, about 70% of Superfund sites locations contaminated by hazardous materials designated for clean-up, are located within one mile of federally assisted housing and 60% of all nonfederal Superfund sites on the National Priority List are vulnerable to natural hazards exacerbated by climate change.
Juanita	Constible	Text Region	15. Human Health		10	10	24	24	Please provide more information about the specific connection of federally assisted housing, which is mentioned, to vulnerability for people who live there. It seems like the statement here is implying that federally-assisted housing is home to a relatively large proportion of households of color or lower-wealth households, but stating the specific connection will strengthen the sentence.	Thank you for your comment. The chapter text has been revised to incorporate your suggestion.
Rebecca	Fournier	Figure	15. Human Health		10		25		Fig. 15.4 In draft form, copywrite material with approvals to share pending is, of course, not visible so it is difficult to tell if there is a more extensive commentary here on the concept of intergenerational equity (whether it be textual or graphic). NCA5 addresses tangential issues such as intergenerational trauma or cultural losses and intergenerational adaptation planning, but there may be value in speaking directly to the concept of intergenerational justice, its relationship to inequities experienced from climate change, and the importance of considering the concept as both 1) one of the many ‚Äúintangibles‚Äù identified by the assessment; critical to consider but difficult to measure and prone to uncertainties, and 2) fundamental when designing mitigation and adaptation policies, adequately compensating for inequitable risk (or benefit) over future generations. [also relevant, Chapter 20: Social Systems and Justice]	Thank you for this comment. Text has been added to describe intergenerational equity and its relevance, especially as regards mitigation planning.
Juanita	Constible	Figure	15. Human Health		10				The substance of the figure is missing, making substantive comment on it impossible.	These figures are currently under review. Permission to use is pending.
Emma	Conrad-Rooney	Text Region	15. Human Health		11	11	4	6	The sentence "Inadequate access to...households, and children" should reference Key Message 11.2 from the Agriculture chapter. KM 11.2 seems to be a more fitting reference than Box 11.1, which is currently cited here and is not very relevant to this sentence.	Thank you for your suggestion. We have edited as you suggested and removed Box 11.1 from the text and replaced it with KM 11.2.
Nick	Procopio	Text Region	15. Human Health		11	11	8	9	Awkward sentence; it should be corrected to read: ¬ì...growing concern about aging or [lack of] water infrastructure...".	Thank you for your suggestion. We have edited so that it now reads aging or inadequate water infrastructure.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Licker	Text Region	15. Human Health	11	11	8	8	What do you mean by "In the US, water insecurity is not follow understood..."? Is there no data on rates of water insecurity? Are you referring to the effects of climate change on	Thank you for your comment. We have revised the text so that it now reads, "In the US, there are growing concerns about aging or inadequate water infrastructure (Greer 2020), especially among households who experience unequal access to piped and treated drinking water and who are dependent on hauling large quantities of water from nearby facilities."	
Juanita	Constible	Text Region	15. Human Health		11	11	23	24	The sentence as written is confusing as to how lack of clean water sources prevent access to healthcare providers. Please consider inserting a comma after clean water sources.	Thank you for your suggestion. We have edited as you suggested.
Robin	Cooper	Text Region	15. Human Health		11		24		Section: Health Care Access and Delivery: The mental health delivery system is already underfunded, under-resourced and stretched to the limits to respond to current demands. Despite the already exiting toll of mental health needs associated with climate crisis, the mental health delivery system is often underprioritized and neglected. Future escalating climate impacts will undoubtedly create more urgent needs. Areas of great need are the integration of psychological first aid and mental health supports into disaster response, prioritizing mental health services for the most vulnerable populations, expansion and training of a more robust workforce, empowering, training and funding community leaders and peer-support services, expanding utilization of virtual and digital resources. The current one-to-one client -based treatment model will need to supplemented by a paradigm shift to a more community based, public health model. Bansal A, Arih I (2022) Mental health, a neglected aftershock of climate disasters. PLOS Clim 1(5): e0000031.doi.org/10.1371/journal.pclm.0000031	Thank for highlighting the continuing challenges in the provision of mental health services - including during disasters. Mental health was deemed of significant importance to warrant a sperate sections in this report and is called out in a key finding. The climate-resilient healthcare section was edited to include a sentence to reiterate that the healthcare system inlcudes mental health and the community linkage. And the definition of health added to the glossay is specific about the inclusion of mental health. Thank you fo the reference.
Skye	Wheeler	Text Region	15. Human Health		11	12	25	36	Thank you to the authors for including sections on specific vulnerabilities for (a) Indigenous Health, (b) African American and Latinx Health and (c) women,Âôs health. The sections are important and excellent to see. We recommend the authors build further on this analysis and better reflect lived reality by noting how these pressures or vulnerabilities intersect. One very important example of this that should be included in the women,Âôs health section (or in the section on African American and Lantinx populations) is that US studies repeatedly find that the impact of extreme or higher than normal temperatures on rates of adverse birth outcomes like preterm birth, low birth weight and still birth are worse for Black or African American pregnant people than white pregnant people. Listing the three different sections without noting intersections does not do justice to the reality of the maternal health crisis in the US or how the climate crisis impacts the maternal health crisis (perhaps little impact on privileged pregnant people and significant impacts on historically marginalized pregnant people). References: Smith ML, Hardeman RR. Association of Summer Heat Waves and the Probability of Preterm Birth in Minnesota: An Exploration of the Intersection of Race and Education. Int J Environ Res Public Health. 2020 Sep 2;17(17):6391. doi: 10.3390/ijerph17176391. PMID: 32887349; PMCID: PMC7503599. Bekkar B, Pacheco S, Basu R, DeNicola N. Association of Air Pollution and Heat Exposure With Preterm Birth, Low Birth Weight, and Stillbirth in the US: A Systematic Review. JAMA Netw Open. 2020;3(6):e208243. doi:10.1001/jamanetworkopen.2020.8243 Cushing, L, Morello-Frosch, R, Hubbard, A. Extreme heat and its association with social disparities in the risk of spontaneous preterm birth. Paediatr Perinat Epidemiol. 2022; 36: 13,Âì 22. doi:10.1111/ppe.12834	Thank you for this comment. The intersectionality is critically important. We have included a statement on this in the Women's Health section and included your suggested references. We have incorporated statements on racial disparities throughout the women's health section. "Women disproportionately experience the burden of climate change because of unique mental, menstrual, and reproductive health needs that intersect with existing social, racial, and economic disparities." and "Women, and particularly women of color, are more likely to live in low wealth households...." and "these impacts are worse for groups that have been marginalized, particularly Black pregnant people, exacerbating existing social inequities." Smith ML, Hardeman RR. Association of Summer Heat Waves and the Probability of Preterm Birth in Minnesota: An Exploration of the Intersection of Race and Education. Int J Environ Res Public Health. 2020 Sep 2;17(17):6391. doi: 10.3390/ijerph17176391. PMID: 32887349; PMCID: PMC7503599. Bekkar B, Pacheco S, Basu R, DeNicola N. Association of Air Pollution and Heat Exposure With Preterm Birth, Low Birth Weight, and Stillbirth in the US: A Systematic Review. JAMA Netw Open. 2020;3(6):e208243. doi:10.1001/jamanetworkopen.2020.8243 Cushing, L, Morello-Frosch, R, Hubbard, A. Extreme heat and its association with social disparities in the risk of spontaneous preterm birth. Paediatr Perinat Epidemiol. 2022; 36: 13â€“ 22. doi:10.1111/ppe.12834
Nick	Procopio	Text Region	15. Human Health		11	11	31	31	Consider changing the word ¬iwhich" within the sentence to ¬i[because/since/as] it" to strengthen the sense of urgency felt by the tribal and indigenous peoples.	Thank you for your suggestion. We have made the following change based on your suggestion: "Indigenous peoples are on the front lines of climate change. This threatens their ability to maintain their cultural and economic lifeways and worsens community-wide vulnerabilities such as limited water availability for human and animal consumption (STACCWG 2021)."
Rachel	Licker	Text Region	15. Human Health	11	11	25	36	This section would benefit from additional information about the specific effects to Alaska Native communities, many of which are losing their land and tradition	Thank you for your comment. We added a reference to one Key Message in the Alaska chapter, and revised the sentence to state: "Climate-related hazards such as flooding, erosion, sea-level rise, and melting ice may lead to impassable roads in remote parts of tribal territories, thereby widening gaps in the ability to access adequate healthcare. (KM 29.2)."	

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Craig	Hanna	Whole Page	15. Human Health		11				In Chapter 15 Human Health, subsection Healthcare Access and Delivery (under Key Message 15.2, Chapter 15, page 11)) provides limited examples of the climate-related risks to health care access for patients with serious and chronic medical conditions (only lung cancer and chronic kidney disease are mentioned, and the causes of access risks mentioned are road failures, no electricity, and no clean water). Consider broadening the scope of this section to include the risk of disruptions in continuity of care for many chronic physical and mental health conditions due to provider closures, and disruptions caused by exacerbation of symptoms. Pharmacy closures, sometimes long term, engender issues in drug regimens causing health crises resulting in emergency room visits and hospital admissions. The greater risks experienced by under-resourced communities is mentioned elsewhere in Chapter 15, but it is important to highlight their vulnerability in this Healthcare Access and Delivery subsection.	Thank you for the comment. The cited examples are subsets of the broader risk of disruption of healthcare facilites. This has been reworded.
Craig	Hanna	Whole Page	15. Human Health		11				Perhaps the most serious access issue not discussed here revolves around the impacts to delivery of LTSS, ranging from home health care to the closure of subacute facilities in the wake of climate change and disasters. While this issue impacts all disabled and elderly persons, it is most severe in the lower-income and underserved communities. Not only are there climate-impacted structural issues with the homes and facilities that care for these patients, but the severe shortage of LTSS workers (including skilled health care workers but especially home care aides, cleaners, and basic care workers) is exacerbated when climate events and worsening climate situations impact the caregivers themselves. Human health for people who rely on LTSS deteriorates with this double impact.¬†	Thank you for this suggestion. Healthcare system was used broadly. To address your comment, we have specifically proposed a definition of healthcare system to include LTSS and added a sentence about disruption of care for those chronically ill.
Rachel	Licker	Text Region	15. Human Health		12	12	1	21	This section inconsistently refers to "Black" and "African American" people. I would recommend using the term "Black people" and also refrain from saying "Whites " or	Thank you for your comments. Regarding the inconsistency in reference to Black people and African American people, we are following the federal standards on race and ethnicity as set by the U.S. Office of Management and Budget (OMB) in 1997 (Federal Register, Vol. 62, No. 210 (Thursday, October 30, 1997) pp 58782-58790.), which set forth: "The name of the Black category should be changed to 'Black or African American.'" Additionally, regarding the comment on redlining and air pollution, we have revised and inserted "Communities of color living in formerly redline zones are exposed to higher levels of air pollution (lane et al. 2022). Regarding the sentence on line 17, the text has been revised to say, "Due to housing discrimination and redlining, African Americans are more likely to live in neighborhoods with fewer trees and more pavement and suffer disproportionately from heat-related deaths (KM22.2; Figure 12.4; Lane et al. 2022; Morello-Frosch et al. 2009; Hoffman et al. 2020): they also experience higher rate of asthma -related emergency room visits (Nardone et al.2020)."
Juanita	Constible	Text Region	15. Human Health		12	12	28	28	In order to make the chapter accessible to the widest possible readership, it would be helpful to provide a definition of cisgender here, in reference to pregnancy. Such a definition somewhere in the chapter would also be helpful for readers on page 13, lines 9-11, and is likely a term to include in the glossary.	Thank you for your comment. We will include the definition of "cisgender" in the glossary.
Robin	Cooper	Text Region	15. Human Health		12		31		Section: Women's Health Disaster exposure during pregnancy can have impacts on development of psychopathology in offspring impacting children throughout their lives. Reference: Nomura, Y, Newcorn, J, Ginalis, C, Heitz, C, Zaki, J, Khan, F, Nasrin, M, Sie, K, DeIngeniis, D, Hurd, Y. (2022) Prenatal exposure to a natural disaster and early development of psychiatric disorders during the preschool years: stress in pregnancy study. J. Child Psychology and Psychiatry. doi:10.1111/jcpp.13698	Thank you for raising this association to our attention. We have included a statement on this relationship. "Emerging evidence suggests in utero exposure to maternal stress during natural disasters is further linked to subsequent psychiatric disorders in early childhood (Nomura et. al. 2022)."
Rachel	Licker	Text Region	15. Human Health		12	12	22	36	Line 23 -- what is meant by "unique health needs"? Can you be more specific? Lines 27-28 -- older women are more likely to die during extreme weather compared to who? Lines 28-	Thank you for your comment. We have modified our statement on unique health needs to be more specific, "Women disproportionately experience the burden of climate change because of unique mental, menstrual and reproductive health needs." We have further removed the statement on older women's mortality in extreme heat. Finally, while we agree that maternal mortality during heat waves is an issue globally, we could not find any supporting literature from the United States.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Licker	Text Region	15. Human Health		13	13	2	4	The first two sentences of this section aren't totally clear. Suggest rewording to -- "Sexual and gender minorities (SGMs) face social, economic, and health disparities, and as a result	Thank you very much for your comment. The text has been revised to incorporate your suggestion to make it clearer to readers.
Juanita	Constible	Text Region	15. Human Health		13	13	20	20	Concerning the statement, HEAT LOSSES REALLY SHOW UP ONLY IN HIGH FATALITY NUMBERS, suggest deleting the word ONLY. While mortality-related costs dominate in climate-health valuation studies, morbidity costs are indeed calculable, and mortality costs are significant in many settings.	Thank you for the suggestion. The text has been revised as suggested by removing 'only'. The revised text is "For example, the high economic loss associated with deaths and illness from extreme heat are not accounted for"
Juanita	Constible	Figure	15. Human Health		13				The substance of the figure is missing, making substantive comment on it impossible.	These figures are currently under review. Permission to use is pending.
Jessica	Hinshaw	Text Region	15. Human Health		14	18	1	2	Within Key Message 15.3 on "Adaptation and Mitigation Actions," we recommend including mention of adaptation and mitigation efforts on food systems (which will have greater detail in Chapter 11).	Thank you for your comment. We like to keep the key messages succinct, and have amended the sentence to read, "This includes integrated approaches that mainstream health into food systems (KM 11.1), infrastructure, water, and sanitation policies." We added KM 11.1 which provides greater detail on adaptation and mitigation efforts on food systems.
Emma	Conrad-Rooney	Text Region	15. Human Health		14	14	2	3	Key Message 3 should be revised to follow a Risk-Based Framework.	Thank you for your suggestion. KM3 contains adaptation and mitigation examples that address climate change risks to human health with a focus on community resilience. The authors feel that KM3 adequately addresses risk management. We cite Chapter 31 as well which addresses risk.
Juanita	Constible	Text Region	15. Human Health		14	14	7	12	This text region provides an opportunity to mention the idea and term health co-benefits. Currently the term is absent, even though the health benefits described here are examples of health co-benefits. Please consider these two text insertions: insert NEAR-TERM after significant; and after health benefits insert , ALSO KNOWN AS HEALTH CO-BENEFITS.	Thank you for your suggestion. We have decided to not insert near term as it limits the time frame. We have decided to keep the text as is in order to ensure our key message is succinct.
Jessica	Hinshaw	Text Region	15. Human Health		14	14	13	26	To actualize resilient health care systems, more resources are needed along with greater focus on the role of community health centers and safety net clinics. These health centers and clinics provide services to the most marginalized populations who face the greatest health inequities caused by climate change.	Thank you for the comment. We have proposed the addition of a defintion to the glossary for this chapter for healthcare sysems that specifically encompasses community components such as community health centers. As does the proposed new glossary or chapter definition of health system.
Juanita	Constible	Text Region	15. Human Health		14	14	28	29	Regarding the impacts mentioned for which surveillance programs can be implemented, please consider inserting CLIMATE-SENSITIVE before infectious diseases, and NON-INFECTIOUS HEALTH HARMS after infectious diseases.	Thank you for your suggestion. The sentence now reads, "Implementing surveillance programs for climate-sensitive infectious diseases, noncommunicable diseases, and health outcomes (e.g., heat stroke, respiratory disease) is an important adaptation measure."
Juanita	Constible	Text Region	15. Human Health		14	14	28	37	This paragraph offers an opportunity to mention the need for not only building but also integrating disease surveillance systems, extreme weather reporting, and economic costs data. Please consider adding at end of paragraph, after line 37: ONCE DEVELOPED, CLIMATE-SENSITIVE DISEASE SURVEILLANCE SYSTEMS COULD BE INTEGRATED WITH EXTREME WEATHER EVENT TRACKING AND ECONOMIC COST ESTIMATES, TO CREATE MORE EFFECTIVE WAYS TO ASSESS THE OVERAL HEALTH BURDENS AND COSTS OF SUCH EVENTS.	Thank you for this suggestion. We have added in similar text and references from Limaye et al. to support these statements.
Robin	Cooper	Text Region	15. Human Health		14		29		Section: Disease Surveillance and mental and behavioral health (e.g suicide, violence, substance use)	Thank you for your suggestion. We edited this sentence and now include mental and behavioral health indicators as examples for non-infectious health outcomes.
Juanita	Constible	Text Region	15. Human Health		15	15	2	10	This passage should also include mention of airborne toxic compounds, such as lead and manganese, that are generated by wildfire events. See this report from the California Air Resources Board on toxic metals emitted during the 2018 Camp Fire event: https://ww2.arb.ca.gov/sites/default/files/2021-07/Camp_Fire_report_July2021.pdf. Unfortunately the U.S. currently lacks robust air toxics monitoring, including in wildfire-prone areas - so this is an important area to highlight in the air quality chapter.	We greatly appreciate the reviewer's comment. We have noted and communicated your comment in the wildfire cross cutting box which is located in a different section of the report.
Juanita	Constible	Text Region	15. Human Health		15	15	4	4	Use of the US billion-dollar disasters list as a metric is a flawed way to contextualize climate-related deaths, as the list includes climate and weather disasters and NOAA does not conduct comprehensive health data collection around the billion-dollar events. As a result, health-related costs are not included in the economic damage assessment at all. The shortcoming of the NOAA billion-dollar disasters data should be noted in this section. For more discussion on the health damages missing from NOAA's assessment, see: Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2019). Estimating the Health?Related Costs of 10 Climate?Sensitive U.S. Events During 2012. GeoHealth, 3(9), 245--265. https://doi.org/10.1029/2019GH000202	Thank you for the suggestion. The text has been revised to incorporate this suggestion with the accompanying citations.
Juanita	Constible	Text Region	15. Human Health		15	15	11	11	The passage on healthcare access and delivery should also discuss the implications of climate-sensitive health problems on the economic burden linked to healthcare needs for treatment in emergency rooms and hospitals. Evidence indicates that climate-sensitive health problems discussed in the chapter are linked to a significant economic burden from both premature mortality (e.g., value of a statistical life) and morbidity (illnesses and injuries linked to climate hazards). While a fuller accounting of the national economic burden of health problems sensitive to climate change currently remains elusive, the topic merits discussion in this chapter. See these articles for a fuller discussion of the issue: 1. Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2019). Estimating the Health?Related Costs of 10 Climate?Sensitive U.S. Events During 2012. GeoHealth, 3(9), 245--265. https://doi.org/10.1029/2019GH000202; 2. Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2020). Estimating The Costs Of Inaction And The Economic Benefits Of Addressing The Health Harms Of Climate Change. Health Affairs, 39(12), 2098--2104. https://doi.org/10.1377/hlthaff.2020.01109	Thank you this suggestion. We have added a sentence in the healthcare section; "Climate-sensitive health problems are linked to a significant economic burden on the healthcare system that can lead to severe financial losses."
Jessica	Hinshaw	Text Region	15. Human Health		15	15	13	13	Consider removing the phrase "exposed the lack of resilience of hospitals and healthcare providers..." Many healthcare organizations and providers have shown extreme resilience under prolonged stress. A more accurate statement would be that COVID-19 exposed the profound lack of support needed to develop and implement a sufficient and sustained response to increasing healthcare needs.	We wholeheartedly agree that many hospitals and healthcare providers showed extreme resilience. This phrase has been modified to reference the healthcare system to reflect the whole nation. Crisis standards of care and the profound tragic burnout of healthcare providers is testament that our healthcare system was not resilient.
Juanita	Constible	Text Region	15. Human Health		15	15	14	14	To paint a fuller picture of the unintended negative consequences of increased air-conditioning use, please consider adding after GHG emissions AND EMISSIONS OF HEALTH-HARMING AIR POLLUTANTS INCLUDING FINE PARTICLES. The supporting citation is: Abel DW, Holloway T, Harkey M, Meier P, Ahl D, Limaye VS, et al. (2018) Air-quality-related health impacts from climate change and from adaptation of cooling demand for buildings in the eastern United States: An interdisciplinary modeling study. PLoS Med 15(7): e1002599. https://doi.org/10.1371/journal.pmed.1002599.	Thank you for your suggestion. The text has been revised to incorporate this suggestion with the accompanying citation.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Juanita	Constible	Text Region	15. Human Health		15	15	14	14	Disease surveillance for infectious diseases, vectors, and health outcomes is merited, but so is disease surveillance for a much wider array of identified climate-sensitive health risks. This pasage should be more expansive to discuss improved surveillance of a broader set of health risks linked to a changing climate. Improving health surveillance can also strengthen understanding of the health-related economic burden of climate-sensitive illnesses, injuries, and early deaths. See these articles for a fuller discussion of the issue: 1. Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2019). Estimating the Health?Related Costs of 10 Climate?Sensitive U.S. Events During 2012. GeoHealth, 3(9), 245--265. https://doi.org/10.1029/2019GH000202; 2. Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2020). Estimating The Costs Of Inaction And The Economic Benefits Of Addressing The Health Harms Of Climate Change. Health Affairs, 39(12), 2098--2104. https://doi.org/10.1377/hlthaff.2020.01109	Thank you for this suggestion. We added in text to demonstrate how surveillance can be paired with weather events and economic costs to assess the burden from these events. We broadened this to include disease surveillance and other health outcomes. We mention a few exampes earlier in the section apart from infectious diseases, including heat stroke and mental health impacts.
Robin	Cooper	Text Region	15. Human Health		16		2		Section: Wildfires In addition to specific wildfire mitigation, adaptation management strategies, addressing the needs of those who fight wildfires (wildland firefighters) needs attention. The Grassroots Wildland Firefighters, an advocacy organization has developed inteventions and legislative strategies addressing urgent mental health needs for vulnerable population of wildland firefighters; ‚ÄCAdequate pay so that firefighters are not dependent on overtime shifts for income ‚ÄCDeveloping adequate mental health awareness training for workers, supervisors and administration including stress management skills ‚ÄCDevelop extensive peer-to-peer support network for wildland firefighters and their immediate family ‚ÄCCreate a meaningful expansion of the Critical Incident Stress Management Program, including dedicated follow-up with employees affected by work-related incidents ‚ÄCDevelop a dedicated mental health support service ‚Äì specific to wildland firefighters, first responders, and immediate family ‚Äì with culturally-relevant, trauma-informed clinicians ‚ÄCAdvocate with the Office of Workers‚Äô Compensation Programs (Federal Firefighter Special Claims Unit) to recognize Post-traumatic Stress Disorder and psychological stress-related injuries as correlated to fire protection and suppression activities Resources: https://www.grassrootswildlandfirefighters.com/one-page-briefing-paper https://www.grassrootswildlandfirefighters.com/mental-health	Thank you for the suggestions. The Focus on Western Wildfires section of the report discusses risks specific to wildland firefighters. We have added a reference to that section of the report in the occupational health section of this chapter.
Jessica	Hinshaw	Text Region	15. Human Health		16	16	3	12	Consider mentioning effective community-based vector control strategies. For example, community-based identification and removal of vector breeding sites has been proven effective and empowering. Citation: https://pubmed.ncbi.nlm.nih.gov/25604757/	Thank you for this important suggestion. We have included a statement, "Coupling novel strategies with well-established community engagement practices, such as remediating vector habitat and increasing personal protective measures can effectively reduce risk and empower communities." Because this report is focused on the United States we have included U.S.-based references. Juarez, J.G., Carbajal, E., Dickinson, K.L. et al. The unreachable doorbells of South Texas: community engagement in colonias on the US-Mexico border for mosquito control. BMC Public Health 22, 1176 (2022). https://doi.org/10.1186/s12889-022-13426-z Johnson, B.J., Brosch, D., Christiansen, A. et al. Neighbors help neighbors control urban mosquitoes. Sci Rep 8, 15797 (2018). https://doi.org/10.1038/s41598-018-34161-9
Julie	Becker	Text Region	15. Human Health		16	16	13	24	A key component that should be emphasized in this section is Importance of social capital and the need to develop strategies to improve and measure interconnectedness at three levels: bonding, bridging, and linking. Social capital is briefly mention in Chapter 9 but needs to developed here, especially as part of community resilience strategies. Social Capital and Community Resilience; Volume 59, Issue 2 Daniel P. Aldrich and Michelle A. Meyer https://doi.org/10.1177/0002764214550299	We have edited as you suggested and added a sentence and your suggested citation to reflect your suggestion to include social capital.
Jessica	Hinshaw	Text Region	15. Human Health		16	17	13	21	This section on community-level resilience did not mention the roles of key preventive health care institutions and workers, like community health centers and community health workers, in preventing, mitigating, and building resilience for climate change. These institutions and health care workers extend services beyond the clinic walls, directly speak to, and are trusted by groups that are most marginalized and impacted by climate change.	Thank you for this comment. Preventive heath care organizaions and workers, like community health workers are considered part of the healthcare and health system. We have proposed terms in the glossary to specifically define the health system very broadly extending into the community and a healthcare system to include community health workers. Also added the following sentence, "A climate-resilient health system is equity-focused, proactive in addressing mental health needs, and linked to community health resources such as community health workers and long-term support and services."
Juanita	Constible	Text Region	15. Human Health		17	17	4	21	The paragraph offers an opportunity to include mention of the negative impact of widespread underfunding of public health systems, and the opportunities afforded with more robust funding. Please consider including at end of paragraph in line 21: MORE ROBUST FUNDING OF PUBLIC HEALTH SYSTEMS AND LOCAL PUBLIC HEALTH INFRASTRUCTURE, WHICH ARE CURRENTLY UNDERFUNDED, CAN ENHANCE STAFF CAPACITY AND TECHINCAL CAPACITY TO TRACK HAZARDS AND DEVISE STRATEGIES TO HELP BUILD COMMUNITY RESILIENCE.	Thank you for your suggestion. We have added your suggestion to Traceable Accounts along with the citation Errett et al. 2022.
Robin	Cooper	Text Region	15. Human Health		17		8		Section: Community Level Resilience Indigenous science, knowledge and healing practices are well developed but often neglected and outside the scope of Western science and health and can be utilized to address the impact of Climate Change (Cajete, 2020). Indigenous knowledge, acquired through centuries of observation and passed down thru ceremonies, stories and relations with knowledge-keepers, is based on viewing the interconnected relationships between humans and other species with humans being considered a part of nature. Mitchell, 2020) Cajete, G.(2020) Indigenous Science, Climate Change, and Indigenous Community Building: A Framework of Foundational Perspectives for Indigenous Community Resilience and Revitalization Sustainability 12 (22) : 9569 Mitchell, S. ‚Äúndigenous Prophecy and Mother Earth,‚Äù All We Can Save- anthology Ed. A.E. Johnson & K.K. Wilkinson, Pub. One World 2020	Thank you for your important comments. We have included this information in KM3. "For instance, many Indigenous peoples in the US perform prescribed cultural burning, a fire management practice that promotes ecosystem resilience and growth of culturally important medicinal plants (STACCWG 2021; Adlam et al. 2021) while also serving as an eco-centric adaptation strategy for improved planetary health (Redvers 2021; Redvers et al. 2022). The Swinomish Indian Tribal Community used values-driven data and community input in developing a climate change health assessment and Indigenous health indicators for adaptation decision-making; the indicators included community connection, self-determination, education, resilience, cultural use, and resource security (Donatuto et al. 2016, 2020, 2021). Community adaptation capacity is enhanced by building flexibility, humanity, spirituality, and resilience. Adaptation strategies must integrate workforce development into co-governance and promote institutional support systems for community-defined, -driven, and -led adaptation efforts that include a diversity of cultures, histories, lifeways, and knowledge systems (Rising Voices 2019; Maldonado et al. 2021; STACCWG 2021)."

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Robin	Cooper	Whole Page	15. Human Health		17				SECTION: Community-Level Resilience and Adaptation Strategies to Build Capacity The present and coming challenges to individual and community mental health make it imperative to foster coping and adaptive capacities. While individuals alone can take steps to strengthen emotional coping skills, these are insufficient for the scale of need and require broad social and systems-level change from community programs, governmental policies, and financing. (Clayton, et al 2021) MORE EXTENSIVE COMMENTS/IDEAS: COMMUNITY LEVEL RESILENCE AND ADAPTION Community and individual resilience has been defined as the ‚Äúas the ability of a person or a community to function in the face of adversity, to survive, and, perhaps, even to thrive‚Äù (Hobfoll, et al 2015, Clayton, et al 2021). The more common definition of resilience, the capacity to "bounce back" to some pre-impact status, will become irrelevant as climate change progresses. We are challenged to envision a different future. Preventing harm to our planet is an essential component of the public health response to climate change. Rapid reductions in carbon emissions must be a top priority, as is preparing human-built infrastructures and natural resources to withstand and adapt to climate impacts. Equally important, but generally less acknowledged and addressed, is the urgent need to proactively build the capacity of individuals, families, organizations, and entire communities to cope with climate adversities. The present and coming challenges to individual and community mental health make it imperative to foster coping and adaptive capacities. The most harmful bio-psycho-social-spiritual impacts of climate disruption are caused by persistent and overwhelming toxic stresses, not just acute disasters. Developing coping and adaptive strategies can be catalyst for social and cultural changes that fuel better social, psychological, and ecological wellbeing and can encompass wide-spread societal transformational change. Such dramatic change is driven by envisioning a different vision of the future, one modeled on pluralism not elitism, social cohesion and connections, embraces justice and equity and participatory engagement and leaves of individuals within communities. Such a view, addressed within a social-ecological (SE)	Thank you for this comment. We agree that greater supports for community mental health are needed and have included language in the section on mental health along these lines. Unfortunately, given space limitations we cannot cover more details about mental health interventions.
Robin	Cooper	Text Region	15. Human Health		18		2		SECTION: Process Description Suggestion: Vigorous attempt to get a mental health expert onto future authorship group	Thank you for your suggestion. We will pass your suggestion on to NCA5 leadership.
Juanita	Constible	Traceable Account	15. Human Health		18	18	7	9	The listing of climate-health impacts needs to be more inclusive of air pollution episodes and other health-relevant environmental changes. Please consider inserting after extreme events: AND CLIMATE CHANGE-FUELED ENVIRONMENTAL CHANGES. After flooding, insert HIGH AIR POLLUTION EPISODES.	Thank you for your suggestion. The text now reads, "Evidence indicates that extreme events and climate-related environmental changes, such as heat and cold waves, wildfires, drought, flooding, poor air quality days, and stronger tropical cyclones will continue to place stress on food, water, and energy supplies (KM 2.2)."
Julie	Becker	Text Region	15. Human Health		18	19	17	4	1) There is a need for local data,ÂÏby zip code for key indicators, such as air quality, temperature, and precipitation. When working in communities, specific data is needed, especially linking the number of health conditions to weather and temperature events-- this supports/refutes community observations with data. The lack of local current data is a gap that needs to be addressed to encourage community participation. 2) Health practitioners should be recording the links between disease and illness and climate events, even as secondary or tertiary causes, through ICD 10 codes This will provide a mechanism of data collection to assess how climate is effecting health presented at practitioners‚Äô facilities and can be quantified. 3) The lack of training in health professional schools (medical, nursing, and public health) regarding the links between climate and health is a significant gap that needs to be urgently addressed. Climate and health must be a required as part of the education (it is not currently) curriculum to train existing and future practitioners.	Thank you for your suggestions. 1. Please see A4.9 for locations where these data are available at the geographic scale you are suggesting. 2. Thank you again, but this is beyond the scope of what is allowed within the NCA5. We cannot include suggestions such as changing ICD codes as that would be policy prescriptive. 3. We have added your suggested edit to Traceable Accounts, which now reads: "There is limited curriculum on the health impacts of climate change. Greater integration into medical school, nursing school, and public health curriculum can increase awareness of the established links between climate change and health."
Juanita	Constible	Traceable Account	15. Human Health		19	20	11	15	The Traceable Account for Key Mesage 15.2 does not include a single source citation reference, and should include reference to the foundational sources that informed the author team in developing KM2. Please include at least the most improtant source citations for readers.	Thank you for your suggestion. We have included a reference to CDC's page on justice, equity, diversity, and inclusion in climate adaptation planning (CDC 2022) and Watts et al. 2019. We have also included Goldsmith et al 2022 and Roos et al. 2021.
Juanita	Constible	Traceable Account	15. Human Health		20	20	10	12	This evidence referenced by this sentence would be strengthened and clarified by brief mention or examples of the ways in which the named communities are over-burdened. Are the authors referring to climate-health impacts, structural racism, environmental exposures, limited access to health care, or limited access to economic opportunity? Brief mentions of a couple of these dimensions would help clarify the point for readers.	Thank you for your suggestion. This is the description of confidence and likelihood section. A more complete description of community impacts can be found in KM 15.2
Juanita	Constible	Traceable Account	15. Human Health		21	21	11	11	Please include source citation(s) for the statement about pollen exposures posing health risks to people with respiratory health issues such as asthma.	Thank you for noticing the omission. The citations have now been added to the text.
Greeley	Miklashek	Whole Chapter	15. Human Health						Population density stress is killing us NOW through ALL of our myriad and rapidly increasing "diseases of civilization", none of which are found in traditional living migratory Hunter-Gatherer clans. Mother Nature long ago saw fit to install a population regulation mechanism in mammals, including primates, including our species. The main driver is our overactive stress response when crowded, exposed to stressor filled environment, cut off from the social support of our clans and Higher Power. This system can be seen in operation today in our declining health: 55% of adult Americans have at least one serious chronic health problem requiring ongoing medical treatment, 20% of adult Americans ages 20-50 are dying from alcohol use disorders, the incidence of "diseases of despair" is rapidly rising among our youth, and a large proportion of Americans would be dead without the $4T annual healthcare expenditure we must make just in order to stay alive another day. Details may be found in the FREE online PDF, "Stress R Us", or in PB/Kindle at Amazon Books sold at cost. Overpopulation is the one topic NEVER discussed as a cause, let alone the key cause of our health problems, as well as climate collapse. Will our government and academic institutions ever dare to tell the truth? The survival of our species and what's left of the rest of the diverse life on this dying planet depend on the truth finally being told.	Thank you for your comment. Detailed coverage of these topics is beyond the scope of this report.
Glenn	Branch	Whole Chapter	15. Human Health						It would be appropriate to add a discussion of education, and climate change education in particular, here. In addition to community mental health services (mentioned on ch. 15, p. 8), formal and informal educators play a vital role in monitoring and sustaining the mental health of students with whom they interact. In the case of climate change education in particular, this role is especially important, since students may become anxious or depressed when learning about the present and impending disruptive effects of climate change, so teachers need to be prepared accordingly.	Thank you for your suggestion. We have added your suggestion to Traceable Accounts along with the citation Errett et al. 2022.
Gail	Overstreet	Whole Chapter	15. Human Health						Our family lost our home and everything we owned in a very large Western Wildfire, along with thousands of other Californians. Thousands of people - from this single fire - were left profoundly traumatized both physically and mentally, and external mental health resources to address this widespread and chronic trauma were and are simply not available at scale. These trauma impacts go on to have a lasting broad and deep impact on both community and economic health. As far as solutions to addressing this vast health-resources gap, please consider assembling and widely publicizing a portal with self-led trauma-informed practices, such as proven and accessible stress-reducing breathing practices or trauma-reducing body movement practices. For example, the Insight Timer app is a free resource where such a channel could be offered, either by creating new relevant content or aggregating existing content from the wide array of relevant content in the Insight Timer community. Climate change education, to include physical and mental health resources, is critical for any plan that addresses mitigating and adapting to climate change since future generations will face - and need to be self-equipped with knowledge and practical skills to cope with - the challenges and events of climate change.	Thank you for your suggestion. The suggestion of a portal is beyond the scope of this report. We have added your suggestion on climate change education to Traceable Accounts along with the citation Errett et al. 2022.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Andra	Yeghoian	Whole Chapter	15. Human Health						A significant amount of research has shown the further threat that Climate Change poses to mental health as well, has already begun to increase traumatic stress for all, but most importantly for our most vulnerable and marginalized populations, including children and teenagers. It is critical that K-12 schools are included in any plan addressing physical and mental health of schools. K-12 schools are also significantly behind in bringing their facilities up to speed to withstand the impacts of climate change. This threatens the health of children and youth in the immediate, and long-term.	Thank you for raising these issues. We have added text to describe the importance of youth education as a means of empowerment. The need to address reilience in K-12 facilities is also important. We are unfortunately unable to cover it in the limited space we have available in the chapter.
Robin	Cooper	Whole Chapter	15. Human Health						Although the chapter on health includes mention of mental abd behavioral health in a number of sections, the entries tend to be cursory and lack detail. None of the authors for this chapter have expertise in the mental health disciplines. Perhaps a deeper understanding could be provided by adding experts in the field of mental health and climate change in the next assessment. I offer this comment and others as compliation of comments from the Climate Psychiatry Alliance (www.climatepsychiatry.org)	Thank you for this comment. We agree that raising mental health concerns around climate is imperative. We note that NCA 4 dedicated a section to this topic. Here we have chosen to focus on youth mental health. Although we wish we had more space available to explore these topics in greater detail, we are unable to do so given the many areas that must be covered in the chapter.
Nick	Procopio	Whole Chapter	15. Human Health						This section was well written and covered all the major topics that should be considered when discussing human health effects of climate change. The emphasis on the disproportional effects on different minority groups, including not only racial and economic disadvantaged groups, but also marginalized communities (e.g., SGMs) was warranted and well executed.	Thank you so much for your comment!
Nick	Procopio	Whole Chapter	15. Human Health						One section that should be addressed more directly (rather than dispersed throughout the chapter) is air quality effects on human health. While the topic is covered in the previous chapter (14), this section reads empty without more of a mention. Some readers may only read a select group of chapters or read the chapters out of order, and therefore topics such as particulate matter, ozone, aeroallergens (e.g., pollen, from changes in plant distribution and length of seasons, and mold spores, from the aftereffects of flooding) are all topics that should be mentioned within this section. Particulate matter is only mentioned briefly in the women's health section. Ground level ozone was not mentioned at all. Pollen is mentioned toward the end of the chapter, but as consequence of heat-mitigating tree planting; while this is a logical comment to make on that adaptation, the increased pollen exposure (and specifically the increased asthma related emergency department visits that may result), warrant explanation earlier in the chapter. A few mentions of KM 14.# are included in Chapter 15, but not enough to make up for the lack of discussion about the aforementioned topics.	Thank you for your comment. Because there is an entire chapter on air quality (Chapter 14) which we cite multiple times, the authors have decided not to add additional air quality content to the Health chapter because of space limitations. We cite Chapter 14's Key Messages 14.2, 14.3, and 14.4 in our chapter. We have expanded on air pollution so that the text now reads, 'greater exposure to poor air quality' in our introduction.
Nick	Procopio	Whole Chapter	15. Human Health						Flooding is another topic that could warrant its own section, especially since increased precipitation is predicted for many regions of the country. It is mentioned in the introduction of the chapter, but its discussion throughout the chapter is limited.	Thank you for your suggestion. Although we do not have a speicific section that focuses on flooding, we mention flooding throughout our chapter. We added a reference to a box specifically focused on flooding - Box 4.2 which we cite in KM 15.2 - which calls attention to the unequal impacts of flooding in the aftermath of Hurricane Harvey.
Nadia	Gronkowski	Whole Chapter	15. Human Health						CLIMATE CHANGE AND LEARNING The Early Years Climate Action Task Force appreciates the authors,Äô inclusion of both mental and physical health impacts on children. As a complement to the information in box 15.1 (page 15-8, lines 1-9), the Task Force offers the recent report ‚ÄúThink of the Children: The Young ‚Äì and Future Generations ‚Äì Drive U.S. Climate Concern,‚Äù from Capita and the Aspen Institute, which includes 2022 Siena College survey data sharing the perspectives of parents of children ages 0-8 on climate change. Parental attitudes provide an additional relevant indicator of how climate change is affecting the behaviors and mental health of families. Suggestion for Improvement: The Task Force recommends that the authors further explore the links between the negative impacts of climate change and children,Äôs preparedness and opportunities to learn. This important connection was named in the report,Äôs case study on the Arizona Department of Health Services heat policy guidance, and should be emphasized further throughout as a major short- and long-term challenge for children,Äôs mental health and cognitive development. COMMUNITY PARTNERSHIPS AND EARLY LEARNING SETTINGS The Task Force applauds the authors,Äô emphasis on community health and partnerships (Key Message 15.2) as important protective factors in the context of a changing climate. Connectivity and access to local resources and social networks is critical to climate preparedness, and bolstering these supports must be considered a critical component of the U.S.,Äôs climate response. Suggestion for Improvement: Increase language about child care centers and other early learning settings and maternal health care as key components of community resilience that benefits infants, children, and families. The Task Force encourages the authors to consider changing all mentions of ‚Äúschool,‚Äù throughout the report to ‚Äúearly learning and school environments,‚Äù to more fully capture the breadth of environments where children learn and spend their time.	We agree that climate change poses unique risks to child cognitive development and learning. We wish we had more space to include these details in this chapter. Space constraints unfortunately prevent this.
Juanita	Constible	Whole Chapter	15. Human Health						Please consider using the term PEOPLE OF COLOR to mean non-white people instead of the word MINORITY. Minority carries a connotation of lesser worth, and is not even mathematically accurate in some parts of the U.S. (including some rural areas).	Thank you for your comment. We have taken your suggestion and removed the word minority from the chapter.
Craig	Hanna	Whole Chapter	15. Human Health						In summary, the task force comments point out the following: Chapter 15 Human Health: Additional areas of stress on the access and delivery of health care under climate change include long-term services and support (LTSS) and several other areas.	Thank you for this comment. Long-term services and several areas are considered part of the healthcare system. We have proposed terms in the glossary to specifically define the health system very broadly extending into the community and a healthcare system to include assisted living. Also added the following sentence, "A climate-resilient health system is equity-focused, proactive in addressing mental health needs, and linked to community health resources such as community health workers and long-term support and services."
Jessica	Hinshaw	Whole Chapter	15. Human Health						The chapter did not include information about the growing issue of climate refugees crossing into the US from Central and South America. Community health centers and safety net clinics are experiencing increased patient volumes as a result.	Thank you for your suggestion. Cross-border migration is mentioned in Chapter 17 (Table 17.1), Chapter 26 (KM 26.1), Chapter 19 (Table 19.1), and Chapter 18, and Traceable Accounts.
Jessica	Hinshaw	Whole Chapter	15. Human Health						This chapter did not mention certain key groups that are often marginalized or heavily impacted by climate change, including: people with disabilities, people experiencing homelessness, people with chronic diseases, and older adults. For instance, in the recent heat waves in the Pacific Northwest, older single adults who were living alone in non-conditioned apartments were hard-hit. Further, older adults are more likely to have cardiovascular issues and other chronic problems that are exacerbated by extreme heat and air quality issues.	Thank you for this comment. Text was added to the beginning of the chapter to emphasize the wide range of vulnerable groups.
Reid	Sherman	Whole Chapter	15. Human Health						There are several 'more likely', 'increase', and 'decrease' without any numbers or percentages. Can the chapter add precision to any of these?	Thank you for your suggestion. Where possible, we have added more precision. Oftentimes, the evidence indicates likely increases or decreases without more specificity.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jody	Alyn	Whole Chapter	15. Human Health						This chapter is appropriately vast in scope, inclusive in its categories and specific in its examples. It is clearly written. The language is direct and easy to understand. The roles of structural racism and discrimination in exacerbating the public health crises associated with climate change have too-long needed to be emphasized. The situation is dire. That this chapter so consistently calls out those linkages, including so visibly as in one of the key messages, is welcome and essential. It is difficult to overstate this. The three key messages are spot on. The integration of relevant data is impressive. Though every sentence is packed with critical information and supporting citations, the flow of the narrative is smooth. Though the picture is quite grim, I appreciate that this chapter provides some direction for climate mitigation through existing and new or needed interventions and with examples of adaptation assessments and strategies that can direct action. Again, the call to simultaneously mitigate inequities is critical, as is the call for more research to address research gaps/areas of uncertainty and the cautions about limitations in modeling. Throughout the chapter, the language used to describe those most affected is respectful, appropriate and accurate (e.g., terms like ‚Äúcommunities that have been marginalized‚Äù and ‚Äúcommunities that have been under resourced and overburdened.‚Äù) There is one place where a copy edit may be in order. Is the use of the word ‚Äúminority‚Äù line 30, page 15-3 intentional or just something from an old draft? Of course the authors are well aware that people who used to be minorities are majorities in many places in the US. BIPOC is used elsewhere in the draft. I also have a question about the use of Black and Latinx. Latinx populations are larger in the US and may share some socio-economic, geographic and labor characteristics but where does this leave Arab, East Indian and other groups that are people of color? Curious about how the choice was made to use Black and Latinex vs Black and Brown. Last but not least, I noticed a caption that said, ‚ÄúPeople born in North America in 2020 will have an increase in exposure to six climate-related hazards compared to people born in 1960, demonstrating intergenerational inequity. Everyone Things at 12 Months have not worked. Loneliness. Bad Lives born	Thank you for these comments; and "appreciation"; as well as noting specifically the manner in which the chapter "consistently calls [various] linkages" linkages between structural racism in exacerbating public crises with climate change. Regarding the helpful comment on the figure caption on intergenerational inequity, we have added the phrases "on average" and "intergenerational exposure variability" to clarify that statement. Thank you for your comment regarding "Black and Latinx" nomenclatures. In certain sections "Latinx" was used because of the citations. Further on, "BIPOC" was used because it was cited in the references, specifically in Lancet, 2021. Regarding the use of "the word minority". The use is neither "from an old draft" nor "intentional" per se. We deploy it based on its usage in the citations (specifically Benz and Burney 2021.)
Rachel	Licker	Whole Chapter	15. Human Health					Through out the chapter, inconsistent terminology is used to refer to communities, for example -- low income and low wealth; BIPOC, people of color, and "minority" communities; Black us	Thank you for this comment. The section does not use "inconsistent terminology" to "refer to communities." The section does use some terms interchangeably, specifically: BIPOC and people of color. Other terms are used variously when they are specifically used in particular citations --for consistency with those citations. The result of this may seem to some readers as "inconsistent", though it follows from the specific references from specific discussions. In general the section does follow standards on race and ethnicity set by the U.S. Office of Management and Budget (OMB) in 1997. (See: Federal Register, Vol. 62, No. 210 (Thursday, October 30, 1997) pp 58782-58790.), which set forth: "The name of the Black category should be changed to “Black or African American.’”"	
Sophi	Beym	Figure	16. Tribes and Indigenous Peoples		5	5	3	3	Excellent visualization. Add a water cistern and water vapor collection unit to structure under Hope for future generations.	These are great ideas. Unfortunately, we didn't generate the visual, and are not in the position to make changes to it. We did, in the caption, clarifty that it is not something we generated, and should be taken as an example, not something that we actually made wholly based on our work in the chapter.
Reid	Sherman	Text Region	16. Tribes and Indigenous Peoples		5	5	13	13	Replace "was" with "ways."	Thank you, this has been fixed.
Emma	Conrad-Rooney	Text Region	16. Tribes and Indigenous Peoples		7	7	18	28	As a reader, it is very helpful for a chapter to reference other relevant chapters. However, there are so many key messages referenced here that it is challenging for the reader to know which aspects of this sentence "climate change threatens... and medicinal plants" is covered in these various key messages. Also, there appears to be some overlap in content between the sentences "climate change threatens... and medicinal plants" and "Other disruptions include ... travel for subsistence." Therefore, it could be helpful to reorganize these two sentences and more clearly indicate which key messages refer to different aspects that are threatened by climate change.	This is a great catch, and good insight. We adjusted the sentence to be more clear about the meaning. We appreciate the chance to make this improvement
George	Kling	Text Region	16. Tribes and Indigenous Peoples		8	9	11	36	Health Risks section. This section is severely lacking for several reasons. Knowing that many of the authors were also STACC authors (https://sites.google.com/view/stacc2021-itep/home) it is unclear why they clearly pulled so much from STACC for other IP chapter sections, but not for the Health Risks section. There are only two paragraphs in the IP health section and the larger one is all about COVID. The COVID paragraph lists impacts but the writing is difficult to follow and it isn?t clear that these are climate change impacts that COVID exacerbated. Moreover, it appears that the authors primarily cited themselves for this section, which is fine to a point, but there is much more encompassing and comprehensive literature that should be cited, such as: Zavaleta-Cortijo, C., Ford, J. D., Arotoma-Rojas, I., Lwasa, S., Lancha-Rucoba, G., Garc~a, P. J., Miranda, J. J., Namanya, D. B., New, M., Wright, C. J., & Berrang-Ford, L. (2020). Climate change and COVID-19: reinforcing Indigenous food systems. The Lancet Planetary Health, 4(9), e381?e382. DOI:https://doi.org/10.1016/S2542-5196(20)30173-X.	Thank you for this comment. We appreciate the prompt to revisit the STACC report and cross walk the information with this section. There are fabulous components of the Health and Wellbeing chapter that we will look to integrate into this section. We agree that this section's narrative could be improved and we will work to make future drafts clearer. COVID and the cascading impacts have been prominent in the literature over the past few years. The report's focus on COVID, and unprecedented impact of the virus and subsequent diseases, make it an important inclusion. Hence why we have dedicated the space to it. We will also look into the additional sources your cited, thank you for including it. Any citation of the authors by the authors is to strengthen the body of evidence of the section.
George	Kling	Text Region	16. Tribes and Indigenous Peoples		8	9	11	36	Health Risks section. The health risks section could be improved if they referenced Figure 29-3 page 9 from the AK chapter. This part of the AK chapter is more well-rounded than the current two paragraph section in the IP chapter (with the caveat that Figure 29-3 mentions spiritual health in the caption but fails to list it in the graphic itself under social context).	Thank you for calling our attention to this. We have made inclusions on Alaska and look to provide references to the AK chapter's key messages. There are significant updates to this chapter and others so we hope that they satiate any concerns.
George	Kling	Text Region	16. Tribes and Indigenous Peoples		8	9	11	36	Health Risks section. One of the key health messages from STACC is that Indigenous Peoples? health and wellbeing (HWB) is founded on mutually beneficial relationships among humans, nonhuman relatives, and the environment; therefore, HWB is highly impacted by climate change. However, this relationship and worldview of many IP with cultural health, spiritual health, mental health, physical health, and the natural world is not mentioned anywhere in the health risks section, and this omission is fundamental to understanding the effects of climate change on Indigenous People. Some mention of this could also go in the ?culture paragraph? (page 9, lines 25-36) if not the health section, but it?s not there either. Likewise, there is almost nothing on social-emotional health (i.e., mental health) in the IP chapter. The AK chapter does a much better job and could be cited or referenced, especially in the AK chapter on page 11, lines 28-39. Mental health is also part of the health chapter in the STACC report, and that could easily be referenced here.	Thank you for grounding us and centering this perspective beyond physical health to also include cultural health, spiritual health and relationships to the natural world, including nonhuman relatives and the environment. As with other comments in this section we appreciate the call to refer to the great work of the STACC report and Alaska Chapter. We look to find ways to reference the Alaska Chapter and integreate information from the STACC report.
George	Kling	Text Region	16. Tribes and Indigenous Peoples		9	9	11	17	The health section in this chapter references ?Sports? several times and uses many citations from one author. However, the term ?sport? mislabels and inadvertently minimizes the examples that are referenced, and many Indigenous People would find this offensive. These are important cultural events and activities necessary to maintain cultural continuity. It would be better to reference this as cultural activities instead of sports, or, to clearly differentiate between the two and indicate why ?sports? is a more Indigenous-accepted term for such activities.	We clarified this point by changing to: "During the peak periods of COVID-19 infection, some Indigenous peoples were unable to fulfill environmental stewardship responsibilities and participate in community-based cultural, physical, and spiritual activities as they stayed home to protect themselves, their loved ones, and their communities. Disrupted stewardship and cultural sport activities included first salmon ceremonies (Leonard 2021c), canoe journeys (Leonard et al. 2020), wildfire response (Green et al. 2021), and athletic sports (e.g., hoop dancing) (Leonard et al. 2020)."

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
George	Kling	Text Region	16. Tribes and Indigenous Peoples		9	9	20	23	Here the report cites COVID as being the ?prevalent incident type for federally recognized tribes (FEMA 2022)?. However, the logic is flawed because Tribes can?t request disaster recovery funds related to natural disasters that aren?t infrastructure-based, and you also must have already in place a hazard mitigation plan. Many tribes would have applied to FEMA for natural hazard funds IF they were allowed to use funds for natural resource recovery rather than human-made infrastructure.	First, these numbers were pulled directly from FEMA's publicly accessible data. COVID19 was not a traditional disaster to which FEMA normally responds. Thus, it's response and the funding programs attached would function differently than to a hurricane, tornado, or earthquake. The number of Tribes who received declarations also includes Tribes that may have also come in under statewide declarations, all of which would be eligible for certain response and recovery funding. Tribal Governments and citizens did not receive individual assistance claims, like they would if their house was flooded or damaged form a tornado because those were not the resources being distributed during this declaration. However, Tribal Governments could receive Crisis Counseling Assistance and Training Programs that were made available through the Individual Assistance Program. Other resources to respond to the disaster, like PPE and testing machines were distributed to Tribal Nations as well under this declaration. Because this was not a natural hazard in the same sense as a flood, certain funds were not available. This was coded as a biological incident and the decision to make FEMA the lead agency for COVID19 response and recovery was because no other federal agency had the logistic infrastructure to respond to a disaster quite like this. The issue of Hazard Mitigation Plans and funding is a separate issue. Some funding like disaster Hazard Mitigation Grant Programs (both disaster and non-disaster) are only available with a Hazard Mitigation Plan, however, Tribal Nations still have 30 days to draft and approve a Hazard Mitigation Plan from when a disaster is requested to get Disaster Hazard Mitigation funds. FEMA is currently rewriting its Hazard Mitigation Planning Handbook and Guidance with a broader push to include Tribal Government's Adaptation Plans.
George	Kling	Text Region	16. Tribes and Indigenous Peoples		9	9	25	36	This Culture paragraph is equally as sparse and lacking as the Health section, and there is little mentioned elsewhere in the chapter about culture. And there is absolutely no mention of spiritual values at all. Because spiritual values are intimately linked with ?culture?, it would be helpful to make some reference to these values in this culture section (or wherever the authors think is most appropriate).	The culture paragraph, and the references to culture and spirituality throughout the report, have been revised and improved.
Marcy	Rockman	Text Region	16. Tribes and Indigenous Peoples		9	9	25	26	This statement is true and with my following comment I do NOT want divert attention to the importance of cultural heritage of, with, and for Indigenous people, but expressing concern here that it be balanced with recognition in some way in this chapter/section or potentially whole document that all communities have ties to history and cultural heritage; that cultural heritage is not co-defined by Indigenous people, which many climate documents tend to do. This larger situation is perversely creating a language around cultural heritage that divides by ancestry, class, and race and suppressing broader policy attention to it. This chapter appears to be well thought out and structured - the phrasing of this particular statement struck a chord of concern.	We reviewed our chapter and would actually argue that the other chapters of NCA actually already reflect certain heritage, culture, and etc. of different more dominant groups in the U.S. or exclude important groups. It is up to those other chapters to make those improvements. Some of the authors in meetings have raised this concern and hope that NCA continues in its trajectory toward being more diverse.
Sophi	Beym	Text Region	16. Tribes and Indigenous Peoples		10	10	17	17	Exactly! Being forcibly relocated and then being forced to pay flood insurance? Not justice.	Thank you, yes, those most impacted by flooding may not be getting needed benefits from the NFIP.
Sophi	Beym	Text Region	16. Tribes and Indigenous Peoples		10	10	22	25	IF a community is mapped under the NFIP, then they automatically join. And, so, the partnerships with universities and Tribes enable students to deploy necessary digital mapping skills to protect some Tribes from the web NFIP can create for a federally recognized tribe forcibly relocated in a Special Hazard Flood Area (SHFA).	It is important to clarify, that participation in the NFIP is voluntary. However, those who live within a non-participating community cannot benefit from the program should there be a flood. FEMA has been inconsistent in how it has included Native sovereign land onto Flood Insurance Rate Maps (FIRMs) that inform the NFIP. It would be wonderful to build capacity in this space. More University and Tribal partnership would greatly strengthen flood risk identification, mitigation, and resilience.
Reid	Sherman	Text Region	16. Tribes and Indigenous Peoples		11	11	7	7	Focus in this KM is on Resilience more than Mitigation and Adaptation. Make sure the usage of the term is in alignment with other chapters.	We reviewed the content of the other chapters and confirmed that resilience is being used in compatible ways.
George	Kling	Text Region	16. Tribes and Indigenous Peoples		11	14	8	7	In this section there is much text about sovereignty and self-determination and how they are impacted by policies and institutions of settler colonialism, but there is no mention that climate change also impacts sovereignty and self-determination in a very real way.	The section was reviewed and climate change was mentioned explicitly in each paragraph. Extra care was taken to include the words climate change across the paragraphs. We appreciate the commenters' ensuring that the reader can understand and follow the climate change thread.
Emma	Conrad-Rooney	Figure	16. Tribes and Indigenous Peoples		11				It would be helpful to add a figure key for figure 16.5 a.	Change request form
George	Kling	Text Region	16. Tribes and Indigenous Peoples		12	12	19	21	Recognizing that the following paragraphs describe accurately the reality of government-to-government consultation, there should be a mention of the limitations and disagreements in co-management in practice. For example, MMC has studied and reviewed co-management in MMPA that reveal issues inherent in government-tribal cooperation, such as a lack of trust and unequal levels of authority and capacity.	We created a new sentence that expresses this key point. Thank you to the commenter.
Crystal	Stiles	Text Region	16. Tribes and Indigenous Peoples		13	13	5	5	There is a typo - the word was should be ways.	Great catch. Thanks!
George	Kling	Text Region	16. Tribes and Indigenous Peoples		13	13	26	30	Here it is stated that the CARE Principles are being used in climate change projects. This is misleading, because only a few of the many projects use CARE principles. It would be helpful to reword this statement to be accurate, and to make a recommendation for more projects to use CARE principles.	Edited to CARE Principles "increasingly being applied" to reflect the limited, yet growing number of cases. Thank you for this comment.
Emma	Conrad-Rooney	Text Region	16. Tribes and Indigenous Peoples		14	14	9	12	Key Message 3 should be revised to follow a Risk-Based Framework.	We understand the point here, and appreciate the commentators' raising this. We had actually, at an earlier stage of the chapter, verified that the chapter follows this framework, at the same time, this is the only chapter with a topic that doesn't not automatically map on to a risk based framework.
George	Kling	Text Region	16. Tribes and Indigenous Peoples		14	14	22	24	Please add ?actual implementation of adaptation actions? to the list, because this is actually one of the most important IP-led actions.	We are requested more words to be able to do this.
Ngozi	Ngwube	Text Region	16. Tribes and Indigenous Peoples		16		1		Key Message 16.2 Social Systems and Indigenous Resilience : However, their ability to exercice this right is undermined by various factors such as the absence of sufficient high-speed internet connections enabling to reach and connect with a wide range of audience in all the branchs of government, private and public sectors decision makers.	Excellent point, which we incorporated.
Kieren	Daley Laursen	Figure	16. Tribes and Indigenous Peoples		16	18	1	1	Given that this figure could not be reviewed given its "copyright" issue, it is not possible to give it a proper review, but according to the caption, there may be more applicable photos available that should be considered for inclusion in the chapter.	The figure has been deleted
Crystal	Stiles	Text Region	16. Tribes and Indigenous Peoples		16	16	2	2	Suggest replacing the word adaption with adaptation.	Fixed
George	Kling	Whole Chapter	16. Tribes and Indigenous Peoples						It is striking that the Tribes and IP chapter and the Alaska (AK) chapter make no reference to one another, because there is so much possible cross over and both chapters could be improved by citing the other. It is also striking how little the IP chapter mentions any AK context, and it is assumed that this is because the IP authors were leaving all AK related info to the AK chapter authors. However, if one were to read only the IP chapter, they would think that climate change isn?t an issue in AK since AK is rarely mentioned. Two examples of how this situation can be improved are (1) Referencing the impacts described in the Our Health section (pages 8 - 13) from the AK chapter would greatly improve the Health Risks section (pages 8-9) in the IP chapter. The current Health Risk section in the IP chapter is shockingly short and doesn?t mention any of the risks from the AK Chapter, which will affect many IP across the U.S. and not just those in AK. For example, the AK chapter?s primary focus is vector-borne diseases and there is also a good paragraph on mental health impacts, neither of which are referenced in the IP chapter, and both issues will have implications across the country. (2) The second example is that the IP chapter focuses heavily on the importance of sovereignty and self-determination, especially see page 12 lines 23-36. This is great, but, it doesn?t at all mention the unique circumstances that most Native Alaskans find themselves in, where there are no treaties and the political spaces are complex. In the AK chapter there is a good paragraph outlining many key AK players (page 16, lines 26-34), which the IP chapter would benefit from by mentioning in order to give context to the AK IP experience, especially since approximately 20% of all IP in the U.S. are in Alaska.	Addressed throughout the chapter, and took care to specifically cross reference the health and Alaska chapters/key messages in the health section of the IP chapter. Similarly, made reference to the jurisdictional details referenced in the Alaska chapter within the IP chapter. We also note that due to the fact that we chose to refer to Indigeneous Peoles more generally (being inclusive of Alaska Native Communities), we have limited the need to each of the specific Indigenous groups that are included in the relevant discussions (including Pacific Islanders, IP in the Carribbean, state-recognized Tribes, Alaska Natives, etc.
George	Kling	Whole Chapter	16. Tribes and Indigenous Peoples						The second major chapter-wide issue is that the IP chapter clearly steers away from making any recommendations, in contrast with the AK chapter that has actual recommendations. This renders the IP chapter quite bland, and the reasoning behind this is unclear. The IP chapter would greatly benefit from making actual recommendations, such as using the CARE Principles more widely, and working with the multiple jurisdictions to improve self-determination and sovereignty for IP (e.g., the AK chapter makes this recommendation in a powerful and useful paragraph on p. 36, lines 27-34, which could be used as a model or a reference for the IP chapter).	We completely share the sentiment, and the author team has a strong desire to ensure that scientific work figures into policy recommendations. However, we are bound by the rules of the National Climate Assessment, and we cannot make specific policy recommendations. Regarding the Alaska chapter, we cannot comment on their recommendations and writing process, and we are confident that the author team is working within the NCA boundaries.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rebecca	Fournier	Whole Chapter	16. Tribes and Indigenous Peoples						It is important to recognize additional risks and challenges in displacement than those currently identified in the assessment, including physical violence (more specifically, sexual violence, often against women and girls). Mental health services are harder for migrant populations to access and they frequently face disruptions in continuity of care. Such populations may present emotional or mental struggles in ways that don,Äôt align with modern Western diagnostic criteria and often seek out guidance from spiritual or traditional healers; both can obscure our awareness of mistreated, or undertreated, conditions (e.g., PTSD, drug and alcohol abuse) resulting from major stressors like forced migration if resources are not shared with such providers or if, through displacement, access to such providers is no longer available. Challenges during integration or assimilation include language barriers (*note: loss of language, inequitable access to adaptation resources due to language ARE addressed in the text nicely), religious and cultural norms in addition to the economic and social challenges outlined here. Distrust of government-provided support and/or mainstream medical care providers may compound these negative impacts. [also relevant, Chapter 20: Social Systems and Justice, Chapter 1: Overview]	Reviewed and addressed
Reid	Sherman	Whole Chapter	16. Tribes and Indigenous Peoples						This is a very important chapter to include and is an effective summary of a diverse array of topics, including applicable science and the data on which that science is based.	Thank you, we appreciate your reading.
Casey	Thornbrugh	Whole Chapter	16. Tribes and Indigenous Peoples						Terminology: Consider using "Tribal Nations" in lieu of "tribes."	Thank you for the suggestion. We feel it would not be good to make this change given that we would then have to refer to state or unrecognized tribes as 'tribes'. We agree with the rationale here but think that it can't be pulled off without accidentally sending an inaccurate message about non-Tribal nations.
Tom	Ellison	Text Region	17. US International Interests		3	3	2	2	Suggest replacing "will accelerate with additional emissions" with "will accelerate through mid-century even if emissions are cut sharply." Even in an optimistic, Paris-compliant scenario like SSP1-RCP1.9 where emissions drop sharply starting in 2020, temperature continues to rise to about 1.5¬∞C through mid-century. This is a relevant point for this section's audience in the international risk and security realm, because even in a best case scenario impacts will worsen significantly over the coming decades.	We thank the reviewer for the comment. The text has been revised to incorporate this suggestion and now reads "...climate change is rapid, widespread, and will continue through mid-century even if emissions are cut sharply..."
Tom	Ellison	Text Region	17. US International Interests		3	3	11	15	The global security implications of the energy transition itself are a key point that is not as broadly appreciated as the implications of climate change itself. Suggest including more examples and specific discussion throughout (besides competition for critical minerals). For example, cybersecurity and electrification, shifting economic leverage from fossil fuel exporters, potential energy price spikes/protests, etc.	We thank the reviewer for the comment. The chapter text has been revised to incorporate this perspective. More examples were added to the National security section (17.2).
Rachel	Licker	Text Region	17. US International Interests		3	3	16	17	I found this sentence vague - please specify what is meant here.	We thank the reviewer for the comment. The text has been revised to incorporate this suggestion. We revised the sentence to read "Despite documented evidence of increasing climate change risks, mitigation and adaptation responses by public and private sectors are not yet sufficient to avoid rising loss of life, biodiversity and infrastructure (IPCC 2021, IPCC 2022a)."
Reid	Sherman	Figure	17. US International Interests		5				"climate resilience" is listed as bullet under the category "climate resilience", what is the difference between "adaptation/risk reduction" and "adaptive and transformative adaptation" -- suggest removing the last bullet or clarifying	We thank the reviewer for the comment. The finalized figure will incorporate this sugegsiton.
Tom	Ellison	Text Region	17. US International Interests		6	11	8	24	There are elements where this section on national security would benefit from increased synthesis with the chapters on US impacts, which after all are the most direct implications for US citizens' security and well-being. For example, chapter 5 on energy and chapter 30 on Alaska give detailed discussions of the cybersecurity implications of electrification and Russian buildup in the Arctic, respectively, which have national security implications but are not discussed much here.	We thank the reviewer for this comment. The text has been revised to incorporate this suggestion. We added cross-references to energy and Alaska chapters and added text on Russian activity in the Arctic.
Emma	Conrad-Rooney	Text Region	17. US International Interests		6	6	9	14	Key messages 17.2 should be revised to follow the Risk-Based Framework.	We thank the reviewer for the comment.We reviewed Risk Based Framework guidelines. The text reflects a focus on social system rather than the climate system.
Tom	Ellison	Text Region	17. US International Interests		7	7	2	3	Suggest specifying which forms of conflict are being referred to here.	We thank the reviewer for this comment. The text has been revised to incorporate this suggestion and now reads "Climate change impacts and responses can contribute to political and social instability as well as various forms of conflict". We The space limitations prevent detailed discussion.
Tom	Ellison	Text Region	17. US International Interests		9	9	4	7	This is a key point, suggest including some more specific examples, such as potential conflict over land rights in pursuit of ecosystem conservation or nature-based solutions, or disruption of biodiverse ecosystems for renewable energy siting.	We thank the reviewer for this comment. The text has been revised to incorporate this suggestion. We added text on biodiversity loss.
Tom	Ellison	Text Region	17. US International Interests		9	9	12	14	Suggest including a specific mention of Russia's military activity in the region and Arctic Council tensions amid the invasion of Ukraine, which are discussed in the Alaska section. Russia is not mentioned by name at all in the national security chapter.	We thank the reviewer for this comment. The text has been revised to incorporste this suggestion. We added text about Russian military activity added and cross reference with Alaska chapter after consultation with Alaska chapter team.
Tom	Ellison	Text Region	17. US International Interests		10	10	6	7	This seems to be a nod to China's provision of inexpensive infrastructure in vulnerable states and its invocation of leadership of the developing world to expand its influence for broader purposes. If so, suggest specifying and expanding on this.	We thnak the reviewer for this comment. The text has been revised to incorporate this suggestion. We added text regarding geopoltiical context and countries cooperating and competing in activities.
Don	Falk	Text Region	17. US International Interests		11	11	8	9	Add literature reference: "...defense, diplomacy, and development approaches (Samaras et 8 al., 2019; Burnett & Mach, 2021; Garfin et al. 2021)." Garfin GM, DA Falk, CD O,ÄôConnor, K Jacobs, RD Sagarin, AC Haverland, A Haworth, A Baglee, J Weiss, JT Overpeck, and AA Zuv‡iga-Terv"n. 2021. A new mission: Mainstreaming climate adaptation in the US Department of Defense. Climate Services 22: 100230. https://doi.org/10.1016/j.cliser.2021.100230	We thank the reviewer for the comment. The text has been revised to incorporate this suggestion. We added the reference.
Don	Falk	Text Region	17. US International Interests		11	11	22	23	Add literature reference: "...global, regional, national, and local scales (Garfin et al. 2021)." Garfin GM, DA Falk, CD O,ÄôConnor, K Jacobs, RD Sagarin, AC Haverland, A Haworth, A Baglee, J Weiss, JT Overpeck, and AA Zuv‡iga-Terv"n. 2021. A new mission: Mainstreaming climate adaptation in the US Department of Defense. Climate Services 22: 100230. https://doi.org/10.1016/j.cliser.2021.100230	We thank the reviewer for the comment. We added same citation earlier in same section. We did not cite here as article focused on domestic actions and text here focused on international actions.
Reid	Sherman	Text Region	17. US International Interests		11	11	23	24	This section ends abruptly with a reference to "a wide range of responses" by the US government with partners. Some examples might be helpful.	We thank the reviewer for the comment. The text has been revised to incorporate this suggestion. We removed the last sentence.
Steve	Scharre	Whole Page	17. US International Interests		11				For the section on key message 17.2, suggest adding in two other points about how the US is trying to address these challenges. The first is targeted efforts to build adaptive capacity and resilience in key areas of concern that, if successful, would reduce future risks to US interests when climate impacts arise. And the second is the importance of building early warning systems for disaster preparedness and planning, but also longer-term indicators & warnings to better understand and forecast how a climate hazard can cascade and compound and cause other second and third order impacts to US national security interests.	We thank the reviwer for the comment. The text has been revised to partially incorporate this suggestion. We added text on building adaptive capacity and resilience to reduce future risk, and addressing threats. We appreciate other suggestions, but space is limited. The author team has deliberated and prioritized the information and illustrations to include.
Tom	Ellison	Text Region	17. US International Interests		12	12	3	6	The implications of these dynamics for security issues should be more explicitly included in the national security section. For example, how will job losses in fossil fuel sectors or energy price spikes influence political stability in key US allies, adversaries, or fragile states? How will petrostates' stranded assets potentially shape more risky geopolitical action or spoiler activity toward climate mitigation?	We thank the reviewer for this comment. The text has been revised to incorporate this suggestion. We added text on disruptions in energy transitions to highlight some of these dynamics.
Reid	Sherman	Text Region	17. US International Interests		12	12	10	11	Please clarify whether this includes any dynamic consideration of adaptation effects on those potential costs.	We thank the reviewer for the comment. The text has been revised to incorporate this suggestion. We revised the narrative to more clearly address the potential for adaptation to ameliorate costs from physical climate risks.
Reid	Sherman	Text Region	17. US International Interests		13	13	17	17	This reference should be to IFC 2016, not ICF 2020.	We thank the reviewer for the comment. The text has been revised to incorporate this suggestion. We corrected the reference.
Reid	Sherman	Text Region	17. US International Interests		13	13	26	36	This discussion of increased business interest in climate action does not discuss adaptation, where there have been long-standing challenges to mobilize private investment but we are beginning to see some interest being generated due to increased risk awareness and market opportunities. There should be some reference to this area here rather than just mitigation.	We thank the reviewer for the comment. The text has been revised to incorporate this suggestion. We added additional text on adaptation in subsequent paragraph.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Tom	Ellison	Text Region	17. US International Interests		15	15	7	9	There is a strong corruption-security nexus as well, and this would be worth connecting more explicitly in the national security section. Suggest changing sentence to "can increase corruption risks, undermining business efficiency, frustrating the effectiveness of climate responses, and exacerbating insecurity or poor governance."	We thank the reviewer for this comment. The text has been revised to incorporate this suggestion. We added corruption risk text in Key Messeage 17.2 on 'national security section' in paragraph under Table 17.1.
Reid	Sherman	Text Region	17. US International Interests		15	15	21	22	It's not clear where in the main text this statement is discussed further.	We thank the reviewer for the comment. The text has been revised to incorporate this suggestion. We removed the sentence.
Tom	Ellison	Text Region	17. US International Interests		15	15	32	37	The dire and inequitable impact on vulnerable populations' wellbeing also has human and national security implications--i.e. empowering armed or criminal groups that exploit refugees and migrants. Suggest altering sentence to "This jeopardizes these populations' security and raises equity concerns, particularly..." to better connect this dynamic to the security section.	We thank the reviewer for this comment. The text has been revised to incorporate this suggestion. We added an emphasis on the impacts going beyong adaotation and an emphais on low-income countries. The point reviewer raises is also covred in the National Security section.
Reid	Sherman	Text Region	17. US International Interests		16	16	16	25	This summary should reference the continued imbalance between adaptation and mitigation finance which is significant and has been a topic of considerable debate at recent COPs.	We thank the reviewer for the comment. We revised the text to address this comment.
Reid	Sherman	Text Region	17. US International Interests		17	17	14	30	This paragraph might be usefully separated into two, the second of which could include some detail on the statement in the key message about "knowledge of effectiveness" which does not seem to be discussed here.	We thank the reviewer for the comment. The text has been revised to incorporate this suggestion. We accepted suggestion to split into two paragraphs, and added text speaking specifically to the knowledge of effectiveness.
Tom	Ellison	Text Region	17. US International Interests		18	18	20	24	Given space constraints of 23 pages, NCA5 does an admirable survey of the myriad ways climate change can impact instability; conflict, economics, and US defense, diplomatic, and development resources. Nevertheless, the discussion is limited to largely global or abstract categories of impact, with the national security section mentioning briefly only two specific countries and drawing heavily from 2021,Âôs National Intelligence Estimate on climate change. But this speaks to a gap that the USGCRP might fill,Äithe lack of a sufficiently timely, policy-oriented, and geographically detailed US government scientific assessment of climate change outside the US. The IPCC Assessment Report process does not adequately fill the need because its worldwide mandate lacks sufficient focus on geographies key to US interests, it reflects a lowest-common denominator global consensus, and it is insufficiently timely, with an 8 year gap between the most recent report and its predecessor. Therefore, US national security and international policymakers and analysts must rely on the IPCC, existing academic literature, in-house analysis, or ad hoc contracted studies, which are suboptimal or potentially inconsistent. Perhaps an International Climate Assessment is in order to accompany the NCA.	We thank the reviewer for the comment. No specific edits were made since none were required.
Reid	Sherman	Traceable Account	17. US International Interests		22	22	26	37	This seems like duplicate text from an earlier section of the Traceable Accounts.	We thank the reviewer for the comment. The text has been revised to incorporate this suggestion. We removed the duplicate section.
Reid	Sherman	Text Region	17. US International Interests		27	27	4	7	These two references should be distinguished as "Global Commission on Adaptation 2019" and "GCA 2021". The former was published by the Commission through its joint secretariat partners, the World Resources Institute and the Global Center on Adaptation; the latter was published individually by the Global Center on Adaptation, one of those two partners.	We thank the reviewer for the comment. The authors will work with the Technical Support Union to correct the bibliography. Once formatting is fixed, we will also add the weblink to the 2019 Global Commission Report was incorrect; should be: https://gca.org/wp-content/uploads/2019/09/GlobalCommission_Report_FINAL.pdf?_gl=1*y9lujx*_ga*MTg0MTQ0MDI4NC4xNjgxMjYxNDc0*_up*MQ..
Steve	Scharre	Whole Chapter	17. US International Interests						Well done chapter. To clarify for the reader though, I suggest including a rough timeframe up front on how long the analysis is meant to go out towards. Are you assessing the impact to US international interests over the next 5 years, the next 20, or beyond? I think you can clarify by saying the near (5) and medium (20) years.	We thank the reviewer for the comment. Timeframes for findings are included throughout the chapter where applicable. The assessment is not structured around a specific timeframe or set of timeframes which need to be introduced earlier in the chapter.
Steve	Scharre	Whole Chapter	17. US International Interests						Suggest you provide additional language, probably in Key Message 17.2, on the risk of geoengineering. It's mentioned once in Table 17.1 but then not expanded on, and it's an issue that's probably worth unpacking for the reader who might not know what it is or why its a national security issue.	We thank the reviewer for the comment. The text has been revised to incorporate this suggestion. Added text in national security section and suggested additions to the glossary of geoengineering and solar radiation management. Carbon dioxide removal already in the glossary.
Tom	Ellison	Whole Chapter	17. US International Interests						The Center for Climate and Security (CCS) appreciates the opportunity to comment on the 5th National Climate Assessment (NCA5) and applauds the work and expertise brought to bear by its authors. We find little to dispute in the report,Âôs contents on national security and international US interests. Broadly, CCS applauds NCA5,Âôs increased discussion of international impacts and national security implications of climate change, in chapter 17, compared to NCA4. CCS strongly agrees with NCA5,Âôs discussion in chapter 17.2 of the ways the changing climate is exacerbating insecurity, straining US military and foreign policy capabilities, and prompting increased attention from the US national security community. CCS also concurs with chapter 17,Âôs broader discussion of the ways climate change will degrade economic prosperity, shape trade, and hinder development. This is especially relevant to consider in conversation with national security, because climate change,Âôs compounding impacts on interdependent, complex human and natural systems are critical to security, a dynamic highlighted well in chapter 17.1. However, some important climate security topics are covered in inadequate detail, geographic precision, or comprehensiveness. There is room to improve climate security considerations in NCA5 or future assessments in three key areas: more detailed exploration of international climate impacts and their repercussions for US interests, increased treatment of the security implications of climate mitigation and adaptation policy, and more analysis of domestic US climate impacts for US interests abroad. This is largely a result of the NCA,Âôs existing focus and scope, informing our recommendation that future iterations of the NCA or companion publications provide room for more dedicated discussion of these issues.	We thank the reviewer for the comment, but as reviewer suggests, space limitations prevent us for adding more.
George	Ott	Whole Chapter	17. US International Interests						It would be very beneficial to assemble global resource estimates for some of the key minerals required for the projected growth in solar and wind energy using a methodology similar to fossil fuels (see figure 17.2). In the fossil fuel industry, companies and governments are required to provide estimates of proven, probable and prospective reserves for oil, gas and coal. Based on demand projections, we can see how many years of supply in the earth's crust are producible now (proven), can be developed with current technology (probable) and require new technology for development (prospective). Understanding that this is a "large task" that may involve more proprietary information, we should start making these projections now to identify geologic resource constraints (if any), determine if the reserves present in the earth and onlly require demand and price to drive capital investment for discovery, proving and ultimate production.	We thank the reviewer for the comment. The points the commenter raises are beyond the scope of this chapter and we have not revised the text.
Rachel	Licker	Whole Chapter	17. US International Interests						The chapter is missing the elephant in the room - that the US is the largest historic contributor of emissions and the impacts that follow. It is critical for that information to be prominently featured to inform discussions of responsibility in the international arena. More information is also needed on the benefits of international finance for mitigation, in addition to adaptation, as well as considerations of new arenas that have opened up in international fora (e.g., on loss and damage).	We thank the reviewer for the comment, but the suggestion is outside the scope of this report. The chapter focuses on the impacts of climate change on US interests internationally. Questions of responsibility are beyond this mandate. The chapter discusses, extensively, the ongoing and projected impacts of climate change on vulnerable communities around the world and the need for a comprehensive approach to manage these risks.
Ariela	Zycherman	Text Region	18. Complex Systems		3	3	1	20	the introduction could benefit from a strong definition of how complexity is being approached in this chapter.	We have added a sharper introduction of how complexity is being approached in this chapter into the introductory section.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Nadia	Gronkowski	Text Region	18. Complex Systems		6		11		Page 798 - Line 11 The Early Years Climate Action Task Force recommends adding pregnant people and young children to the list of climate-vulnerable populations in line 11. The Task Force encourages the authors to elevate the young children (prenatal to 8), their caregivers and families as a key population and a fundamental issue in Climate Science and Policy. There is extensive (and growing) evidence that this segment of the population is exceptionally vulnerable to climate disruptions, emergencies and disasters. Climate change not only endangers life in the early years, but lacking appropriate attention and support, the damage incurred in the early years carries over and accrues over the full lifespan of an individual. In this sense, climate policy and programs that are sensitive/centered on the early years are a great investment that provides support in the present and yields resilience over the long term. The Task Force also recommends naming ‚Äúinfants and children‚Äù throughout the report and generally increasing the information presented about the impacts of climate change and climate emergencies on our nation‚Äôs youngest citizens. The younger a child is, the more susceptible they are to many of the negative impacts of climate change, meaning that infants are at high risk; furthermore, infants have unique needs in the context of disaster preparedness and community resources that must be considered as the nation plans for climate resiliency.	Thank you for your comment. The commenter is correct that there is a growing body of literature that shows the deleterious effects of climate change on pregnant women, such as the impacts of extreme heat, in addition to groups already identified as disproportionately vulnerable. There are numerous diverse groups of people that are expected to face increased impacts, making it a challenge to name them all individually. However, we agree that our sentence can be more inclusive to the commenter's suggested groups as well as others. Hence, we have chosen to include the phrase "people with health conditions and disabilities, pregnant women, caregivers, young children, and the elderly."
Ariela	Zycherman	Text Region	18. Complex Systems		7	7	1	9	happy to see the intersectionality language and the language about the relationship between inclusion in research leading/ or not leading to inclusion in solutions.	We appreciate the reviewer's comment.
Jessica	Ruvinsky	Text Region	18. Complex Systems		11	11	13	22	Also: Participatory modeling has been used to diagram potential cascading impacts across infrastructure sectors and their downstream effects on vulnerable populations; network analysis performed on this model helped identify key intervention points (County of Los Angeles, 2021; Ruvinsky et al., 2022). County of Los Angeles, 2021: LA County Climate Vulnerability Assessment. Chief Executive Office. https://ceo.lacounty.gov/wp-content/uploads/2021/10/LA-County-Climate-Vulnerability-Assessment-1.pdf or https://cso.lacounty.gov/the-plan/cso-current-initiatives/ Ruvinsky, J., G. Gero, R. Kampalath, and J. Hart, 2022: Systemic vulnerability: Cascading impacts in Los Angeles County. Paper presented at the National Adaptation Forum, Baltimore, MD, October 27, 2022.	Based on feedback from the NASEM review, we have reworked the scope of this box, such that crosscutting themes and findings are instead revealed through a single specific example. Given this, the suggestion of this addition is no longer relevant in the box, and we have instead added it within key message 18.3.
Ariela	Zycherman	Text Region	18. Complex Systems		18	19	1	23	I agree with with the statements here across the sections, that complexity is remarkably understudied particularly the questions related to the social contexts of both complex events and solution implementation. It might be helpful to reference the tendancy to approach discreet risks and events, and give some context of what is valuable about that approach and what is missing from it. It isnt just the tendancy towards the technocratic approach is one thing, but the ability to look across climate risks, climate impacts, and interwoven systems both social and physical AND over the long term is also missing.	The text of the traceable account, as well as the chapter introduction and main text, has been modified to more explicitly encompass these themes.
Emma	Conrad-Rooney	Whole Chapter	18. Complex Systems						Key messages 18.2, 18.3, and 18.4 should be revised to more clearly follow the Risk-Based Framework.	They have been revised accordingly. All key messages now more clearly follow the risk framework.
Ariela	Zycherman	Whole Chapter	18. Complex Systems						key message 18.1 seems to mostly describe human- nature systems from the approach of mitigation and adaptation. This seems to jump the gun, by missing a discussion of how humans impact nature and how nature impacts humans, particularly through interconnected climate events. consider reorganizing or reframing	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. We have made edits to reorder the emphasis on human-natural systems before transitioning to the mitigation/adaptation focus on climate risk decision making in both the key message and its supporting text.
Ariela	Zycherman	Whole Chapter	18. Complex Systems						boxes 18.1 and 18.2 are such strong examples! Really helpful.	We thank the reviewer for the comment.
Ariela	Zycherman	Whole Chapter	18. Complex Systems						The chapter seems to approach complexity primarily from a cross sectoral approach, or from human impacts but with limited information on how these are related across climate risks. The addition of a discussion related to cascading and compounding events and how these further intersect with social systems would strengthen the climate approach to understanding complexity. The Camp fire is a good example of this where there were multiple fires during the recovery period as well as lasting smoke pollutions. It wasnt just that migration led to complext impacts, but that the climate events themselves were compounding .There are bits of this in the discussion in key message 18.4, but it starts from the management side, not the causal side.	The comment is appreciated. While KM 18.4 does provide an assessment of the policy and governance responses to climate risks (e.g., "management side"), the nature of multihazard and multi-risk environments and their complex intersections across systems (or the "causal" or demand side) is noted. Revisions to earlier key messages, as well the introduction, address this concern by increasing emphasis on cascading and compounding dynamics across hazards, vulnerabilities, risks, impacts, and responses.
Debra	Freeman	Whole Chapter	18. Complex Systems						Mostly gratitude that quality minds are at least being asked to ask the questions. I do hope you are able to find the existing,Äîor encourage the growth of future,ÄïÄútools and communities of practice to integrate disciplinary divides in support of complex-systems research,Äù (chapter 18, page 18, major uncertainties and research gaps), into even more accessible and actionable data. A question you may have already addressed in your text. If I have misread it, thank you for your patience and forgiveness and may it bolster your resolve. Question: concern about the ease of introducing a false variable into a complex system, which can magnify errors, how to mitigate that. Need for: adequate checks and balances of competing interests, rightsizing access to checks and balances (unequal individual, micro-economic resources and present court or arbitration processes), reallocating rightsizing a future-life centered value hierarchy (e.g. adequate education and health protection for children after they‚Äôre born to learn, study, and support the future ‚Äúcommunities of practice,Äù referenced above) Example 1: Without large scale enforceable carbon pricing reflective of current and future costs, and with uneven monetary subsidization, an individual consumer might encounter a $1 hamburger and $5 head of lettuce, which, in the aggregate, can exacerbate a false demand model in the marketplace, vicious feedback loop, etc. Example 2: Is it adequate to value a statistical life at $10 million (https://www.npr.org/2020/04/23/843310123/how-government-agencies-determine-the-dollar-value-of-human-life) if it still allows a legal subsidy for a fossil fuel plant at all, much less near a school? Should the number be increased to reflect maximum future losses of potential and maximum difficulty in mitigation, enforcement, etc? What are the best feedback loops to avoid GIGO, the butterfly effect? Is it changing legislation to nullify corporate arbitration costs that misbalance interests? Rightsizing market subsidies and caps to better reflect values of future human health? You have put more hours of research than I have reading this, and yet, much of this is not new, although the missed opportunity costs are rising.	The comments regarding appropriate checks and balances and right-sizing are well taken, and they are currently addressed in the text as the governance principle of transparency and accountability. We have increased emphasis on these themes, including in the revision of figure 18.4. However, the authors cannot currently specify what appropriate characteristics or parameters for those policy and governance actions should be because of the state of rigor in the scholarship, which we emphasize in KMs 18.3 and 18.4.
Weston	Fisher	Whole Chapter	18. Complex Systems						Should be the most important chapter. However, in addressing complex systems attention the chapter should discuss the relationship to overshoot of other planetary boundary conditions contributing to the global deterioration of the biosphere. e.g., species loss, decline in biodiversity, disruption of the nitrogen/phosphorus cycle from agricultural activities, degradation of marine and freshwater systems, introduction of novel entities, etc. It is unwise to view climate change impacts in isolation from other alarming planetary changes associated with human activities. Please review the recent work of the Stockholm Resiliency Centre.	The chapter authors agree with the intent of the comment and have provided examples of other boundary conditions and environmental systems that intersect with climate-related ones, but have not been able to list all or address each for brevity and clarity.
Charles	Hunt	Text Region	19. Economics		3	3	17	25	This is clearly incorrect based on the balance of the report and the entire adaptation chapter - ‚Äú¬ but adaptation strategies vary in their effectiveness and costs (medium confidence).‚Äù Based on the definitions in the Front Matter this should be changed to ‚ÄúVery High‚Äù	Understanding the effectiveness and costs of adaptation is an emerging area of research with mixed, and often uncertain, findings. Thus we have retained the original "Medium confidence" level.
Ariela	Zycherman	Text Region	19. Economics		3	3	23	23	Line 23, before "Adaptation." Since this is the economics chapter, and there is a separate, independent adaptation chapter, perhaps you could describe how economics incentivises adaptation. i.e., economic theory suggests that adaptation will occur and is efficient because doing so offers greater benefits than costs (not adapting). In other words, there seems to be a missed step in the key message going from weather impacts to adaptation without mentioning first that economics dictates/explains that adaptation should occur. Im also suprised there is no mention of the economics of mitigation at all in the chapter.	Thank you for the comment. We have added some text under the "adaptation" sub-section of Key Message 19.1 describing the economics of adaptation, in particular under what conditions adaptation might or might not occur. The economics of mitigation is beyond the scope of our chapter; we have included text to clarify this in our introduction.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Ariela	Zycherman	Text Region	19. Economics		3	3	29	29	You need a comma after the parenthesis: "), worker"	This edit has been implemented.
Juanita	Constible	Text Region	19. Economics		3	3	31	37	Human health harms from climate change are important economically but have been understudied and under quantified in part due to gaps in health surveillance, a topic mention in Chapter 14 (Human Health) that should also be mentioned here. Despite that difficulty, some studies have begun to quantify the economic harm of climate-sensitive health threats. Given that, it would be good to discuss a sample of the literature in this passage. See these articles for a fuller discussion of the issue: 1. Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2019). Estimating the Health?Related Costs of 10 Climate?Sensitive U.S. Events During 2012. GeoHealth, 3(9), 245--265. https://doi.org/10.1029/2019GH000202; 2. Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2020). Estimating The Costs Of Inaction And The Economic Benefits Of Addressing The Health Harms Of Climate Change. Health Affairs, 39(12), 2098--2104. https://doi.org/10.1377/hlthaff.2020.01109	We thank the reviewer for the suggestion. After careful consideration, we believe that the current discussion of physical and mental health impacts presented as an example of nonmarket impacts is sufficient.
Juanita	Constible	Text Region	19. Economics		3	3	31	37	Importantly, emerging evidence indicates that marginalized populations, including low-income populations and communities of color, are more exposed to economic harms from climate-sensitive health threats. See these articles for a fuller discussion of the issue: 1. Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2019). Estimating the Health?Related Costs of 10 Climate?Sensitive U.S. Events During 2012. GeoHealth, 3(9), 245--265. https://doi.org/10.1029/2019GH000202; 2. Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2020). Estimating The Costs Of Inaction And The Economic Benefits Of Addressing The Health Harms Of Climate Change. Health Affairs, 39(12), 2098--2104. https://doi.org/10.1377/hlthaff.2020.01109; 3. Limaye, V. S. (2022). Reducing the inequitable health and financial burdens of climate change. One Earth, 5(4), 320--323. https://doi.org/10.1016/j.oneear.2022.03.016	We thank the reviewer for the suggestion. We believe that the later section of text titled "Economic Vulnerability and Inequality" and Figure 19.2, presenting available empirical evidence on vulnerability, provide a discussion of the material raised within these articles.
Ariela	Zycherman	Text Region	19. Economics		4	4	3	3	"real estate" what? value?	The text has been edited to read "real estate values"
Juanita	Constible	Text Region	19. Economics		4	4	11	14	Importantly, the NCEI 2022 data source cited here does not include any health-related economic damages-- this limitation should be mentioned in the text. See: Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2019). Estimating the Health?Related Costs of 10 Climate?Sensitive U.S. Events During 2012. GeoHealth, 3(9), 245--265. https://doi.org/10.1029/2019GH000202	We have modified the text to read "at least $150B per year" to indicate that this estimate is a lower bound on costs that were enumerated for in this particular accounting exercise. We have also added "substantial and unequal health costs" to the list of example impacts that follows this statement.
Ariela	Zycherman	Text Region	19. Economics		4	4	13	13	delete "today". Its redundant with "currently" used above.	This edit has been implemented.
Ariela	Zycherman	Text Region	19. Economics		4	4	20	20	"restructured investment landscape" is too vague. Sounds like jargon. Can you be more specific?	This language was deliberately chosen because the nature of these changes will vary by sector, location, time period, etc, so it was not appropriate to be more specific.
Ariela	Zycherman	Text Region	19. Economics		4	4	28	28	"historical climate" what? trends?	"Historical climate" is correct.
Ariela	Zycherman	Text Region	19. Economics		4	4	35	35	"seawalls that protect cities": seawalls are often considered a form of maladaptation, since they only prolong the problem and making the sea walls only contributes to the CO2 problem. You may want to add a caveat here. Or have a section that describes that in the short-run, market economics may incentivize maladaptation.	We have inspected the text carefully and have chosen not to alter the text because it is accurate supports the discussion regarding the role of population density.
Debra	Freeman	Whole Page	19. Economics		5				-19-5 line 14-15 assumes ‚Äúadaptation may face political difficulties due to behavior changes that populations are reticent to adopt‚Äù without adequate correction of feedback loops in complex systems which are easy to throw off based on GIGO, the ‚Äúbutterfly effect,,‚Äù etc. -19-line 5, carbon dioxide is only $51 a ton? Maybe you should up it to rightsize prices. Inaccurately subsidized prices can skew consumer demand ($1 burger vs $5 lettuce) and magnify errors in models; see chapter 18.	The discussion of the Social Cost of Greenhouse gasses is a description of how a number used in regulation is computed.
Melissa	Shapiro	Table	19. Economics		6	8	5	1	Table 19.1. Additional economic estimates featured could include the following: ‚ÄúApproximately $3.45 billion (in 2020 dollars) will be required over the next 50 years in order to protect infrastructure in Alaska Native villages from damage due to flooding, erosion, or permafrost degradation.‚Äù (See BIA (2020). The Unmet Infrastructure Needs of Tribal Communities and Alaska Native Villages in Process of Relocating to Higher Ground as a Result of Climate Change: Fiscal Report 2020. Available at: https://www.bia.gov/sites/default/files/dup/assets/bia/ots/tcrp/Informational_Report.pdf)	Thank you for this comment. The BIA report provides more recent useful additional information, including economic estimates of the future costs (i.e., adaptation costs assuming no residual damages) to protect and relocate Alaska Native villages due to climate hazards. We have included this estimate in panel b of Table 19.1.
Reid	Sherman	Table	19. Economics		6				Chapter text and table use Fahrenheit but table caption text uses Celsius.	Thank you for your comment. In this table, we report results directly from the literature, which is why many of the estimates are in F. We have modified the key to focus only on RCPs and not on degrees of warming.
Ross	McKitrick	Text Region	19. Economics		11	11	22	23	You can't refer to higher temperatures without also referring to the increased CO2 that drives it. The latter has a beneficial effect on US agriculture including on grasslands which support livestock production. Satellite data show substantial greening of grasslands due to rising CO2. For moderate warming the net effect of combined increase in temps and CO2 is beneficial for the crops you discuss. See Challinor, Andrew J., et al. A meta-analysis of crop yield under climate change and adaptation. Nature Climate Change 4.4 (2014): 287; and Dayaratna, Kevin, Ross McKitrick and Patrick J. Michaels (2020) Climate Sensitivity, Agricultural Productivity and the Social Cost of Carbon in FUND. Environmental Economics and Policy Studies https://doi.org/10.1007/s10018-020-00263-w	This statement is an example used to illustrate the effect of market prices. The text describes the effect of higher temperatures holding other factors fixed. We aknowledge that it includes omissions of other enviornmental factors that are altered by climate change that will impact agriculture, such as rainfail levels, rainfall variance, humidity, cloudiness, wind and carbon-dioxide concentrations. We added some text under Key Message 19.1 in the "Projected Direct Impacts" sub-section reflecting these points.
Ross	McKitrick	Text Region	19. Economics		12	13	30	20	While I don't doubt that the author group can find studies that assert all these perils, we have to ask whether, in principle, the authors believe climate cooling would convert all these losses into gains. If a warming climate is projected to injure peoples' health, ruin agriculture and cause infrastructure to collapse, would those same models predict a cooling climate would benefit crop production, promote health and extend the lifetime of infrastructure? That sure wasn't the expectation during the 1970s cooling scare. The authors need to take some account of the reward structure in academia over the past decade, in which both grants and publication counts accumulate much more easily for researchers who can find harm from warming, and there is little incentive for seriously questioning the robustness of such modeling and estimation work. Is it really the case that warming will only bring harm, costs, injuries and damages, and not a single benefit even when adaptation is taken into account? If that's what a scan of the recent literature says I think that tells us more about the academic reward structure than it does about the likely effects of climate change.	Thank you for the comment. The author team has worked to account for both costs and benefits of climate change, as reflected in the scientific literature. For example, some regions and sectors depicted in Figure 19.1 are projected to experience benefits (negative damages) from warming. We believe that conveying both positive and negative impacts is essential to conveying the overall risks of climate change to the United States economy.
Ross	McKitrick	Text Region	19. Economics		13	13	3	8	Barrage (2021) appears not to be in the peer-reviewed literature. The entry in the reference list is just a title.	Thank you, the reference has been fixed.
Juanita	Constible	Text Region	19. Economics		13	13	3	8	Healthcare costs shouldered by patients should also be mentioned, in addition to the costs of climate change on healthcare provision. See: 1. Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2019). Estimating the Health?Related Costs of 10 Climate?Sensitive U.S. Events During 2012. GeoHealth, 3(9), 245--265. https://doi.org/10.1029/2019GH000202; 2. Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2020). Estimating The Costs Of Inaction And The Economic Benefits Of Addressing The Health Harms Of Climate Change. Health Affairs, 39(12), 2098--2104. https://doi.org/10.1377/hlthaff.2020.01109; 3. Limaye, V. S. (2022). Reducing the inequitable health and financial burdens of climate change. One Earth, 5(4), 320--323. https://doi.org/10.1016/j.oneear.2022.03.016	Thank you for the comment. The text has been modified to now include "The direct health impacts of climate change are expected to generate higher medical costs, raising... out-of-pocket spending," with a citation to the Limaye et al. (2019) study you mention.
Juanita	Constible	Text Region	19. Economics		13	13	9	15	How medical costs burden different patient populations differently should be discussed, as this distinction has key equity implications given current gaps in healthcare coverage across the US. See: 1. Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2019). Estimating the Health?Related Costs of 10 Climate?Sensitive U.S. Events During 2012. GeoHealth, 3(9), 245--265. https://doi.org/10.1029/2019GH000202; 2. Limaye, V. S., Max, W., Constible, J., & Knowlton, K. (2020). Estimating The Costs Of Inaction And The Economic Benefits Of Addressing The Health Harms Of Climate Change. Health Affairs, 39(12), 2098--2104. https://doi.org/10.1377/hlthaff.2020.01109; 3. Limaye, V. S. (2022). Reducing the inequitable health and financial burdens of climate change. One Earth, 5(4), 320--323. https://doi.org/10.1016/j.oneear.2022.03.016	The welfare impact and incidence of costs, attributable to gaps in healthcare coverage, are beyond the scope of this chapter.
Ariela	Zycherman	Text Region	19. Economics		13	13	16	16	"Essential infrastructure": Could add a sentence about how infrastructure has historically promoted inequality, and climate change may make this worse, e.g., https://www.pnas.org/doi/10.1073/pnas.2119890119 , or the work of Daniel Armanios (Carnegie Mellon).	A discussion of the origin of existing infrastructure distributions and spatial distribution of pre-existing inequality is beyond the mandate of this chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Ariela	Zycherman	Text Region	19. Economics		15	15	32	32	delete "gains". Redundant.	"Gains" is correct. These are income reductions relative to a counterfactual, but not necessarily reductions in abosolute levels, as would indicated by removing the word "gains".
Ariela	Zycherman	Text Region	19. Economics		17	17	5	5	may want to define "investment schedule" (jargon)	Text has been changed to simply say "investments".
Ariela	Zycherman	Text Region	19. Economics		17	17	16	16	"develop adaptation plans". What about mitigation plans? Where is the economics of mitigation to compliment the adaptation discussion? Seems like an important discussion to omit. e.g., carbon tax, cap and trade, just transitions, border adjustment, loss and damages to rural and Native communities in the US, etc.	The economics of mitigation are beyond the scope of this chapter. We have now added text to the Introduction to explicitly explain this.
Ariela	Zycherman	Text Region	19. Economics		17	17	32	32	you need a period after "Fried 2021)".	This edit has been implemented.
Debra	Freeman	Whole Page	19. Economics		18				19-18 Line 20, ‚Äúmisalignment between current prices and expected effects of climate change,Äù needs more than communication to market actors to be fixed. Can you change the conditions that got them so out of whack? Consumers need legislation and enforcement, due to misaligned interests, micro-access, macro-subsidies, and unbalanced costs of right-sizing. If oil companies knew about climate effects 50 years ago and they haven‚Äôt diversified into cleaner energy sources yet, telling them again seems like it will be less effective than increased regulation, right-sized carbon pricing, right-sized valuation of current human life and future health (maybe you should up the valuation of a statistical human life beyond $10 million by a factor of 3-5, or push back on upmarket conditions? In practice, very few people have $10 million to ensure or enforce that downmarket, after the fact). Thank you for asking the questions and making your work transparent; it is a wonderful change. I hope you will introduce the feedback loops between macro-economic policy and micro-economic choices mentioned in chapter 18 to allow consumer options better aligned with scientific objectives.	Thank you for this comment. We are unable to make policy recommendations. The mandate of the NCA to summarize and synthesize the state of scientific research on this topic, without making policy recommendations.
Kevin	Schwarzwald	Text Region	19. Economics		19	19	21	26	Because the relationships between climate variables and societal impacts are complex and nonlinear, for a given lead time, the sources of the largest future uncertainties in the socioeconomic impacts of climate change may not be the same as the sources of the largest future uncertainties in underlying climate variables. In Chapter 19.1, the NCA5 draft correctly emphasizes the dominance of ‚Äòscenario uncertainty,Äô or ‚Äòthe trajectory of future emissions,Äô, in long-term projections of the impacts of climate change, based on the dominance of scenario uncertainty in projections of future climate distributions over the uncertainty from the range of climate models outputs (‚Äòmodel uncertainty,Äô) or from the irreducible internal variability in the climate system. ref 1. (cited below) shows that, given the complex relationships between climate and society, the dominant sources of uncertainty in projections of the impacts of climate change may be different from those in underlying climate distributions, because of the shape of the relationship between climate and a socioeconomic variable of interest or the geographic distribution of affected populations. Though long-term changes in climate vulnerability are undoubtedly most dependent on scenario uncertainty, for a given timescale of a certain policy or economic decision, model or internal uncertainty may have a larger impact on the true range of future outcomes. Perhaps it would be informative for the NCA5 to here (or perhaps more fittingly in Chapter 31 - we posted a similar comment there as well) mention that for a given socioeconomic impact of climate change, the balance of the three primary sources of climate uncertainty (scenario, model, and internal) may be different than that same balance for the climate variables that drive that impact. References: ref 1. Schwarzwald, Kevin, and Nathan Lenssen. 2022. ‚ÄúThe Importance of Internal Climate Variability in Climate Impact Projections.‚Äù Proceedings of the National Academy of Sciences 119 (42): e2208095119. https://doi.org/10.1073/pnas.2208095119.	We have coordinated with Chapter 31 and other chapters on this issue. Most directly, we note that Key Message 2.3 of Chapter 2 directly addresses primary sources of uncertainty involved in climate projections and impacts. We agree with the scientific basis of the comment, however have not included a discussion of how uncertainty propogates through economic projections. A key reason that we have not treated this topic with greater depth is because the different sources of uncertainty, beyond policy/emissions-uncertainty, have limited policy implications and are unlikely to alter the economic decision-making of our audience. Conditional on emissions, total uncertainty is the most relevant measure for economic decision-making. The comment reflects scientifically important questions, but we view the challenge (and space requirements) of explaining them clearly to not be worth the benefits that their communication would generate for this audience.
Juanita	Constible	Figure	19. Economics		19				This figure is helpful to depict the topic but it is conceptual in nature; the social cost of carbon depiction and breakdown by sector does not include any quantitative information on a vertical axis. As such, the figure caption should refer to this figure as an illustrative example of how the social cost of carbon is estimated, to prevent readers from interpeting the figure incorrectly. For example, health-related costs appear to dominate within the social cost of carbon example depicted in the figure - even though that may or may not align with the share of health damages within current social cost of carbon estimates.	To prevent confusion, the caption now states "This figure is a graphical depiction of how the social cost of greenhouse gases is computed, but the illustrative values shown here may differ from estimates used for regulatory purposes."
Ariela	Zycherman	Text Region	19. Economics		25	26	1	18	Overall, there can be much more said about the economic vulnerabilities of those in low-income communities or other hisitorically disenfranchised communities in this section.	Thank you for your comment. We have expanded the "Economic Vulnerability and Inequality" subsection under KM 19.1 to address this valuable point, including mentioning research gaps on this important topic.
Bilal	Ayyub	Whole Chapter	19. Economics						Assessing the impacts of a changing climate requires a system of systems modeling methods including physical, cyber, human, social, monetary, etc. systems. The projection timelines and resolutions differ among them. Establishing the causal coupling and capturing its multi-directionality are great challenges. The interactions are not well understood. Should the pursuit in this area be conditional in the context regions, climate hazards, economy nature/capacity, etc. What are the appropriate distinctions to consider in this case? The chapter reads like a product of a brainstorming sessions that produced great ideas and insights, but lack an appropriate and thoughtful order... can it be enhanced? It might help to start with defining "economics as a notion" and its underlying dimensions including sectors. Then assess these impacts along these dimensions. Should economic input-output thinking be used? Should the pursuit including both adverse and favorable impacts?	We thank the reviewer for the comment, which raises many important considerations in the study of the economic impacts of climate change. Indeed, many of the issues and tools the commenter raises, such as systems modeling, timelines, causality, input-output linkages, and heterogeneity in impacts are discussed in detail in the academic literatures underpinning our chapter. Due to space constraints, we highlight these where most important and direct the commenter to the references for further details. Similarly, a discussion of "economics as a notion" is beyond the scope of our chapter.
George	Kling	Whole Chapter	19. Economics						The main problem with this chapter is that there is no mention of the impacts of climate change on the subsistence economy. Indeed, the word ?subsistence? is nowhere in the chapter, and the overall treatment of the topic is entirely a ?western? economy focus, even though it does at least take into account indirect economic effects such as through ecosystem disruption and health impacts. There is a brief section on Indigenous economies in the Tribes and Indigenous Peoples Chapter 16, p. 7 lines 15-30, and this should at a minimum be cross-referenced to the Economics chapter. There also appears to be no mention of a subsistence economy in the chapter on Alaska.	We appreciate the reviewer's comment and note that it has identified a broader shortcoming of the scientific research literature. We believe that this represents an important area for future work. To the extent that 'subsistence economies' refers in the United States and its territories to Indigenous, Native, and Tribal economies, we have pointed readers to Ch. 16 and 29, and referenced impacts to Alaskan Natives' displacement due to climate change as well as Tribal governments' efforts to prepare for climate change. We would like to note that Ch. 29 discusses subsistence activities extensively. In our chapter, we note in Table 19.1, panel (c), that subsitence activities are an important impact which is difficult to quantify.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Ariela	Zycherman	Whole Chapter	19. Economics						There is research that shows important inequities in the economic impacts of disasters on individuals and households and in relief programs that is not included in this chapter. Some highlights: Disaster losses and impacts on property values hinder inter-generational wealth building (Mehta et al. 2020) for non-White individuals, who are more at risk of losing wealth as a result of hazard damages than White households (Howell and Elliot 2019). The existing inequitable distribution of wealth among racial and ethnic groups also means that property damage from disasters has a greater impact on some, particularly African American families whose median wealth in the United States is $11,000, compared with $141,900 for White Americans (Howell and Elliot 2019). Disasters and relief programs can present economic opportunities such as low-interest loans but the most benefit accrues to those who already have resources and higher education levels, while those with less wealth and education are at a disadvantage trying to recover (Howell and Elliot 2019). Renters are often slower to return and at greater risk of displacement after a flooding disaster due to increased rents and slower rebuilding times for affordable housing. Renters also tend to receive less post-disaster assistance, which has a greater impact on lower income households and racial groups that are more likely to be renters (Mehta et al. 2020). Relief funding programs for households and individuals such as FEMA's Individual Assistance, SBA home loans and National Flood Insurance Program have caps on the amount of assistance and in some cases limit eligibility based on income, which helps direct funding to lower and moderate-income households. However, since payments tend to be based on the value of property lost or damaged, lower-income households and renters receive less funding from these programs (Emrich et al. 2018). Relief programs also have barriers to accessing funding such as language barriers and credit requirements for SBA home loans (Emrich et al. 2018). Emrich, C.T., Tate, E., Larson, S.E., Zhou, Y. Measuring social equity in flood recovery funding. Environmental Hazards, https://doi.org/10.1080/17477891.2019.1675578 (2018). Howell, J., & Elliott, J.R. Damages Done: The Longitudinal Impacts of Natural Hazards on Wealth Inequality in the United States. Social Problems, 66, 448–467 https://doi.org/10.1093/socpro/spx045	Thank you for these suggestions. We have added citations to Mehta et al. (2020), Howell and Elliot (2019), and Emrich et al. (2020) to our chapter.
Ariela	Zycherman	Whole Chapter	19. Economics						Research on cascading impacts shows that workforce availability is a key factor in system resilience or failure during a disaster. It's page 105 here https://assets-us-01.kc-usercontent.com/0234f496-d2b7-00b6-17a4-b43e949b70a2/5a0e0a91-02b5-4e90-995f-c47440c73001/LA-County-Climate-Vulnerability-Assessment-1.pdf	Thank you for the comment. Cascading impacts are discussed in Chapter 18, (Complex systems), and are not within the scope of this chapter.
Debra	Freeman	Whole Chapter	19. Economics						Thank you for asking the questions and making your work transparent; that is already a good change. Although this section can be the most powerful driver, as a non-expert, I had expected to see more specific recommendations to overcome known obstacles of the last decades. Since this is a federal government document, I am grateful to the reference to chapter 18 and look forward to actionable insights, eg, recommendations for federal regulation and federal budget. As a non-expert, my comments are on the micro-economic level of wondering why such deep misalignments of pricing still exist based on climate cost ($1 burger, $5 head of lettuce). If it is because of macro inequalities of Valuating current human life and future health, or subsidizing or regulating problematic entities, then the included recommended changes of more communication to the responsible actors don't seem sufficient. You are the experts who know how to balance macro-economic drivers with diminished micro-economic choices.	Thank you for this comment. We are unable to make policy recommendations. The mandate of the NCA to summarize and synthesize the state of scientific research on this topic without making policy recommendations.
Charles	Hunt	Whole Chapter	19. Economics						The economy is too important to American Citizens and businesses to place this chapter this far into the report. It is telling that generations of politicians have taken up some version of "it's the economy stupid". Moving this to chapter 3 along with significant revisions to make the impacts on the economy clear (and I suspect completely unacceptable to Americans and perhaps more to the point their representatives) would make the report more impactful and useful to policy makers across the country.	We appreciate this comment. As authors, we are unable to influence the ordering of chapters.
Charles	Hunt	Whole Chapter	19. Economics						The chapter needs to include a series of projections of the impacts to the US Economy through 2050 (and ideally through 2100) based on a statistically significant number of economic model simulations for each of two or three climate models. The analysis needs to clearly describe the methods used, the assumptions, and like climate models include both the median projections and the ranges to make the level of uncertainty clear. I recommend using year by year climate model results (not just the medians) as input to the economic models to develop over all projections that include the expected impacts for each of the impact types included in Table 19.1 under each of the climate models. There is a pressing need for a better understanding of the economic impacts and the general statements in the chapter, while vastly superior to the the treatment of the economy in the NCA3 do not meet the need. Economic projections for even the next few quarters is challenging but even with significant ranges of projections the information would be essential to policy makers. Ideally, the projections would be made at the state level, aggregated to the regions covered in the report, and summarized nationally. The mandate for the NCA seems to require such diligence. If this cannot be done by the time the report must be published, it should be a recommendation for follow on analysis.	Thank you for this comment. The proposed analysis is beyond the scope of this chapter.
Ariela	Zycherman	Text Region	20. Social Systems and Justice		3	3	36	36	With regard to "overburdened communities," Executive Order 13985 has a similar term for people who live on the margins. Can we reference the E.O.? Prefer "overburdened communities". It is more a question of consistency in terminology.	Executive Order 13895 defines underserved communities. We have chosen to use the term overburdened here because it captures the burdens caused both by systemic oppression and by the impacts of climate change. Both terms have valuable use, but indicate slightly different things. The report glossary provides definitions of terms.
Marcy	Rockman	Figure	20. Social Systems and Justice		4				In circle titled "Recognition" - suggest that the word "essential" might work better than "imperative" here.	We have made this change.
Ariela	Zycherman	Text Region	20. Social Systems and Justice		5	5	1	1	Whereas the titles for the other Key Messages summarize the gist of the message, the title for this first Key Message seems incomplete. Perhaps revise to "Social Context Influences How People Know and Think About Climate Change	We have revised this key message.
Brittany	Gutermuth	Text Region	20. Social Systems and Justice		5	5	2	3	addition ‚Äúexposure to climate change education‚Äù	We have added language in KM2 that addresses education.
kottie	christie-blick	Text Region	20. Social Systems and Justice		5	5	9	10	The ways in which people understand, think about, and respond to climate change also depends on the science education they receive in school. As today's students learn about Earth's systems, they develop a better understanding of climate change and what must be done to change our current trajectory. The Next Generation Science Standards were designed to aid Americans to become more scientifically literate. To date, 44 states have science standards influenced by NGSS or the Framework for K-12 Science Education, which emphasize human impact on Earth's systems. https://www.nextgenscience.org/search/node/Earth%20and%20Human%20Activity https://ngss.nsta.org/about.aspxhttps://ngss.nsta.org/about.aspx	We have added language that shows how education can impact understanding of climate, including K-12 education. Analyzing the impacts of, or advocating for, NGSS is beyond the scope of our chapter.
Brittany	Gutermuth	Text Region	20. Social Systems and Justice		5	5	9	10	addition ‚Äúexposure to climate change education‚Äù	We have added language in KM2 that addresses education.
Marcy	Rockman	Text Region	20. Social Systems and Justice		5	6	35	4	This is well said.	
Andra	Yeghoian	Whole Page	20. Social Systems and Justice		5				It would be great to see explicit reference to the role that K-12 schools can play here in regards to supporting the general publics understanding of climate change mitigation and climate change adaptation.	We have mentioned the role of K-12 education in KM2. Analyzing the impact of these educational practices is beyond the scope of our chapter and is a data gap.
Charles	Keeling	Whole Page	20. Social Systems and Justice		5				One or more references to climate change education could be appropriately added to chapter 20, pp. 5-6: "How People Know and Think About Climate Change".	We have added language in KM2 that addresses education.
Elizabeth	Wilkening	Whole Page	20. Social Systems and Justice		5				Understanding how we are working with people (preK to gray) an educating them about climate change is important. If the US does not have a uniform climate curriculum for classrooms and programs to educate the communities, then we are not going to make any progress. Education programs should start with what a person is experiencing and help make connections to the why, how, and what's next. If we don't start there, we are only going to have people fall back on disinformation and denial.	We have added language in KM2 that addresses education.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Brittany	Gutermuth	Text Region	20. Social Systems and Justice		6	6	4	4	Highlight the importance of direct climate change education in secondary education as a way to inform the public on both aspects of impacts and solutions: Climate change education needs to be part of any plan to address climate change. An informed population will be ready to face the substantial challenges climate change poses. Americans receive the bulk of their science knowledge through their secondary science education, making climate change education standards at this level imperative. State science standards that include climate change will ensure teachers have the support they need to bring meaningful climate change education to their students.	We have added language in KM2 that addresses education.
Steph	Courtney	Text Region	20. Social Systems and Justice		6	6	16	30	I'm sure all of this is written to be very precise, but I have a hard time following some of this text, specifically the "impact of growth on emissions" -- would be much easier to read even if changed to "emissions tend to increase with growth", increase faster with growth, I can't tell what kind of relationship impact is supposed to portray	We have revised the text in question, so it now refers to "relationships", rather than "impacts" (e.g., the relationship between economic growth and carbon emissions instead of the impact of economic growth on emissions). We are generally revising the chapter text for reading.
Charles	Keeling	Whole Page	20. Social Systems and Justice		6				One or more references to climate change education could be appropriately added to chapter 20, pp. 5-6: "How People Know and Think About Climate Change".	We have added language in KM2 that addresses education.
George	Kling	Text Region	20. Social Systems and Justice		7	7	34	37	This paragraph references a coalition. For the benefit of the reader, it would be useful to expand on how this coalition was structured. The authors have discussed the outcome of the coalition, but the very structure of the coalition may have played an important role in the group?s success. Structuring of collaborations across human stakeholder groups, and how that impacts the success of responding to climate change impacts, is an important piece to include in this chapter.	We have added a reference to a City of Tulsa site that provides more information on the coalition.
Elizabeth	Wilkening	Text Region	20. Social Systems and Justice		8	10	1	37	Engagement should also include the Arts to reach everyone at a visceral level. Arts are a way of educating people and connecting the head to the heart.	We agree with this comment. Recommending that climate engagement also include the arts is outside the scope of this chapter. The NCA as a whole is soliciting artists and artwork, which will be used within the NCA.
Emma	Conrad-Rooney	Text Region	20. Social Systems and Justice		8	8	10	11	For sentence "Governance before...formation of landscapes," Key Message 11.2 from the Agriculture chapter should be cited since it covers issues of food insecurity and injustice.	We are coordinating with the agriculture chapter and referencing their idscussion of food insecurity.
Steve	Roth	Text Region	20. Social Systems and Justice		8	8	10	15	This passage is misleading. The whole point of saving is that so you can weather a storm, so of course people with money are better prepared for a disaster--that's why they had the money to begin with. But these studies are generally not isolating all the factors listed in this sentence. So as long as minorities have less wealth, they are more affected.	It is true that those with less wealth have been shown to frequently be more affected, but it is also true that wealth mediates access to the resources and assistance provided. This is a separate finding and important to point out. We do not feel that this paragraph, as written is misleading.
Jim	Titus	Text Region	20. Social Systems and Justice		8	8	15	18	The statement about there being no such thing as a "natural disaster" should be cut. Of course natural disasters exist, so the statement is wrong. Rather the question is simply whether "natural disaster" is the best term for the collection of disasters that includes earthquakes, tsunamis, and weather-related disasters. Old contracts still call them "Acts of God" and one can only imagine the authors debating whether that exists. But the suggestion that governments are ignoring science by continuing to use the term reveals at best, a lack of awareness of how language evolves and an aversion to using a dictionary. The authors' argument is with Websters, not governments.	Social science research has long established that a disaster occurs at the intersection of the hazard and human social systems. This research base is cited in the chapter, and is sufficient to merit inclusing in the chapter, even if common understandings of this term are not aligned with the literature.
Ariela	Zycherman	Text Region	20. Social Systems and Justice		8	8	30	30	Consider adding " and Essential" to the title for Key Message 20-4	We have revised this key message.
George	Kling	Text Region	20. Social Systems and Justice		8	8	31	37	This Key Message 20.4 alludes to co-production of knowledge which is great to see, although it lacks depth around the topic. It is at most a weak thanks to a focus on the production of communication material, rather than the outcome of communicating about climate change. Communication certainly is important, but this section fails to move the discussion one step further to how communication influences action, decision making, and implementation of solutions. Perhaps the authors could further reference the role of collaboration and co-production in the context of not only co-producing relevant communication material for different stakeholder groups, but how the engagement of those stakeholder groups can lead to more effective solutions to climate change impacts for those groups.	Thank you for this comment. We absolutely agree with you and have added significant language in KM2 regarding coproduction.
George	Kling	Text Region	20. Social Systems and Justice		8	8	31	37	There is no discussion of building the capacity of younger generations to prepare for a climate-driven career through educational systems that are lagging behind. To support effective solutions to climate change in the Arctic, a multidisciplinary group of individuals is required. Currently, particularly in western academic institutions, students are not necessarily encouraged to (a) understand how their chosen path relates to the climate crisis, or (b) become trained in multiple disciplines and methodologies to better tackle problems facing society from more of a systems perspective. Communication, collaboration, and co-production skills in and of themselves are currently not taught as standard.	We have added language to KM 2 that addresses education; and have added language regarding multi-disciplinary and co-produced science.
Mary	James	Text Region	20. Social Systems and Justice		8	8	34	35	The use of the term 'climate change science' implies that this is a recognized branch of the sciences.	We have revised to say 'the science of climate change'
Brittany	Gutermuth	Text Region	20. Social Systems and Justice		8	8	35	36	Climate change education needs to be part of any plan to address climate change. An informed population will be ready to face the substantial challenges climate change poses.	We have added language in KM2 that addresses education.
Charles	Keeling	Whole Page	20. Social Systems and Justice		8				One or more references to climate change education could be appropriately added to chapter 20, pp. 8-10: "Engaging Diverse Stakeholders is Possible".	We have added language in KM2 that addresses education.
Lisa	Marun	Text Region	20. Social Systems and Justice		9	10	1	37	'What Is Effective Climate Change Engagement?' The challenges of climate change are such that both understanding of its magnitude and consequences, as well as having the tools to effect behavioral changes are necessary in all segments of society, and at all ages. As such climate education should be part of formal curricula, and it needs to be integrated as this is a challenge that has social, economic, political, health, and environmental effects. The 5th National Climate Assessment has surprisingly omitted the crucial role of climate education in our schools, at every grade level. We do the next generation an injustice by not giving them tools and knowledge about climate change early enough, and with continuous, layered depths of information for them to process and apply.	We have added language in KM2 that addresses education.
kottie	christie-blick	Text Region	20. Social Systems and Justice		9	9	13	23	Formal and informal educators need a strong grounding in the causes and effects of climate change, as well as mitigation and adaptation strategies, so they can teach it reliably in the classroom, or informal educational setting (zoo, nature center, camp, aquarium, etc.). Further, educators need training in how to teach climate change in an engaging way, and at an appropriate level, academically and emotionally, for their learners (elementary - high school).	We have added language that discusses how education can impact knowledge of climate. We also feel that the climate assessment itself can act as an education tool for educators and the NCA team is in discussion about derivitive products.
Ian	Quartin	Text Region	20. Social Systems and Justice		9		20	25	The Next Generation Science Standards currently only addresses climate change, the climate crisis and its social justice dimensions with almost no standards requirements: one each in high school and middle school and none at the elementary level. For an issue that will impact every aspect of life - not just the survivability of theirs and future generations but also the green economy and career paths we can prepare them to enter - there is not enough about this being taught in public schools. There needs to be additional standards at all levels of instruction, funding and curriculum support for educators to know and be trained to teach on these issues, and an honest acceptance of the scientific facts and uneven impacts that will are affecting us and will affect our children and students.	While advocacy for the Next Generations Science Standards is beyond the scope of our chapter, we have added language in KM2 that addresses education.
Olivia	Collins	Text Region	20. Social Systems and Justice		9	9	20	25	Next GenerationScience Standards NGSS does not address climate change at the elementary level and NGSS has one middle school standard addressing climate change in a cursory manner. NGSS has one high school standard addressing climate change in a cursory manner. We need standards that directly and unflinchingly address climate change at every age level. Not only can these standards be taught as part of the science curriculum, but in an effort to achieve social justice, environmental justice must be addressed. Climate change education must address this as well. If teachers are excellent messengers for climate change, they need to have the proper training to teach it to students. Including climate change as part of the required standards will motivate states to direct funding for proper training. Preparing students for the "green economy" means they also must understand why such career paths are pivotal to their community.	We have added language in KM2 that addresses education.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Charles	Keeling	Whole Page	20. Social Systems and Justice		9				One or more references to climate change education could be appropriately added to chapter 20, pp. 8-10: "Engaging Diverse Stakeholders is Possible".	We have added language in KM2 that addresses education.
Katie	Boyd	Whole Page	20. Social Systems and Justice		9				Climate education is a very important part of enacting climate solutions - education is a critical component and foundation to support a broad societal response (e.g. Bowman & Morrison, 2021; Kwauk, 2020; Otto et al., 2020; UNESCO, 2020). For example, Research studies highlight that educating secondary students on climate change topics can result in a significant reduction of individual CO2 emissions (Cordero et al., 2020). Furthermore, educating youth has been shown to increase parent awareness and parents‚Äô level of climate concerns (Lawson et al., 2019). I would encourage you to add more references and information about recommending climate education throughout the US throughout this document. Here is one place where it is particularly relevant. I think you should add a recommendation for the need for climate education and the teaching of the Next Generation Science Standards in schools throughout the United States. References: Bowman, T. & Morrison, D. (Eds.). (2021). Empowering climate action in the United States. Part of Resetting Our Future Series. Changemaker Books. Cordero, E. C., Centeno, D., & Todd, A. M. (2020). The role of climate change education on individual lifetime carbon emissions. PloS one, 15(2), e0206266. Kwauk, C. (2020). Roadblocks to Quality Education in a Time of Climate Change. Brief. Center for Universal Education at The Brookings Institution. Lawson, D. F., Stevenson, K. T., Peterson, M. N., Carrier, S. J., L Strnad, R., & Seekamp, E. (2019). Children can foster climate change concern among their parents. Nature Climate Change, 9(6), 458-462. Otto, I. M., Donges, J. F., Cremades, R., Bhowmik, A., Hewitt, R. J., Lucht, W., ... & Schellnhuber, H. J. (2020). Social tipping dynamics for stabilizing Earth‚Äôs climate by 2050. Proceedings of the National Academy of Sciences, 117(5), 2354-2365. United Nations Educational, Scientific and Cultural Organization (UNESCO). (2020). Education for Sustainable Development: A Roadmap.	We have added the Lawson reference and language regarding education. Recommending climate education and NGSS it outside the scope of this report.
Mia	Cavaco	Whole Page	20. Social Systems and Justice		9				Next GenerationScience Standards NGSS does not address climate change at the elementary level. NGSS has one middle school standard addressing climate change in a cursory manner. NGSS has one high school standard addressing climate change in a cursory manner. We need standards that directly and unflinchingly address climate change at every age level. Not only can these standards be taught as part of the science curriculum, but in an effort to achieve social justice, environmental justice must be addressed. Climate change education must address this as well. If teachers are excellent messengers for climate change, they need to have the proper training to teach it to students. Including climate change as part of the required standards will motivate states to direct funding for proper training. Preparing students for the "green economy" means they also must understand why such career paths are pivotal to their community.	We have added language in KM2 that addresses education.
Ariela	Zycherman	Figure	20. Social Systems and Justice		9				The first step really ought to be identifying the stakeholders. Projects that co-develop the objectives and benchmarks with the intended audience will be more successful in the long term because those objectives and benchmarks are based on what the community actually needs versus perceptions of their need.	We agree that the process is more iterative than was originally depicted and have updated the figure to better reflect the interactive nature of the process
Steve	Roth	Text Region	20. Social Systems and Justice		10		2		This author is right that Liberals talk about climate change more Climate change is becoming a talisman for some liberals (like stolen election for some of my friends). The author seems to want to talk to different people based on the concerns of those people rather than by telling us what to think. I can't argue wit that. But why then is this entire report mostly written for a Liberal reader?	We are adding language that reaches broad audiences.
Diego	Molina-Castrillon	Text Region	20. Social Systems and Justice		10	10	20	25	If teachers are trusted messengers to communicate to the community about climate change, we must make sure that across the country, teachers are properly trained to educate the youth on climate change. For this, we need to set clear cut standards at the federal level ensuring that every student, regardless of age learn about climate change in an age appropriate manner, that is also relevant to the geographical and social context of each region.	We have added language in KM2 that addresses education. Recommending federal standards for education is outside the scope of this chapter.
Ariela	Zycherman	Text Region	20. Social Systems and Justice		10	10	28	31	Great resource for a living Lit Review on Communicating Probability Information: https://crcm.shinyapps.io/probcom/	Thank you for providing this resource; we believe the section is adequately referenced but agree this is a potentially useful resource
Charles	Keeling	Whole Page	20. Social Systems and Justice		10				One or more references to climate change education could be appropriately added to chapter 20, pp. 8-10: "Engaging Diverse Stakeholders is Possible".	We have added language in KM2 that addresses education.
Christy	Folk	Whole Page	20. Social Systems and Justice		10				The section on Effective Climate Change Engagement fails to address the importance of climate education for younger audiences, particularly school-aged children. Climate change education is largely left out of the curriculum due to the omission of such topics from Next Generation Science Standards. To give an overview, the current standards do not address climate change at the elementary level and include only one standard addressing climate change in a cursory manner for middle school and high school. The draft assessment includes the topic of using trusted messengers, specifically teachers and peers, as a way to increase the acceptance of information related to climate change. The solution is to include Next Generation Science Standards that directly address climate change at every age level, and not only as part of science curricula, but in other subjects such as social studies, given the far-reaching implications of climate change in terms of environmental and social justice issues. Teachers need to have the proper training and preparation to teach topics such as climate change to students. Including climate change topics in required standards will lead school systems to prioritize and fund adequate education and engagement with the topic. In addition, students will acquire knowledge on the career opportunities available to them in the green economy that will benefit their communities and prepare them to enter the workforce with an understanding of the problems that the climate crisis presents to society. Therefore, climate education in schools cannot be overlooked in the process of effective climate change engagement, and the need for Next Generation Science Standards to more robustly include climate change should be addressed in this National Climate Assessment.	We have added language in KM2 that addresses education.
Steve	Roth	Text Region	20. Social Systems and Justice		11	11	1	26	I guess Liberals don't like to talk about the big elephant in the room when it comes to migration, but you should. We can't even control our borders now. What happens when climate change causes even more people to flee to USA?	We are adding language concerning internal and international migration.
George	Kling	Text Region	20. Social Systems and Justice		11	12	3	15	This section lacks a discussion about the intricacies of what qualifies for disaster relief and support. Climate change in and of itself has historically not been sufficient to qualify Alaskan communities for disaster aid due to, for example, its slower time frame than a hurricane. While progress has been made, these barriers still exist and could be mentioned.	We have added more language about inequitable disaster impacts, including access to risk reduction policies and programs.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Marcy	Rockman	Text Region	20. Social Systems and Justice		11	11	10	14	I suggest adding "yet" to the first sentence of this paragraph or the concept elsewhere In this paragraph. Work by A. R. Siders and Katharine Mach speak to the need to plan for managed retreat and the social implications of doing so (or not doing so). References for these points include Siders 2018, https://doi.org/10.1007/s10584-018-2272-5; Mach and Siders 2021, https://doi.org/10.1126/science.abh1894, and Siders et al 2019, https://www.researchgate.net/profile/Ar-Siders/publication/335597267_The_case_for_strategic_and_managed_climate_retreat/links/5eb1e097a6fdcc7050ad569e/The-case-for-strategic-and-managed-climate-retreat.pdf. Also concerned this is not capturing the impacts of disaster displacement and the state of US planning for it, such as the 2018 Camp Fire in CA, reference Spearing and Faust 2020, https://doi.org/10.1016/j.ijdrr.2020.101822.	We have added language in KM3 that addresses this concern.
Marcy	Rockman	Text Region	20. Social Systems and Justice		12	12	4	15	Recommend incorporating here findings that current US federal structure for home buyouts exacerbates inequality, particularly racial inequality, reference Elliott et al 2020, DttOpsI://1d0o.i1.o1r7g/71/02.1317870/2337182020391025049305 9439, and Loughran and Elliott 2021, https://doi.org/10.1080/10511482.2021.1931928. Elliott pointed out to me in personal communication that, as described in the 2021 article, as federal policy is directed at the mortgage value of individual properties and not human connections to place and community, those with greater social and economic capital who accept buyouts use those forms of capital to maintain these connections, while those with less social and economic capital are less able or cannot do so and so lose those connections.	We have added multiple references to buyouts and are providing two complex case studies.
Alysse	Moldawer	Figure	20. Social Systems and Justice		13	13	1	2	Figure 20.3. Drivers of Migration is a little confusing for me. I see on page 11, line 11, an introduction of the Figure, and then what reads as a discussion on how unjust migration might work. This paragraph on page 11 does not help me understand the layers of circles in the figure though. It is the layers of circles that I am unclear on. I take away from the figure that "Just Transitions" are possible outcomes, and that "Drivers of Inequity" are possible outcomes, and the Figure defines those outcomes respectively in a clear way with the bullet-points. I cannot tell though if the layers of the circles suggest directionality: for example Does epistemology need to shift before governance? Then governance needs to change before human drivers? And the middle circle, is "Environmentally informed migration" the outcome that is either "Just" or "Driver of Inequity"? I think either more explanation of how the figure is to be read, or if each circle can interact with any other circle, as opposed to a linear progression of outer circle to inner, the shape of the figure could change? I am not sure. In short, I understand from the chapter that these are all factors, but why they are layered like this is unclear, and if all layers represent the outcome or just the inner or outer layer. Thank you!	We are substantially editing this figure for more clarity.
George	Kling	Text Region	20. Social Systems and Justice		14	14	7	7	What is meaningful community engagement? This should be clarified within the text as historically non-community groups have performed ?community engagement? as a box ticking exercise.	We have clarified this phrase.
Emma	Conrad-Rooney	Text Region	20. Social Systems and Justice		15	15	2	6	Key messages 20.6 should be revised to follow the Risk-Based Framework.	We have revised this KM.
Ariela	Zycherman	Traceable Account	20. Social Systems and Justice		25	25	30	34	See also research by Dr. Juliana Maantay at The City University of New York: https://www.gc.cuny.edu/people/juliana-maantay	See above.
John	Rosenfield	Whole Chapter	20. Social Systems and Justice						You need 2 environmental psychologists to be added to the list of authors. They should add information to the chapter on Social Systems and Justice.	The author team includes an environmental psychologist (Markowitz).
John	Rosenfield	Whole Chapter	20. Social Systems and Justice						You need 2 environmental psychologists to be added to the list of authors. They should add information to the chapter on Mitigation.	The author team includes an environmental psychologist (Markowitz).
Zachary	Van Tol	Whole Chapter	20. Social Systems and Justice						It is well established that exposure is a key determinant of climate-related health outcomes. A multitude of variables impacts exposure times including occupation and housing status. Within the United States context, we find that Covid-19 and inflation are causing increasing amounts of unhoused and unstably-sheltered individuals, particularly in urban areas. Therefore, I find it troubling that this chapter-- centered on justice and equity-- ceases to mention this sub-population and only includes one citation with a mention of unhoused individuals. Specifically, there is an important piece to be told about the risks that present themselves when housing status, age, severe mental illness (SMI), and pre-existing physical health ailments interact with climate extremes. There is, albiet severely lacking, literature that points to the inequitable climate burdens attributed to homeless individuals, particularly with respect to heat. Some helpful literature includes: Shaw, M. (2004). Housing and public health. Annual Review of Public Health, 25, 397,Äi418. Scopus. https://doi.org/10.1146/annurev.publhealth.25.101802.123036 Saverino, K. C., Routman, E., Lookingbill, T. R., Eanes, A. M., Hoffman, J. S., & Bao, R. (2021). Thermal Inequity in Richmond, VA: The Effect of an Unjust Evolution of the Urban Landscape on Urban Heat Islands. Sustainability, 13(3), Article 3. https://doi.org/10.3390/su13031511 Longo, J., Kuras, E., Smith, H., Hondula, D., & Johnston, E. (2017). Technology Use, Exposure to Natural Hazards, and Being Digitally Invisible: Implications for Policy Analytics. Policy & Internet, 9. https://doi.org/10.1002/poi3.144 Wadhera, R. K., Choi, E., Shen, C., Yeh, R. W., & Joynt Maddox, K. E. (2019). Trends, Causes, and Outcomes of Hospitalizations for Homeless Individuals. Medical Care, 57(1), 21,Äi27. https://doi.org/10.1097/MLR.0000000000001015 Cusack, L., Loon, A. van, Kralik, D., Arbon, P., Gilbert, S., Cusack, L., Loon, A. van, Kralik, D., Arbon, P., & Gilbert, S. (2013). Extreme weather-related health needs of people who are homeless. Australian Journal of Primary Health, 19(3), 250,Äi255. https://doi.org/10.1071/PY12048	We are adding these citations to the chapter and a sentence that discusses impacts on the unhoused.
Glenn	Branch	Whole Chapter	20. Social Systems and Justice						Since this chapter is about social systems, it would benefit from the addition of further material about one of the most important social systems relevant to acceptance of and action on climate change: education. With regard to the key messages under both "How People Know and Think About Climate Change" and "Engaging Diverse Stakeholders," for example, it would be appropriate to discuss the current state and future needs of education and outreach efforts on climate change. It would be best, however, for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change, and one possibility might be to add a section to this chapter to do so.	We have added language in KM2 that addresses education.
Jennifer	Jones	Whole Chapter	20. Social Systems and Justice						A key recommendation to include is for all levels of government and school districts to require Climate Literacy education as part of standard-based education aligned to state standards for K-12 students.	Recommending an educational program is beyond the scope of this report, but we have added language about education in multiple parts of our chapter.
Sam	Davis	Whole Chapter	20. Social Systems and Justice						I would have liked to have seen a case study (Box) on the environmental justice implications of the bioenergy sector in the US Southeast. See: Koester & Davis (2018) Siting of Wood Pellet Production Facilities in Environmental Justice Communities in the Southeastern United States. Environmental Justice 11(2)	Thank you for this comment. This case study is beyond our scope for the chapter, but we will forward the suggestion to the Southeast Chapter.
George	Kling	Whole Chapter	20. Social Systems and Justice						There is no mention of the Arctic in this chapter, even though the human experiences of climate change are distinctly different in the Arctic compared to the rest of the continental U.S. In fact, the chapter lacked any discussion of how the U.S. experiences incredibly diverse climate and weather events as compared to many other nations. There is a chapter dedicated to Alaska, but given that policymakers (presumably the focus audience of this publication?) are unlikely to read it all, it would make sense to highlight if not the Arctic specifically, at least the diversity in climate change pressures to human systems across the U.S.	We have added reference to the Arctic and cited relevant research in the Arctic.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
George	Kling	Whole Chapter	20. Social Systems and Justice						In the introduction, ?overburdened populations? is defined. However, the chapter goes on to use phrases such as ?vulnerable? and ?disadvantaged? populations without adequate definitions. It would be more useful to include specific definitions if these other terms are distinctly separate to ?overburdened populations? or maintain consistency by only using the phrases which have been defined or described to a degree.	We have revisited all of these terms and edited for consistency and preciseness when discussing people and communities.
Joe	Witte	Whole Chapter	20. Social Systems and Justice						RE: Key Message 20.1. How People Know and Think About Climate Change Hopefully USGCRP will include the critical role that education, both formal and informal, plays in developing the knowledge needed for a functioning democracy for all about Earth Systems. Voters need to have critical thinking skills in order for the United States of America to advance in the rapidly changing economic world in order to be leaders for the world. INFORMAL EDUCATION and FORMAL EDUCATION. Thank you.	We have added language in KM2 that addresses education.
Jim	Titus	Whole Chapter	20. Social Systems and Justice						Someone should carefully scrub this chapter of tangential commentary that represent a point of view that is not well-established and could undermine efforts for the legitimate points to be accepted. For example, it is not helpful to suggest that CO2 emissions were largely caused by slavery and colonialism rather than industrialization. The NCA does not need to become the 1619 Project of climate change, and one could just as easily argue that industrialization was incompatible with slavery and even the end of colonialization. But why go there?	Thank you for this comment. We appreciate the insight that the chapter should not make claims that lack establishment in appropriate literature or knowledge bases. We have reviewed the document and are removing any information that does not have a strong literature base.
Marcy	Rockman	Whole Chapter	20. Social Systems and Justice						Noting there is little mention of cultural heritage as part of social systems in this chapter and how it shapes social responses to climate change, or where lack of policy attention to heritage can in turn shape responses such as decisions to move or not to move. One reference on this topic is Siders and Rockman 2022, https://www.arch.columbia.edu/books/reader/826-preservation-sustainability-and-equity#reader-anchor-1.	We are adding a case study of migration that confronts issues of cultural heritage as a motivating factor to stay in place.
Nadia	Gronkowski	Whole Chapter	20. Social Systems and Justice						The Early Years Climate Action Task Force applauds the NCA5 authors for including children consistently throughout as a population that will disproportionately bear the impacts of climate change. Including this framing in impacts that are often associated with children and families -- such as food insecurity, access to clean water, etc. -- and in less obvious or immediate effects of climate change -- such as conflict, energy insecurity, and pathogens ,Äì will support climate and early childhood advocates in preparing for the many diverse needs of children and families in the years to come. Suggestions for Improvement: The Task Force encourages the authors to elevate the young children (prenatal to 8), their caregivers and families as a key population and a fundamental issue in Climate Science and Policy. There is extensive (and growing) evidence that this segment of the population is exceptionally vulnerable to climate disruptions, emergencies and disasters. Climate change not only endangers life in the early years, but lacking appropriate attention and support, the damage incurred in the early years carries over and accrues over the full lifespan of an individual. In this sense, climate policy and programs that are sensitive/centered on the early years are a great investment that provides support in the present and yields resilience over the long term. The Task Force also recommends naming ‚Äúinfants and children‚Äù throughout the report and generally increasing the information presented about the impacts of climate change and climate emergencies on our nation‚Äôs youngest citizens. The younger a child is, the more susceptible they are to many of the negative impacts of climate change, meaning that infants are at high risk; furthermore, infants have unique needs in the context of disaster preparedness and community resources that must be considered as the nation plans for climate resiliency. The Task Force appreciates the authors‚Äô many mentions of pregnant people, and encourages them to consider expanding this to include ‚Äúpregnant and lactating people.‚Äù Lactation is not only key to healthy infant development, but presents an important strategy for infant food security in climate emergencies.	Thank you for this comment. While we recognize the vulnerabilities that may accompany the health of children and families, the disaster literature does not provide enough of a literature base to speciffically focus on families as experiencing an inequitable distribution of harm. We willl convene with the chapter on Health and let them summarize any disparate impacts on health for these populations that should be addressed according to the literature.
Jane	Heinze-Fry	Whole Chapter	20. Social Systems and Justice						It is future generations who will face, and thus need to be equipped with the knowledge and skills to cope with the challenges of climate change. Thus, climate education is a critical component of any plan for responding to climate change. The draft NCA does not adequately address climate change education as a primary tool in addressing the impacts of climate change. Evidence indicates that current public education addressing climate change is inadequate to the need and must do better. Students and teachers need to be better educated about climate science and systems. This chapter with its emphasis on how and why we think about climate change the way we do is the perfect place to introduce education as a primary tool. Think narrow. Think broad. For a narrow perspective of a science teacher, the most effective way to improve climate change instruction in the public schools (where most of us learn the bulk of our science) is to improve the state climate change science standards and ensure that teachers are prepared to teach in accordance with the improved standards. The Next Generation Science standards are a good place to start, but even they can be improved. Climate change impacts play out within social systems. A transformative action would be to integrate climate change across the curriculum (New Jersey provides one such model.) Then give teachers continued professional education on climate change through workshops and conferences, as well as up-to-date resources and easily accessible studies on the subject. Conclusion? The purpose of public education is to prepare today‚Äôs students to thrive in tomorrow‚Äôs world. They need to be armed with knowledge of the climate and social systems within which they live and the strategies they can deploy within those systems to make them better. If state science standards do not recognize that climate change is real, caused by human activity, serious, and soluble, they are not fit for this purpose. Students and the rest of society deserve better. The National Climate Assessment needs to shine a light on the importance of broad public climate education to assure the public‚Äôs resilience to climate change challenges.	We have added language in KM2 that addresses education.
Missy	Holzer	Whole Chapter	20. Social Systems and Justice						Consideration to connect with pages 9-10: Since this chapter is about social systems, it would benefit from the addition of further material about one of the most important social systems relevant to acceptance of and action on climate change: education. With regard to the key messages under both "How People Know and Think About Climate Change" and "Engaging Diverse Stakeholders," for example, it would be appropriate to discuss the current state and future needs of education and outreach efforts on climate change. It would be best, however, for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change, and one possibility might be to add a section to this chapter to do so.	We have added language in KM2 that addresses education.
Ariela	Zycherman	Whole Chapter	20. Social Systems and Justice						Active voice would make the chapter more engaging to read	We are rewriting large parts of the chapter for engagement and active voice.
Steph	Courtney	Whole Chapter	20. Social Systems and Justice						I appreciate the use of this environmental justice framework in Fig 1, but it might be helpful to reconcile or compare this framework to the justice framework used in other chapters (overview and a few others), at least since they're so similar. Now I see the other framework is mentioned on page 15, but they use different terms, this is confusing and needs to be explained	We are changing some of the language in the figure to be more consistent with other chapters.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Steph	Courtney	Whole Chapter	20. Social Systems and Justice						I know the whole report is getting many comments to this effect, but I'd like to add my own comments -- I think there needs to be a lot more content about community engagement, beyond natural resource managers/owners. K12 education and workforce training/development are critical components of successful societal shifts; public education is absolutely required for the self-determination of all peoples and, therefore, justice. I appreciate the mentions, and I'm in a time crunch so I may have missed some content, but this is a critical component of our way forward. Communication is a means to an end, sure, but it happens in every single social system described in this chapter, and is critical to the function and success of all of them.	We have added language in KM2 on community engagement.
Casey	Thornbrugh	Text Region	21. Northeast		3	3	6	6	Capitalize "Tribal Nations."	Thank you for your comment. "Tribal Nations" is now capitalized. Authors have also revised the sentence to say "The Northeast is the homeland of Indigenous peoples, including 18 federally recognized Tribal Nations and many Indigenous communities.
Casey	Thornbrugh	Text Region	21. Northeast		3	3	6	6	What about Tribal Nations forcibly removed from the homelands in the northeast now in Oklahoma, the Midwest or other locations, but with continued cultural ties to the Northeast?	Thank you for your comment. Following the language from Chapter 16, Tribes and Indigenous Peoples, the authors revised the sentence to state, "The Northeast is the homeland of 18 Federally recognized Tribal Nations, and many Indigenous peoples both within the region and who were removed from their lands in the Northeast and relocated to other regions of the United States."
Nick	Procopio	Text Region	21. Northeast		3	3	12	12	New Jersey is conspicuously absent from the Introduction. Recommend mentioning the ¬ìNew Jersey Shore" at line 12: ¬ìSeasonal tourism tied 12 to outdoor recreation is particularly important, with summer tourism in coastal communities like the New Jersey shore,¬Ó"	The authors appreciate this comment, but declined to adopt the suggestion because of the prevalence of dependence upon seasonal coastal tourism applies from Maryland to Maine. In this case the authors decided to not name any particular states to preserve word count.
Casey	Thornbrugh	Text Region	21. Northeast		4	4	6	6	Capitalize "Tribal Nations."	Thank you for your comment. "Tribal Nations" is now capitalized.
Casey	Thornbrugh	Text Region	21. Northeast		4	4	11	17	Key message 1 (the title/headline) is somewhat confusing to me ‚Äì I don‚Äôt know without context who the responses are from or what they‚Äôre responding to (and Fig 1a, though the context helps). After reading the section, I think it means adaptation and mitigation plans and actions from all different governing bodies across the region, which is very broad, but perhaps there‚Äôs another way to phrase it. I see now that this type of phrasing is also the theme of the KM‚Äôs‚Ä¶ anyway, something to think on if other folks bring it up.	Based on this feedback, we have changed the key message title to: "Chronic Impacts of Extreme Weather are Influencing Adaptation and Mitigation Efforts".
Casey	Thornbrugh	Text Region	21. Northeast		4	4	23	25	Do we know how far inland flooding impacts were recorded?	Thank you for your comment. These references do not reference flooding impacts. However, the conclusions regarding coincidance of extreme precipitation with the Atlantic hurricane season were based on precipitation observations gathered from Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New Jersey, New York, Pennsylvania, Maryland, Delaware, West Virginia, and Washington DC. The text has been modified to clarify the geographic scale of the observations used in this research.
Thomas	Knutson	Text Region	21. Northeast		4		27		Add here that: "An anthropogenic influence on summertime WBGT has been detected over eastern North America (Li et al. 2017) and over much of the northeast U.S. region (Knutson and Ploshay 2016), based on increasing trends over 1973-2012; WBGT trends were more detectable than temperature trends alone. Large increases of summer WBGT are projected for the coming century for the eastern North America region (Li et al. 2017)." (See Fig. 5a of Knutson and Ploshay 2016, supported by attributable human influence on WBGT over eastern North America in Li et al. 2017, their Fig. 4). References: Knutson, T.R., Ploshay, J.J. Detection of anthropogenic influence on a summertime heat stress index. Climatic Change 138, 25-39 (2016). https://doi.org/10.1007/s10584-016-1708-z Li, C., Zhang, X., Zwiers, F., Fang, Y. and Michalak, A.M. (2017), Recent Very Hot Summers in Northern Hemispheric Land Areas Measured by Wet Bulb Globe Temperature Will Be the Norm Within 20 Years. Earth's Future, 5: 1203-1216.	Thank you for the comment! Wet Bulb Globe Temperature (WBGT) is certainly more detectable than dry bulb temperature alone in the Northeast, largely because of the added component of radiation in the computation of WBGT. The Northeast has the largest series of Urban Heat Islands in the U.S., which influences the WBGT and gives a more accurate depiction of the apparent temperature. The study cited in the comment supports how humans can influence WBGT especially in the Northeast. The WBGT goes beyond the scope of this assessment but certainly could give greater insight to future assessments. Therefore, no changes were made at this time.
Thomas	Knutson	Text Region	21. Northeast		5		3		Here are some additional text/studies relating to tropical cyclones or annual-averaged precipitation under climate change (past or projected) that are specifically relevant to the Northeast U.S. "In terms of past precipitation changes, the mean annual precipitation has been increasing significantly over much of the northeast U.S. over the 20th century, and anthropogenic forcing has evidently contributed to this increase (Knutson and Zeng 2018), supporting the projections of further increases in the coming century (e.g., Fig. 4.3). Concerning landfalling cyclones, the modeling study of Liu et al. (2017) projects an increased occurrence of tropical cyclones undergoing extratropical transition in the eastern subtropical Atlantic, and then propagating northwest toward the northeast U.S. coast, potentially leading to an increased future risk in the Northeast of landfalling extratropically transitioned tropical cyclones. Wright et al. (2015) project increased tropical cyclone precipitation intensities over CONUS land (post-landfall). Other relevant studies exploring risk of CONUS or northeast U.S. landfalling tropical cyclones include Garner et al. (2021), Knutson et al. (2022), and Jing et al. (2021). Garner et al. (2021) project tropical cyclones to form closer to the U.S. southeast coast and to propagate more slowly along the coast in a future warming scenario. Similarly, Knutson et al. (2022) project that despite a projected reduction in basin-wide Atlantic tropical storms and hurricanes, a greater fraction of these storms will make landfall over CONUS and that basinwide intensities are projected to increase slightly. Jing et al. (2021) compare North American landfalling TC projections from three modeling approaches. They report relatively small and not statistically significant changes in landfall intensities and in the return period of various landfall intensities. An exception was a projected increase in 100-yr return level of landfall intensity for the northeastern U.S. in the HiFLOR model, though the other two modeling approaches did not support this projected change. Two studies differ on whether, where, and how much tropical cyclone propagation speeds are projected to change in the northeast U.S. coastal region (Zhang et al. 2020; Gori et al. 2022). Sea level rise is projected to increase coastal inundation risk from tropical cyclones (e.g., Gori et al. 2022). The above U.S. or North America landfalling tropical cyclone or post-tropical cyclone studies do not yield	Thank you for the comment! All of the studies cited in the public comment reinforce what we are saying and are helpful. The mean annual precipitation has been increasing in the Northeast U.S. and part of that can be attributed to landfalling tropical cyclones. Two of the most infamous tropical cyclones, Hurricane Irene (2011) and Hurricane Sandy (2012), are examples of systems suggested by the Liu et al. (2017), that the Northeast will see more in the future. However, the projections of TCs in these studies do not necessarily have a high degree of confidence due to the variance in the findings among these studies. Due to the lack of confidence, those studies were not included. Rainfall amounts and rates from landfalling TCs are largely a function of the translational speed and the physical size. The anthropogenic influence on these factors may not be detectable yet, nevertheless, extreme rainfall amounts from tropical cyclones continue to impact the Northeast. Therefore, no changes were made.
Nick	Procopio	Text Region	21. Northeast		5	5	4	6	It might be worth adding ¬ìindustrial pollutants" to this list; although this is covered on page 21-16.	The authors appreciate this comment. The authors did not add "industrial pollutants" because the context is not meant to specifically address industry, but did add "contaminated soils" to reflect broader framing.
Emma	Conrad-Rooney	Text Region	21. Northeast		5	5	31	33	The sentence "Impacts of pluvial...tidal wetlands and forests" should reference Chapter 9. Coasts.	Thank you for your comment. This sentence has been moved along with the rest of the paragraph to the KM 21.2 section of the chapter. The Coasts chapter is referenced.
Nick	Procopio	Text Region	21. Northeast		6	6	12	12	Please specify that this refers to the NJDEP's Bureau of Climate Resilience Planning.	Thank you for your comment. No change was made because this was already specified later in the same sentence.
Casey	Thornbrugh	Text Region	21. Northeast		6	6	16	20	This statement allows an opportunity to support Wabanaki Tribal sovereignty. This highlights from a climate resilience standpoint the value of the Stafford Act having applicability to Tribal Nations. Maine's Land claims settlement act does not allow the Stafford Act (post 1980) to apply to Federally Recognized Tribal Nations within Maine.	The authors appreciate this comment. The commentor raises an important barrier for Tribal Nations in accessing Federal funding particular to the state of Maine, but which applies to many other contexts nationally. The authors did not have adequate space to address the Wabanaki Tribe specifically, and this key message does not address barriers. The authors did add a sentence to Key Message 5 about public funding, "Capacity barriers exist to accessing federal funds, especially for Indigenous peoples (Chapter 16)." This cross-references to Chapter 16, Key message 16.2, documenting the barriers Indigenous peoples throughout the U.S. have experienced to accessing federal funds.
Casey	Thornbrugh	Text Region	21. Northeast		6	6	22	23	States and cities are specifically mentioned, but are there any examples of Tribal HMPs in the Northeast?	Thank you for your comment. We searched for Tribal HMPs and found Shinnecock and Seneca have plans. The Shinnecock Plan is more directly related to climate change-- both adaptation and mitigation. We included a link to this plan in our chapter.
Casey	Thornbrugh	Text Region	21. Northeast		6	6	30	30	Many Tribal Nations in the Northeast have long standing ambient air quality and temperature monitoring stations. Is it possible to highlight those in this section?	Thank you for your comment and very true, many Tribal Nations in the Northeast have long standing ambient air quality and temperature monitoring stations. However, this section deals more with co-benefits of natural and nature-based features (NNBFs) that can improve conditions such as air quality and control ambient air temperatures. Not as certain about air quaility, but there are several examples Tribal NNBFs in the Northeast that improve water quality and build resilience to storm surge and sea level rise. chapter now references Tribal NNBFs.
Casey	Thornbrugh	Text Region	21. Northeast		7	7	3	4	Are there any examples of Tribal NNBFs?	Thank you for your comment. We found several examples and added them to the text.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Nina	Zhao	Figure	21. Northeast		7	7	7	8	Fig. 21.1 ‚Äì group of peers and I like the use of a diagram to help readers visualize the entire region‚Äôs collective effort to combat negative climate impacts. It helps break up the monotony (no offense) of huge blocks of texts too. We find ourselves drawn to figures, in general. However, we felt the title of figure could be more specific and relevant to the content: perhaps ‚ÄúExamples of Nature-Based Strategies in Response to Extreme Natural Events in the Northeast.‚Äù The current title was slightly confusing as the first thing I thought of was ecological responses from non-human populations.	We thank the reviewer for the helpful suggestion, which has been incorporated into the figure.
Emma	Conrad-Rooney	Figure	21. Northeast		7				It would be helpful to either include a legend for the coloration in the map or to choose a simpler version of the map. Also, it would be clearer if the figure had arrows rather than circles pointing to the different locations. Adding arrows might help improve the accuracy of where they are pointing to. For example, the dot in Massachusetts looks to be too far southeast to be pointing to Boston.	We thank the reviewer for the helpful suggestion, which has been incorporated into the figure.
Casey	Thornbrugh	Figure	21. Northeast		8	8	1	9	KM 2 (or I guess just the key message title? Not sure how to refer to the ‚Äúheadline,‚Äù but that‚Äôs what I‚Äôm talking about in both relevant comments) mentions both impacts and adaptation but the text is a lot more about impacts, only one paragraph about adaptation already happening,Ã¶ I‚Äôm torn because I like that the KMs are clearly meant to balance impacts and solutions, which is good, but trying to fit it all in means they‚Äôre quite vague. A more descriptive KM like ‚Äúwarming threatens coastal communities, economies, and ways of life,‚Äù is slightly more informative. Again, not something I feel really strongly about, but figured I‚Äôd share.	Thank you for your comment. While we appreciate your suggestion for a more descriptive title we were encouraged to keep these key messages short and leave further description to the text that follows.
Emma	Conrad-Rooney	Text Region	21. Northeast		8	8	10	12	The sentence "Ocean warming...future warming" should reference Chapter 9. Coasts and Chapter 10. Oceans.	We thank the reviewer for the helpful suggestion, and the cross references have now been incorportated into the text.
Casey	Thornbrugh	Figure	21. Northeast		10	10	1	2	Fig 3 might be more intuitive with a change in color ramps. In a) my brain automatically went to dark=more, which is the opposite of the current ramp. In b), dark=more change, so that‚Äôs good, but the blue is a bit unintuitive because the content is about warming waters.	We appreciate the comment, but will leave the map as is. The color ramps follow the original figure by Allyn et al. 2020, and the way that biomass is represented visually in the literature. The caption has been updated to clearly describe what the color ramps represent.
Emma	Conrad-Rooney	Figure	21. Northeast		10				As a reader, I am confused by the titles for figure a and b and the figure caption. It would be helpful to add "a" and "b" into the figure caption to clarify.	Thank you for your comment. Authors added in "a" and "b" into figure caption to clarify.
Casey	Thornbrugh	Figure	21. Northeast		11	11	1	2	Figure 4 would be improved with more explicit labeling by frame, right underneath/integrated into the graphic (figure is great overall, by the way).	Thank you for your comment. We will add labels by frame to the graphic.
Nina	Zhao	Figure	21. Northeast		11	11	2	2	Fig. 21.4 ‚Äì group of peers and I appreciated construction of simple diagram to illustrate change in populations of this ecosystem across time. We were initially confused at what the three panels represented ‚Äì to help future readers, please consider adding ‚Äúpast,‚Äù ‚Äúpresent,‚Äù and ‚Äúby 2050,‚Äù or year numbers above each panel. Secondly, why are there two cod individuals in the ‚Äúby 2050‚Äù panel? If the numbers of cod are expected to decline from the present scenario (with only one cod in the middle panel), shouldn‚Äôt there be one (or no) cod in the last panel? We remain confused by this choice. Finally, some in our group found the horizontal arrow indicating likely right whale migration out of the Gulf of Maine confusing at first. Although you do explain the horizontal arrow's meaning in the caption, I'm sure some readers would appreciate it if you directly put the word "migration" on top of the horizontal arrow in the diagram, just to make it clearer.	Thank you for the suggestion. Dates have been added to the panels and the figure title.
Casey	Thornbrugh	Text Region	21. Northeast		11	11	11	12	The long-standing connection to the land and natural beings within it that Tribal Nations and Indigenous Peoples has provided traditional ecological knowledge from the northeast region to contribute to this knowledge of changes in phenology and life-history events.	Thank you for this comment. These important issues are highlighted in the Tribes and Indigenous Peoples chapter. Because of this coverage, the authors did not add additional Northeast specific text due to the overall chapter word count and number of other edits.
Emma	Conrad-Rooney	Figure	21. Northeast		11				It would be helpful to add the dates to the three panels in the figure, rather than just having the dates in the caption.	Thank you for your comment. Dates are added to the panels.
Julie	Reichert-Nguyen	Text Region	21. Northeast		12	12	13	21	Consider including a couple of sentences on the topic of changes in estuary habitat use of economically important fisheries for that region due to climate change influences. For example, Schonfeld et al. (2022) demonstrated that several finfish species, including summer flounder, a recreationally important fishery for the Chesapeake Bay region, had significant decreases in the usage of Chesapeake Bay relative to the coastal ocean over time (2008-2019) driven in part by the North Atlantic Oscillation (NAO). Here is the reference: Schonfeld, A. J., Gartland, J., & Latour,R. J. (2022). Spatial differences in estuarine utilization by seasonally resident species in Mid-Atlantic Bight, USA. Fisheries Oceanography,31(6), 615,‚Äì628, https://doi.org/10.1111/fog.12611	Thank you for the suggestion. We have included the reference and additional information.
Julie	Reichert-Nguyen	Text Region	21. Northeast		12	13	37	2	Consider citing the Hinson et al. 2021 paper to support the statement of rising water temperatures in Chesapeake Bay and include sentences on the main driving mechanisms, which included atmospheric forcings (particularly increases in surface air temperatures and downwelling longwave radiation) and the warming ocean boundary. Also consider adding text on how marine heat waves are increasing in frequency, number of days per year, and cumulative intensity in Chesapeake Bay (Mazzini and Pianca, 2022). Mazzini and Pianca (2022) also concluded that if the marine heat wave trends persist, by 2100, the Chesapeake Bay will reach a semi-permanent marine heat wave state. These trends in marine heat waves are expected to exacerbate decreases in dissolved oxygen and could have devastating impacts to the bay ecosystem. Given that global forces are resulting in the vulnerable state of estuaries like Chesapeake Bay, efforts to reduce greenhouse gas emissions are that much more critical to minimize devastating impacts to these systems. Here are the references for the papers for consideration to include in the report: Hinson, K. E., Friedrichs, M. A., St.‚ÄêLaurent, P., Da, F., and Najjar, R. G. 2021. Extent and causes of Chesapeake Bay warming. JAWRA Journal of the American Water Resources Association, https://doi.org/10.1111/1752-1688.12916 Mazzini, P. L., and Pianca, C. 2022. Marine Heatwaves in the Chesapeake Bay. Frontiers in Marine Science, 8(750265), https://doi.org/10.3389/fmars.2021.750265	Thank you for the suggestion. We have included the reference and additional information.
Casey	Thornbrugh	Text Region	21. Northeast		13	13	6	7	Has there been research into what coastal forest types in the NE are most resilient to these impacts?	Thank you for your comment. The authors are not aware of research showing that some coastal forest types in the NE are most resilient to the impact of sea level rise.
Casey	Thornbrugh	Text Region	21. Northeast		14	14	18	19	Implications of policy regarding threatened and endangered aquatic mammals has been a point of challenge for the fisheries industry in the Northeast, further complicating efforts to adapt.	Thank you for your comment. Text has been added that addresses barriers to adaptation, as well as discussion of threatened mammals.
Casey	Thornbrugh	Text Region	21. Northeast		15	15	2	2	Change "Indigenous people" to "Indigenous peoples."	Thank you for your comment. Suggestion adopted.
Casey	Thornbrugh	Text Region	21. Northeast		15	15	3	4	Certainly, there are examples of these efforts.	Thank you for this comment. The authors have decided this is not an actionable comment and no change to the text is warranted.
Casey	Thornbrugh	Text Region	21. Northeast		15	15	3	5	Not just state and local governments. Need to mention the federal trust and treaty obligation the federal government has to federally recognized Tribal Nations. This includes federal agencies such as the BIA, EPA, USDA, NOAA and others working directly with Tribal Nations to address climate impacts compounded by other historic and contemporary factors.	Thank you for your comment. Suggestion adopted.
Emma	Conrad-Rooney	Figure	21. Northeast		15				In the figure caption, it would be helpful to include definitions of the HOLC rankings (A to D). Also, it could be more clear to label the neighborhoods with the labels A through D, rather than using the colors, or outlining the redlined neighborhoods in red.	Thanks for the suggestion, we have added definitions of the labels A through D to the figure caption. We have added labels A through D to the map also.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Casey	Thornbrugh	Text Region	21. Northeast		16	16	1	9	In a paragraph addressing Indigenous peoples, need to mention Tribal Nations are inherent sovereign nations within a nation, not just "communities" or "ethnic groups," but sovereign nations that the US has a government-to-government relationship with regardless of socio-economic status of individual Tribal Nations. This government-to-government relationship and the trust and treaty obligation was born from: in exchange for the millions of acres of land, waters and natural resources that were once 100% Tribal controlled to become the United States, ceded through treaties or unceded but dispossessed from Indigenous peoples, the US now has the obligation to uphold Tribal sovereignty, provided resources and support for Tribal governments, and work with Tribal Nations to protect Tribal resources and assets from impacts from things such as Climate Change. Tribal Nations have never seen this trust and treaty obligation fullfilled with mandatory federal funding and services. Tribal nations must compete with one another for federal resources from "discretionary federal funding," which exasperates inequities for Tribal Nations responding to climate change.	Thank you for this comment. These important issues are highlighted in the Tribes and Indigenous Peoples chapter.
Casey	Thornbrugh	Text Region	21. Northeast		16	16	3	4	Do we need to specify the USET SPF? Can we just say Tribal Nations across the Northeastern US?	The authors discussed this comment and agree it is appropriate to replace USET SPF with Tribal Nations across the Northeastern US.
Casey	Thornbrugh	Text Region	21. Northeast		16	16	3	4	Did you mean to specifically include SPF, or just USET? I think ‚Äúmember nations‚Äù or ‚Äúmember tribes‚Äù would also be more understandable.	The authors discussed this comment and agree it is appropriate to replace USET SPF with Tribal Nations across the Northeastern US.
Casey	Thornbrugh	Text Region	21. Northeast		16	16	6	7	There could be plug in about considerations for assisted migration. The man-made infrastructure across the region create barriers that inhibit natural expansion north for some plant species. Human intervention to assist this is an adaptation strategy being strongly considered in the Northeast and exercised in some cases.	Thank you for your comment. Assisted migration is being researched, planned, and implemented in our region and could be highlighted. We reviewed the text to see where it may fit. There was no logical place for this concept within our current narrative.
Casey	Thornbrugh	Text Region	21. Northeast		16	16	37	37	Change "cultural heritage" to "cultural lifeways."	Thank you for your comment. Suggestion adopted.
Casey	Thornbrugh	Text Region	21. Northeast		16	16	38	38	Add "physical and mental."	Thank you for your comment. Suggestion adopted.
Nick	Procopio	Text Region	21. Northeast		17	17	2	2	Specify that this is NJDEP's Blue Acres program.	Thank you for your comment, the suggestion has been adopted.
Casey	Thornbrugh	Text Region	21. Northeast		17	17	22	22	This is a seat at the table. However, ensuring these marginalized groups are a part of the project before decisions are being made would be meaningful.	Thank you for your comment. Suggestion adopted.
David	Saunders	Text Region	21. Northeast		17	17	34	35	Location NCA5_21_Northeast_3OD Page 21-17 Line 34 Comment ‚Äì Add this text to line 34 An examination of retail competition in the energy market in Maryland reveals that, overall, it is not benefitting residential consumers and is especially harmful to low-income households. Reference Peltier, L., & Makhijani, A., Ph. D. (2018, December). Maryland‚Äôs Dysfunctional Residential Third-Party Energy Supply Market: An Assessment of Costs and Policies. Abell Foundation. https://abell.org/publication/marylands-dysfunctional-residential-third-party-energy-supply-market/ Discussion Maryland‚Äôs Electric Customer Choice and Competition Act of 1999 opened the door to electric retail competition and allowed consumers to opt into services from a variety of third-party suppliers. The idea was that a deregulated energy market would provide consumers with choices, spark competition, and save everyone money. It took several years for the third-party energy marketplace to find a foothold in Maryland, but after a policy change in 2009, it began to take off. And, for the next few years, consumers did see some benefits. From 2014 to 2017, however, Maryland households have been losing money by using third-party suppliers,‚Äîpaying about $255 million more in all than if they had stayed with their regulated utility,‚Äôs supply offer. In this report, authors Laurel Peltier and Arjun Makhijani examine the impact of higher rates overall and on low-income households, with a focus on Baltimore City. The report examines publicly available statewide data as well as information collected in interviews with clients at GEDCO CARES, a Baltimore City agency that provides a variety of services to low-income Baltimoreans, including energy assistance. When compared to Baltimore Gas and Electric Company,‚Äôs (BGE) Standard Offer Service rates, the 40 low-income account holders interviewed for this report paid, on average, a 51 percent premium for	We appreciate this suggestion, but space is limited. The author team has deliberated and prioritized the information to include. Based on these agreed priorities, the chapter has not been revised.
Casey	Thornbrugh	Text Region	21. Northeast		17	17	38	38	Remove hyphen in ‚Äúclimate-change.‚Äù	Thank you for the comment. Hyphen is now removed.
Casey	Thornbrugh	Text Region	21. Northeast		18	18	1	7	I really like this close-out to the key message, but is there a way to tie in some of the other topics above to tie it all together? Maybe reference the different types of justice again?	Thank you for this suggestion. Unfortunately, due to space constraints, the authors decided not to re-state the different dimensions of equity.
Casey	Thornbrugh	Text Region	21. Northeast		18	18	2	2	Correct "SPT" to "SPF."	Thank you for your comment. Correction made.
Casey	Thornbrugh	Text Region	21. Northeast		18	18	2	2	"SPF" not "SPT."	Thank you for the comment. Correction made.
kottie	christie-blick	Text Region	21. Northeast		19	19	4	6	The Northeast states have education standards influenced by the Framework for K-12 Science Education or the Next Generation Science Standards (with the exception of Pennsylvania, which has yet to follow these nationally recognized science standards). These standards are designed to create scientifically literate Americans. As such, they help learners understand ways that humans impact Earth's resources and environment. There is a great need for schools to fully adopt and implement these standards, and for educators to be trained to teach the core ideas, concepts, and practices to their learners at an age-appropriate level. https://ngss.nsta.org/about.aspx https://www.nextgenscience.org/search/node/Earth%20and%20Human%20Activity	We appreciate the commenter raising the status of climate-related education in schools across the Northeast. However, integrating this aspect into the chapter is beyond the scope. Moreover, it appears similar climate education-related comments were made in several other places throughout the report, indicating that not insignificant coverage would be needed to capture the state of play accurately and completely. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Casey	Thornbrugh	Text Region	21. Northeast		19	19	9	10	I would want to look at this equity assessment. Tribal Nations should be addressed in it.	Thank you for your comment. The authors have decided this is not an actionable comment. No change to the text is warranted. The reader is directed to the reference to dig into the equity assessment for more detail.
Nick	Procopio	Table	21. Northeast		20				In September 2022, the NJDEP released the Human Health Addendum to the 2020 New Jersey Scientific Report on Climate Change. Consider adding this addendum under NJ's Climate Impact Assessments.	Thank you for your comment. This report has been added to the "Climate Imapct Assessment" box for the State of New Jersey in Table 21.1 (and added to the reference list).
Jim	Titus	Text Region	21. Northeast		21	21	13	18	The caption is not clear or wrong. If it really refers to the percentage of total properties with flood insurance, the hand-wringing in the text about low takeup rates seems odd, because people with no risk of flooding do not need this insurance. The fraction of people in the 100- or even 500-year floodplain would be useful to know, but that is not what the caption says.	Thank you for the comment. The caption and figure deals with housing units, not total properties. Although it is agreed that elevated housing units (like upper floor apartments) have minimal flood risk, it is not zero. If a storm surge or flash flood destroys a multi-story residential property, one would need flood insurance to cover the loss of real and/or personal property. Regarding population by floodplain zonation - FEMA flood maps are focused on riverine flood potential. They do not explicitly consider flash flooding, which can occur anywhere. Thus, even outside these zones there is flood risk that should be covered by insurance. After reviewing the caption, the authors believe it is unnecessary to alter the caption.
Casey	Thornbrugh	Table	21. Northeast		23	23	1	1	Please add links for Saint Regis and Mi'kmaq plans if available.	Thank you for this comment. The links have now been added correctly. Saint Regis Mohawk Tribe Climate Adaptation Plan https://dvc479a3doke3.cloudfront.net/_uploads/site_files/ClimateChange.pdf Mi'kmaq Nation Climate Adaptation Plan: http://micmac-nsn.gov/files/2022/02/Aroostook_Band_of_Micmacs_Climate_Change_Adaptation_Plan__without_comments.pdf If in doubt, the plans can also be access through USET's Climate Page here: https://www.usetinc.org/departments/oerm/climate-change/tribal-climate-planning-documents/
Casey	Thornbrugh	Text Region	21. Northeast		25	25	1	1	Left off 1/24.	Thank you for your comment. This is not an actionable comment. No change to the text is warranted.
Casey	Thornbrugh	Text Region	21. Northeast		25	25	1	1	Missing the Saint Regis Mohawk Tribal Climate Change Adaptation plan in the Northeast.	Thank you for your comment. The Saint Regis Mohawk Tribal Climate Change Adaptation Plan is listed in Table 21.1. Recent Climate Planning and Action Among States and Tribal Nations in the Northeast on page 23. The authors added a paragraph to the Tribal Nations Box on the Saint Regis Mohawk Tribal Climate Change Adaptation plan.
Casey	Thornbrugh	Text Region	21. Northeast		25	25	4	4	Capitalize "Tribal Nations."	Thank you for your comment. After further discussion, authors will revise to say "Indigenous peoples" to better incorporate federally recognized Tribal Nations and other peoples.
Casey	Thornbrugh	Whole Page	21. Northeast		26				Tribal Nations need to be mentioned in section on financing implementation. Tribal Nations deal with discretionary federal funding which means funding is not guaranteed and often Tribal Nations must compete with one another for grants and resources for implementation.	Thank you for your comment. Tribal Nations are now mentioned as a potential beneficiary from new climate mitigation financing options.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jim	Titus	Text Region	21. Northeast		27	27	1	10	I don't carry flood insurance on my little cottage in New Jersey for reasons not included in this list of reasons--and I think it applies to alot of people. Flood insurance is simply not worth it. The deductible is huge, and my contents have negligible value, so even a storm surge a few feet higher than Sandy would not leave me with a claim sufficient to cover 5 to 10 years of premiums. Flood insurance has a huge cross subsidy between people at fairly low risk and those at greater risk--in fact, adverse selection is the whole reason that private flood insurance did not work before creation of the NFIP.	Thank you for your comment. This comment does not appear to raise a question or suggest a revision, so no action is taken.
Kelly	Van Baalen	Text Region	21. Northeast		28	28	1	3	Please consider including the findings of the paper, Economic damages from Hurricane Sandy attributable to sea level rise caused by anthropogenic climate change, by Strauss et al. in 2021. Strauss et al. found that Sea level rise caused by carbon emissions accounted for approximately 13% ($8.1 billion) of the $62.7 billion in losses incurred by New York, New Jersey, and Connecticut from Hurricane Sandy.	We appreciate the reference. We have reviewed the source of information. However, the author team determined that the current references are appropriate given current content and are adequate given the chapter's space limitations.
Jim	Titus	Text Region	21. Northeast		28	28	17	18	This sentence needs a reference for the proposition that private insurers are stating to write flood policies in the Northeast. (People have long been able to get private insurance in Corova NC.)	Thank you for your comment. The authors added a reference to support this statement. There has always been some private sector flood insurance available from the non-admitted markets, but typically cover losses in excess of NFIP policy limits.
Casey	Thornbrugh	Text Region	21. Northeast		29	31	1	4	Some of the funding sections could benefit from more context for less familiar readers. I‚Äôm sure many folks with different backgrounds would say the same of the natural science parts, but I personally wasn‚Äôt always positive I was thinking about the right concepts/definitions when reading about the bonds, ‚Äúdebt financing,‚Äù and ‚Äúclimate adaptation as a service.‚Äù	We appreciate the comment, and the need for finding more detailed information about funding opportunities. However, the chapter has a word limit that restricts the additional context we can provide about any topic. For more information, we suggest: https://toolkit.climate.gov/content/funding-opportunities
Nick	Procopio	Figure	21. Northeast		30				The word "corporate" is misspelled in the New Jersey sentence. Also, how were these values estimated for New Jersey? NJDEP was unable to replicate these numbers.	Thank you for your comment. Multiple misspellings have been corrected. For NJ numbers, there are discrepancies between data and NJ will be removed from the figure. Additionally, bonds passed in the 2022 November election will be added to the figure totals in NY ($4.2 billion bond) and Rhode Island (increased to $171.3 million over last three ballot measures). The figure has been updated to reflect these changes.
Glenn	Branch	Whole Chapter	21. Northeast						A discussion of climate change education and outreach efforts in this region is needed. (Note that the chapter on the Southern Great Plains includes a brief discussion of climate change education on ch. 26, pp. 31-32.) Education and outreach efforts are foundational to topics discussed in this chapter, including: * livelihoods and economies, since a goal of education is to prepare the workers and consumers of the future, which will be transformed by the effects of climate change; * human health and well-being, since educators play a role in ensuring the intellectual, psychological, and social health of their students in the face of climate change; and * planning and adaptation, which require policymakers and voters to grasp the scientific and social issues involved in meeting the challenges posed by climate change. While it would be best for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change, it would help for this chapter to discuss the situation specifically in its region.	We appreciate the commenter raising the status of climate-related education in schools across the Northeast. However, integrating this aspect into the chapter is beyond the scope. Moreover, it appears similar climate education-related comments were made in several other places throughout the report, indicating that not insignificant coverage would be needed to capture the state of play accurately and completely. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Charles	Keeling	Whole Chapter	21. Northeast						A discussion of climate change education should be included similar to the one in chapter 26, pp. 31-32.	We appreciate the commenter raising the issue of climate-related education. However, integrating this aspect into the chapter is beyond the scope. Moreover, it appears similar climate education-related comments were made in several other places throughout the report, indicating that not insignificant coverage would be needed to capture the state of play accurately, completely, and efficiently. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Nick	Procopio	Whole Chapter	21. Northeast						It may be worth including a map at the beginning of each regional section, to help show which states are included.	Thank you for your comment. Please refer to the Front Matter for a map which includes the Northeast states. In addition, we expect the NCA5 website to display regional maps at the beginning of each chapter, including the Northeast.
Emma	Conrad-Rooney	Whole Chapter	21. Northeast						All key messages should be revised to better follow the Risk-Based Framework	The authors appreciate the comment. The authors reviewed the risk-based framing guidance, which encourages authors to describe the risks and impacts, with quantifications where possible. In the Northeast, a significant update since NCA4 is that increasingly those affected by these risks are taking action to respond to them, which the authors considered important to also document in our key messages. Upon review of this guidance the authors felt the key messages follow this guidance to the best degree possible given the number of qualitative issues and values described that are at risk and the qualitative responses in progress across the region.
Brittany	Gutermuth	Whole Chapter	21. Northeast						Climate change education is explicitly discussed in ch. 26, pp. 31 (line 18-27)- 32 (line 1-2), it should be addressed here as well.	We appreciate the commenter raising the issue of climate-related education. However, integrating this aspect into the chapter is beyond the scope. Moreover, it appears similar climate education-related comments were made in several other places throughout the report, indicating that not insignificant coverage would be needed to capture the state of play accurately, completely, and efficiently. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Missy	Holzer	Whole Chapter	21. Northeast						For your consideration for the entire chapter, and for section 2 Key Message 21.5. NJ is one of the first states to include CC education in ALL subjects in ALL grades - K-12. This will go a long way to build a workforce of able decision-makers, change-makers, and action-focused individuals. Consider celebrating this in the chapter. However, to be added to Key Message 21.5, funding is needed to ensure teachers of all subjects have the necessary training and curricular materials to support their teaching. A discussion of climate change education and outreach efforts in this region is needed. (Note that the chapter on the Southern Great Plains includes a brief discussion of climate change education on ch. 26, pp. 31-32.) Education and outreach efforts are foundational to topics discussed in this chapter, including: * livelihoods and economies, since a goal of education is to prepare the workers and consumers of the future, which will be transformed by the effects of climate change; * human health and well-being, since educators play a role in ensuring the intellectual, psychological, and social health of their students in the face of climate change; and * planning and adaptation, which require policymakers and voters to grasp the scientific and social issues involved in meeting the challenges posed by climate change. While it would be best for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change, it would help for this chapter to discuss the situation specifically in its region.	We appreciate the commenter raising the issue of climate-related education. However, integrating this aspect into the chapter is beyond the scope. Moreover, as NCA5 is not policy prescriptive, we cannot integrate the commenter's assertion that additional funding is needed to ensure teachers of all subjects have the necessary training and curricular materials to support their teaching. With similar climate education-related comments made in several other places throughout the report, it's evident that not insignificant coverage would be needed to capture the state of play accurately, completely, and efficiently. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954.
Jim	Titus	Whole Chapter	21. Northeast						Congratulations on using the term "redline" correctly and explaining its relevance accurately. Most chapters in this report state--or imply by context--that the redlining caused segregation, but this chapter correctly explains its significance.	Thank you for your comment. This is not an actionable comment. No change to the text is warranted.
Casey	Thornbrugh	Whole Chapter	21. Northeast						Clearly someone on the writing team specializes in insurance ‚Äì it may be useful to make sure too much of the national-level information isn‚Äôt redundant of the economics chapter or others? It‚Äôs certainly relevant and helpful, but is a lot of information, especially the whole section on Risk Rating 2.0 (pg 28) ‚Äì not sure that level of detail is warranted.	Thank you for your comment. The authors of NCA5 21 Northeast have reviewed the economics chapter and there does not appear to be any redundancy of our discussion of Risk Rating 2.0. Given the recent changes to NFIP rating methodology and the continuing importance of public flood insurance to the financial resiliency of homeowners and businessowners in a changing climate, the authors felt the level of detail was warranted.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Casey	Thornbrugh	Whole Chapter	21. Northeast						The climate education community has been very upset about the lack of focus (or mention) of education and communication as critical components of adaptation and mitigation in this report, so when I was reading the overview, I was motivated to do a quick analysis of where the word ‚Äúeducation‚Äù appeared in the document. By my quick count, it was only mentioned 100 times, 50 of which were in citations or affiliations, but I took note of the chapters that explicitly mentioned education as a potential solution ‚Äì and those chapters were transportation, health, the Northeast, and especially the Indigenous Peoples chapters ‚Äì so I‚Äôm already happy with this chapter for being in that list! Though more would always be good, of course.	We appreciate the commenter recognizing that climate education is discussed in the Northeast chapter. A more detailed discussion on the status of climate education in the Northeast region is beyond the scope of this chapter. For interested readers, we would direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954.
Jim	Titus	Whole Chapter	21. Northeast						It would be helpful for this chapter to provide more specific facts at the state level, including tables or maps that quantify impacts and location-specific expectations. It is important to do so because some federal agencies will create state-specific fact sheets about the impacts of climate change. To avoid the accusation of cherry picking, these agencies are often limited to using the facts presented by IPCC, NAS, and the National Assessment, which as a practical matter, usually means that NCA is the main source.	Thank you for your comment. Such a comprehensive assessment is beyond the scope of what can feasibly be integrated into the space allocated to the Northeast chapter. Interested readers are directed to other federal resources, such as the State Climate Summaries (https://statesummaries.ncics.org/), as well as the recently-released Climate Mapping for Resilience & Adaptation resource (https://resilience.climate.gov/).
Casey	Thornbrugh	Whole Chapter	21. Northeast						When referring to Indigenous peoples/Tribal Nations, check with Tribes and Indigenous Peoples Chapter to make sure terminology is as consistent as possible across chapters.	Thank you for you comment. The authors reviewed the Tribes and Indigenous Peoples Chapter and the terminology used is primarily "Indigenous peoples." The term Tribal Nations is also used. The authors confirmed the terms Indigenous peoples and Tribal Nations are used in the Northeast Chapter as well.
Jim	Titus	Text Region	22. Southeast		3	3	10	15	This statement may be true, but I checked the first 3 of the 9 references listed and none of them stated that the cause of increased environmental risk is slavery, Jim Crow, and discrimination. They support disproportionate exposure, but not the causal link. I did not check the other 6 references, but if any of them support the assertion, the text or reference placement should be revised so that the papers that demonstrate disproportionate vulnerability reference a statement about that, and the few that show the direct causal link between slavery/discrimination and vulnerability are used to support the causal link.	We thank this reviewer for their comment. We have added additional citations that have more clearly established the causal physical linkages (Gonzalez et al., 2023) and associated social (O'Connell 2012) and economic science literature (Aaronson et al., 2021) that establishes the connection between these policies - whether de facto or explicit - and present-day racial inequities in climate exposure and risk.
Ariela	Zycherman	Text Region	22. Southeast		3	3	30	30	While there might be a decrease in cold days, what about extreme events like ice and snow storms? These deserve a mention and maybe more as they seem to be catching communities unprepared, causing unnecessary fatalities and major disruption in critical systems. There was the snowmageddon in 2014 that brought snow to Atlanta and stranded people on the freeway, and this winter storm over Christmas left hundreds of thousands without power.	We thank the reviewer for this comment and agree that extreme cold outbreaks tend to have a lasting impact on our communities because of the infrastructural and social disruptions they can cause. However, it remains "high confidence" that future cold extremes and snowfall will decrease in intensity in the Southeast, as identified in the IPCC AR6. We have edited this statement to read "decreases in the intensity and potentially frequency of disruptive cold season events like snowfall and frost days" to reflect this suggestion.
kottie	christie-blick	Text Region	22. Southeast		3	3	33	34	Increased education for all stakeholders is imperative, including the youth. Eight of the eleven states of the Southeast have education standards influenced by the Framework for K-12 Science Education or the Next Generation Science Standards. (Only Virginia, North Carolina, and Florida have yet to follow these nationally recognized science standards.) These standards are designed to create scientifically literate Americans. As such, they help learners understand ways in which humans impact Earth's resources and environment. There is a great need for schools to fully adopt and implement these standards, and for educators to be trained to teach the core ideas, concepts, and practices to their learners at an age-appropriate level. https://ngss.nsta.org/about.aspx https://www.nextgenscience.org/search/node/Earth%20and%20Human%20Activity	We thank the reviewer for the careful review of our chapter and suggesting we add information about education. We have added a sentence with several new citations that reads: "A growing number of communities throughout the Southeast are working out how to communicate about climate change science across a variety of societal applications in both formal (classroom) and informal (outside of classrooms) learning contexts (Buckley and Moore-Driskell, 2021; Bartels et al., 2012; Stewart, 2022; Panos and Sherry, 2023; McNeal et al., 2014; Monroe et al., 2013;),"
Juanita	Constible	Text Region	22. Southeast		3	3	35	37	The strong emphasis in this chapter on tribal considerations and inclusion of more social science and non-traditional governance models is great. However, the sentence starting on line 35 is hard to follow because of the jargon. Please include additional explanation or definitions, particularly since the term COLLECTIVE CONTINUANCE appears multiple times throughout the chapter.	We thank the reviewer for this helpful suggestion. We have added the definition of collective continuance to this section of the narrative, as well as additional citations where appropriate to expand on the literature base. We have also sought to minimize jargon throughout the chapter narrative based on this and other comments.
Cathy	Day	Whole Page	22. Southeast		3				We appreciate the inclusion of stories about Indigenous communities, both their increased vulnerability and their knowledge, skill, experience, and history with land management and with native plants. These stories are revealing and provide a roadmap toward increased climate justice, including racial justice, GHG mitigation, and resilience. These stories should be elevated as a call for support for reparations and returning land to Indigenous communities.	We thank the reviewer for this comment and for their commitment to Indigenous communities. However, we cannot prescribe specific policy approaches as suggested in our chapter text.
Nicholas	Poggioli	Figure	22. Southeast		5		1		It does not make sense that the legend caption for the right-hand projection is also 2010-2020. It seems that should be 2020-2030, or at least a period into the future.	We thank the reviewer for this catch and our legend and caption will be updated.
Jim	Titus	Text Region	22. Southeast		6	9	9	14	Aside from the general statements about development along the coast, there are more specific estimates of population increase in the areas vulnerable to sea level rise and flooding. During the last decade (as well as the last 30 years) Florida alone has accounted for half the increased population living below 1m, below 3m, and in the mapped 100-year floodplain. The Southeast accounts for 2/3 of the nation's population living below 1m 2m, and 3m, and 90% of the population living below mean higher high water (mostly in Louisiana. See Titus 2003 Environmental Research Letters, Population in floodplains or close to sea level increased in US but declined in some counties, especially among Black residents Table S-3. See also Figures 2 and 3.	We thank the reviewer for the suggestion to add this newly-published evidence, which we feel further supports our existing text which now includes reference to this paper: "Growth along the region's coastlines (Census Bureau, 2019) has increased the population exposed to coastal-specific climate threats (Collins et al., 2022; Sweet, 2022; Thompson et al., 2021; Wing et al., 2022; Titus, 2023)." We have also incorporated a place-based estimate of future flood risk frequency for Jacksonville, FL, including a new figure showing the impact of these conditions on residents.
Juanita	Constible	Figure	22. Southeast		6				The colors on the left panel are extremely difficult to distinguish, due the size and resolution of the figure. It will be even worse for people with certain forms of color blindness.	We thank the reviewer for this comment. We have updated our figure to enhance the perspective on two particular metropolitan areas to highlight their change (Jacksonville, FL and Atlanta, GA). We also note that readers will be able to zoom into this map more closely when NCA5 publishes online, including in the Atlas of datasets. Lastly, we have tested the color map of this figure in the Coblis color blindness simulator (online tool recommended by TSU) and it appears to resolve differences for all forms of colorblindness, based on viewing the color legend. These colors are from TSU based on our testing and exchanges with them back in September 2022. So, we are keeping the color table as-is based on these findings.
Juanita	Constible	Text Region	22. Southeast		8	8	2	4	Consider rephrasing the first sentence of this paragraph. While exposure to hazards is indeed changing due to increased precipitation etc., it is human factors (social, political, economic policies and instututions) that cause those exposures to disproportionately harm low-income communities, communities of color, and others marginalized by U.S. society.	We thank the reviewer for this comment. We name both climate and non-climate stressors, but lacked previous specificity the reviewer is asking for in regards to public and urban planning policy. We have added three references (Chakraborty et al., 2014; Tate et al., 2021; and Collins et al., 2019) and clarified the role of physical and non-physical drivers of flood risk. The passage now reads: "Southeast flood risk is inequitably distributed due to both climate and non-climate stressors. Physical stressors like increases in precipitation, temperatures, and sea level, as well as land cover change exacerbate flood risks (Collins et al., 2022; Kunkel et al., 2020; Neupane et al., 2020; Wing et al., 2022), while social, economic, political policies and institutions differentially shape risk, vulnerability and exposure to flooding (new references)."
Juanita	Constible	Text Region	22. Southeast		8	9	18	9	Please consider grouping these health impacts of flooding with the rest of the health material further down. Furthermore, please consider including a discussion of how heat events are increasingly causing harm in the immediate wake of hurricanes, including after Hurricane Laura in Louisiana. E.g., Case Study 1 of the 2020 Lancet Countdown US Brief: https://www.lancetcountdownus.org/2020-case-study-1/.	Thank you for your comment. We have decided to keep this text in the flooding section as it is describing more indirect health impacts due to flooding where the health section is focused on more direct impacts of climate change. We did remove the sentence on DOT as suggested and added text to the health section on compound hazards, including the reference to the Lancet 2020 report.
Juanita	Constible	Figure	22. Southeast		8				Does the left panel use the Expected Annual Loss for ALL hazards? If so, that includes hazards with no link (or at least not a well-documented link) to climate change. Furthermore, it is worth noting in the caption or the text that the National Risk Index does a terrible job capturing expected annual losses from heat. As of December 2022, for example, the NRI shows NO expected annual losses from heat waves in western Virginia, most of Tennessee, north Georgia (including Atlanta), and Florida south of Jacksonville.	Thanks to the reviewer for this comment. We are using the "All Hazards" National Risk Index for this figure. We do not suggest climate-related links in the narrative or caption to "All Hazards" and instead use this as a way to highlight that highly vulnerable housing is already at risk (left panel) and will bear higher risks related to at least flooding into the future (right panel), as well as adding in the linkage between these communities and status as renters. We have chosen not to edit any of our material based on this comment.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jenny	Brennan	Whole Page	22. Southeast		8				Page 22-8 discusses the interplay of inland and coastal flooding risk and social vulnerabilities. We suggest adding reference to the lack of comprehensive real estate flood risk disclosures in many Southeastern states, particularly for renters, which prevents transparency about flood risk and hinders proactive measures such as purchasing flood insurance and evacuating from an incoming storm. Residents interested in a potential new home can guess about its flood history by looking at a FEMA flood map, however floodplains are not always an accurate depiction of flood risk. Flood disclosures eliminate this guessing game and lead to better preparedness. Few states in the Southeast have comprehensive flood risk disclosures for home buyers, and Georgia is the only state in the Southeast with a flood disclosure requirement applying to rental units. Even this rental disclosure only covers the most extreme repetitively flooded properties (a baseline of three floods over the past five years). In the US, renters are more likely to be households of color and have lower incomes compared to homeowners. The majority of the Latinx and Black populations are renters, and recent immigrants and people over the age of 65 are more likely to rent. The failure to disclose flood risk in rental properties places an additional risk burden on populations already facing other stressors and worsens existing inequities.	We thank the reviewer for this suggestion. We have included a reference to flood risk disclosure policies by state as assessed by a 2022 FEMA document, availability of federal assistance for renters vs. homeowners, as well as highlighting that rental units in the SE tend to be populated by frontline communities. Our text now reads: 'There is a wide range of mandatory flood risk disclosure requirements depending on the state (FEMA, 2022), and virtually all only apply to home buyers. Millions of rental housing units in the region are within counties that already experience high Expected Annual Loss ratings (Harvard JCHS, 2022), and confidence is growing that areas currently populated by communities of color, who also are more likely to be renters, will face disproportionately high future flood risks (EPA, 2021b; Wing et al., 2022; Figure 22.4). All of these populations tend to face more barriers to accessing flood insurance and federal flood disaster assistance, and as well as experience adverse outcomes during disaster recovery (Wilson et al., 2021).
Juanita	Constible	Text Region	22. Southeast		9	9	1	4	Please consider citing this study, and possibly even including a couple of the main findings: Tarabochia-Gast et al. (2022).¬†Flood risk to hospitals on the United States Atlantic and Gulf Coasts from hurricanes and sea level rise.¬†GeoHealth,¬†6, e2022GH000651.¬†	We thank the author for this suggestion and have added it into our citation list as well as added a short sentence connecting its results with our broader narrative, adding the following: "especially when considering flood risks from hurricanes and sea-level change (Tarabochia-Gast et al., 2022)."
Juanita	Constible	Text Region	22. Southeast		9	9	5	7	The sentence beginning with THE US DEPARTMENT OF TRANSPORTATION seems out of place - as currently written, it does not describe a specific stressor or inequity like the other examples in this paragraph.	We have removed the statement as it was agreed with the reviewer that it seemed a bit out of the general narrative of this paragraph.
Thomas	Knutson	Text Region	22. Southeast		9	9	14	16	There is evidence that the proportion of Atlantic hurricane intensity changes that are classified as rapid intensification has increased since about 1980 (Bhatia et al. 2018) and that this increase is unusual compared to model simulated natural variability and in the direction expected from long-term anthropogenic forcing. Ref: Bhatia, K. T. et al. Recent increases in tropical cyclone intensification rates. Nat. Commun. 10, 635 (2019).	We thank the reviewer for this comment and for specifying a manuscript to consider. We have updated the text to read as follows: "However, the impact of climate change on slowing down or stalling tropical storms remains uncertain (Hall & Kossin, 2019), though some scenarios indicate a potential slowdown of Atlantic storms (Zhang et al., 2020; Gori et al., 2022), including near the Southeast U.S. coast (Garner et al., 2021). In addition, rapidly intensifying hurricanes have presented challenges for implementing evacuations (Hotakainen, 2021), and the frequency at which Atlantic hurricanes rapidly intensify may be increasing in response to long-term anthropogenic forcing (Bhatia et al., 2018)."
Thomas	Knutson	Text Region	22. Southeast		9	9	21	24	A couple of additional/updated references to add (which focus on projections of CONUS landfalling hurricanes that are relevant for the southeast U.S in particular) include Wright et al. (2015) for post-landfall tropical cyclone precipitation over the CONUS and Knutson et al. (2022), Garner et al. (2021), Jing et al. (2021), Zhang et al. (2020), and Gori et al. (2022) for various CONUS landfalling or near-landfalling hurricane metrics. These landfalling storm studies do not yield high confidence projections for the southeast US, because results are generally either based on single studies or have important differences between studies, and the projections are generally not supported yet by a detectable anthropogenic influence in observations. Comments: Wright et al. (2015) project increased tropical cyclone precipitation intensities over CONUS land (post-landfall). Garner et al. (2021) project tropical cyclones to form closer to the U.S. southeast coast and to propagate more slowly along the coast in a future warming scenario. Similarly, Knutson et al. (2022) project that a greater fraction of Atlantic TCs will make landfall over CONUS and that basinwide intensities will increase slightly. This led to a greater projected number of CONUS landfalling category 4-5 hurricanes despite fewer total tropical cyclones and hurricanes projected for the Atlantic basin as a whole in Knutson et al. Jing et al. (2021) compare North American landfalling TC projections for various subregions, including the U.S. southeast and Gulf coasts, from three modeing approaches, and report relatively small and not statistically significant changes in landfall intensities and in the return period of various landfall intensities across the three methods. Two modeling studies differ on whether, where, and how much tropical cyclone propagation speeds are projected to change in the southeast U.S. coastal region (Zhang et al. 2020; Gori et al. 2022). Sea level rise is projected to increase coastal inundation risk from tropical cyclone (e.g., Gori et al. 2022). Refs: Knutson, T.R., Sirutis, J.J., Bender, M.A. et al. Dynamical downscaling projections of late twenty-first-century U.S. landfalling hurricane activity. Climatic Change 171, 28 (2022). https://doi.org/10.1007/s10584-022-03346-7 Garner AJ, Kopp RE, Horton BP (2021) Evolving tropical cyclone tracks in the North Atlantic in a warming	We thank the reviewer for this comment and for specifying manuscripts to consider. We have updated the text to read as follows: "With additional climate warming, more North Atlantic hurricanes are expected to strengthen to at least Category 4 intensity and to undergo rapid intensification, sea level rise is expected to worsen storm surge inundation, and tropical cyclone–related rainfall is expected to increase (Wright et al., 2015; Knutson et al., 2019, 2020; Gori et al., 2022). The likelihood of storms making landfall could increase, which may offset the potential decrease in total number of storms and overall exacerbate impacts (Knutson et al., 2022). However, some uncertainty remains regarding the expected degree of change in hurricane activity impacting the Southeast U.S."
Thomas	Knutson	Text Region	22. Southeast		9		27		Regarding seasonal mean precipitation, it could be mentioned here that over the 20th century, mean precipitation during the fall season (Sept.-Nov.) in particular has been increasing to an unusal degree compared to simulated natural variability in the southeast U.S., with anthropogenic climate change contributing to the increase. Source: Knutson and Zeng (2018), see their Supplementary Fig. 2d. Reference: Knutson, T. R., & Zeng, F. (2018). Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends, Journal of Climate, 31(12), 4617-4637. https://journals.ametsoc.org/view/journals/clim/31/12/jcli-d-17-0672.1.xml	We thank this reviewer for adding a human-attributable statement to our discussions on sub-annual precipitation. We have added a statement in the preceding discussion of flood risk drivers to reflect that SON precipitation has been linked with human-caused climate change as suggested by the reviewer.
Ariela	Zycherman	Text Region	22. Southeast		9	9	28	37	I am assuming there is a discussion of green infrastructure's role in stormwater management in another chapter, and it would be helpful to provide a link here.	We thank the reviewer for this suggestion and have added a citation to explore Chapter 12, the Built Environment chapter, which examines green infrastructure solutions for stormwater management.
Emma	Conrad-Rooney	Text Region	22. Southeast		9	10	38	1	The sentence "Extreme rainfall that...hinder first responders" should reference Chapter 9, the Coastal chapter.	We thank the reviewer for this suggestion and have added a reference to Chapter 9 in the citations following this statement.
Jenny	Brennan	Whole Page	22. Southeast		9				There is some discussion in the chapter of the inadequate capacity of sewer infrastructure compared to the volume of extreme rainfall many communities are experiencing (page 22-9). We suggest that a discussion of the effects of flooding on wastewater treatment is added to the chapter, with a focus on worsening septic tank failures as climate change exacerbates flooding and contributes to rising groundwater tables in the region. Rising seas and intensifying precipitation will render a large swath of the coastal plain and areas with poor soil permeability unsuitable for septic, which has ramifications far beyond any one compromised tank. In the rural South, septic tanks treat wastewater from millions of homes, offering an effective, affordable waste treatment and sanitation solution ‚Äì until they fail. Flooded septic tanks cannot properly treat wastewater and cease to function, causing sludge to back up into homes and allowing contaminants to directly discharge into ground and surface waters. Meanwhile, climate change is driving a rising water table and sea levels, resulting in increased flooding and erosion in coastal areas. More frequent and extreme rainfall also increasingly inundates these systems from above, meaning that septic failures could become increasingly common inland as well as in the coastal plain. In some Southeast states, septic tanks service up to 50% of residential structures, representing a huge potential source of environmental contamination and a public health hazard. In the coming years, septic systems concentrated in rural, coastal, and low-wealth areas are likely to fail even more than their estimated current failure rate of 50 percent, polluting groundwater, exposing communities to avoidable contaminants and toxins, and creating unbearable living conditions for families. One study found that septic failures contributed to 35 percent of untreated groundwater-associated disease outbreaks nationally from 1971 to 2008. Shockingly, experts have linked failing septic tanks and lack of proper sanitation to a resurgence of hookworm and other tropical diseases once considered to be long eradicated in the South. The physical and mental health toll of waste sludge backing up into people‚Äôs homes due to a flooded and failed septic tank remains unquantified but undoubtedly significant. Several studies have also linked septic failures to shellfish harvesting closures and toxic	We thank the reviewer for the suggestion. We have added a citation to recent research focusing on the impacts of flooding on onsite wastewater system failures in North and South Carolina and its public health implications from Vorhees et al. 2022.
Ariela	Zycherman	Text Region	22. Southeast		10	10	20	20	"may not achieve long term goals" is vague and unclear. What goals? Consider "may not provide protection over the long-term" or "effectiveness may be short-lived" or something more direct.	We thank the reviewer and have edited this statement to read "may not provide long-term protection, particularly if they are designed to past climate conditions" as suggested.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Juanita	Constible	Text Region	22. Southeast		11	11	11	12	It is worth noting in this section that moving out of a hazardous area with respect to flooding or hurricanes does not necessarily mean finding safety from other hazards. E.g., this study, which finds U.S. residents are fleeing hurricane-prone areas for wildfire-prone areas: Clark et al. 2022, Flocking to fire: How climate and natural hazards shape human migration across the United States, Frontiers in Human Dynamics 4 (2022). Also, where do social infrastructure solutions fit in this section, such as strengthening public health systems, community resilience hubs, etc.? Figures 22.5 and 22.6 hints at such solutions but they are not discussed in the text.	We thank the reviewer for this comment, and we have added Clark et al., 2022 to our discussion of relocation in the Southeast. We have also added community centers/resilience hubs to our Figure 22.5
Jim	Titus	Text Region	22. Southeast		11	12	11	36	It might be worth citing some of the empirical quantifications concerning people moving out of harm's way, given the qualitative discussions. I'll mention results from a paper I know most about (Titus 2023), but there are other examples. In the United States, there are 21 counties where the number of people who have moved out of the land below 1m since 1990 is more than 1% of the entire population of the county, and all but 4 of them are in the Southeast. (All 7 of the counties where the number of people moving out of land below 1m is greater than 8% of the entire population of the county are in North Carolina or Louisiana (Titus Table 4). Although populations of inland floodplains have increased nationwide, there are a few hundred counties where populations in those floodplains have declined, and they are concentrated along the Mississippi River valley and the Appalachians, again largely in the southeast. (Titus Figure 3, Table S8-E). The total and Black populations within the 100-year floodplain of Edgecombe county (Princeville's county) each declined by about 1/3 in the last 30 years, amounting to 2% and 3.5% of the total and Black populations of the entire county. (Table S8-E). The emigration from hazardous areas has disproportionately occurred in Black communities. Nationwide, black residents account for 62% of total displacements from land below 1m, though they account for about 12% of the total population, that is, Black residents are almost 5 times as likely to have been displaced from low land; the displacement from inland floodplains is also disproportionate. (Titus abstract and Table 5). The emigration of Black residents from floodplains is most concentrated in the Southeast, especially New Orleans.	We thank the reviewer for this important equity-related context to relocation and emigration. We have added this to the discussion of other displacement evidence, namely green gentrification in Miami: There is evidence that points to the emigration of Black residents out of floodplains, particularly in the Southeast, including Edgecombe County, NC, where the Town of Princeville, cited in Box 22.2, is located (Titus 2023)
Juanita	Constible	Text Region	22. Southeast		11	11	14	22	Consider broadening the second category of adaptation to RELOCATION or similar (perhaps just RETREAT). Managed retreat is only one type of adaptive action that involves relocation; many people are currently moving (or trying to move) out of harm's way, but often they are doing in an individual way not supported by any government program and thus what is happening is arguably UNMANAGED retreat, or unassisted relocation. Even planned buyout programs rarely rise to the level of true managed retreat, because they tend to focus on individual real estate transactions and not consider replacement housing, receiving communities, community visions for the future, and other factors that are critical for actual managed reatreat programs.	We thank the reviewer for this suggestion, as broad categorization of climate change adaptation (i.e., protect, accommodate, managed retreat, and avoidance) has become widely used in the literature, a growing number of academics and residents involved in the act of relocation have acknowledged that managed retreat is one type of relocation and in fact, people have been moving away from hazardous areas since the beginning of recorded time. Furthermore, this movement is often unmanaged, to include to utilization of buyout funding that underemphasizes the identification or construction of replacement housing in which buyout participants may move. In response, we have broadened our discussion to simply refer to "retreat" instead of some particular kind of retreat.
Juanita	Constible	Text Region	22. Southeast		11	12	35	1	Southeast hazard mitigation plans are also not comprehensive for heat. Please see J. Constible, Hazard Planners Arent Planning for Heat Hazards, NRDC, December 2022, https://www.nrdc.org/experts/juanita-constible/hazard-planners-arent-planning-heat-hazards.	We thank the reviewer for suggesting an additional detail, we have accepted this suggestion.
Jenny	Brennan	Whole Page	22. Southeast		11				The Southeast has a wealth of tidal marsh that will need to migrate inland as sea levels rise in order to survive. Nearly two thirds of the East Coast,Âõs tidal wetlands lie within North Carolina, South Carolina, and Georgia alone. This expanse of marsh is a nationally significant resource, with major contributions to fishery economies, cultural heritage, carbon storage, and flood protection for our communities and numerous coastal military installations. Losing this resource would threaten the multi-generational communities, such as the Gullah Geechee, dependent on marshes for their livelihoods and culture as well as imperil the hundreds of species that support the coastal economy. Over 75 percent of the region,Âõs fishery species shelter in tidal wetlands at some point in their lifecycle. The seafood industry in Alabama, Georgia, South Carolina, North Carolina, and Virginia added a combined $968 million in economic value in 2019. Land and development behind salt marshes also benefit from these systems, and experience 20 percent fewer property damages during a storm. The immense amounts of carbon stored in marshes provides its own value, as it helps mitigate the emissions driving climate change. Research modeling managed retreat versus intensive shoreline armoring adaptation pathways shows that significantly more carbon storage is saved in a scenario allowing for and facilitating marsh migration. But without planning and action to accommodate marsh migration, such as the removal of man-made barriers that impede migration corridors, the marshland and the social systems that rely on its services are at risk. Given the importance of this resource to Southeast communities and their successful climate adaptation, we suggest that the final Southeast NCA5 chapter include a reference to the need for marsh migration. A discussion of marsh migration could be added to the section discussing accommodation and other community adaptation pathways (page 22-11). We encourage the chapter authors to consult the resources compiled in the South Atlantic Salt Marsh Initiative,Âõs Conservation Plan, which was created by over 300 stakeholders to ensure the conservation and restoration of salt marsh and the protection of marsh migration corridors within North Carolina, South Carolina, Georgia, and Florida.	We have addressed the importance of salt marshes in the Southeast by indicating their importance to both human and non-human communities and added the Osland et al 2022 citation which emphasizes the importance of making accommodations for marshes/wetlands to migrate upward as well as emphasizing the biodiversity and ecosystem services values they provide, in the context of rising sea levels. Also, we acknowledge that the South Atlantic Salt Marsh Initiative Conservation Plan referenced in the public comment will not be publicly available until the end of April 2023 which is outside of the NCA5 literature review window.
Juanita	Constible	Text Region	22. Southeast		12	12	11	38	Including buyouts in a section about adaptation tools is a good idea - they are, in fact, a tool for relocation or retreat rather than (as they are sometimes presented) managed retreat in and of themselves. However, the transition between lines 36 and 37 seems a bit jarring. This section might benefit from some framing about the different types of tools available, e.g., land use tools like buyouts, informational tools like resource clearinghouses, and planning tools like resilient design principles.	We thank the reviewer for the helpful comment. We have edited the beginning of this section to familiarize readers with the content that will follow: "Here we describe three general types of climate adaptation tools available to communities in the Southeast, including information clearinghouses, land use policies, as well as city design and planning."
Jim	Titus	Text Region	22. Southeast		12	12	11	36	These passages include some important issues concerning buyouts, but it would be better to present it within a broader context: Why should the government subsidize people who chose to live in hazardous areas? How does climate change alter the relative merits of governmental subsidies versus letting people bear the natural consequences of their decisions?	We thank the reviewer for this comment. We are not assessing the subjective "merit" of particular policy strategies with our chapter scope, and as such have retained the previously drafted language.
Juanita	Constible	Text Region	22. Southeast		12	12	15	16	Consider clarifying this sentence. Most federally funded buyouts in the U.S. do require that the acquired parcels are maintained as open space, so stating that they are not coupled with approaches to limiting future development is confusing. Perhaps clarify that they are not coupled with limiting future development in OTHER areas, e.g., for every X buyouts that remove a home from a floodplain, there are Y new homes constructed in other high-risk areas.	We thank the reviewer for the clarification, and have edited our language to include references to the lack of coordinated application of buyout open space as well as land use techniques that further restrict development in other flood-prone areas: "However, while buyouts do require that the land be converted to open space after purchase, applying other proactive land use planning techniques that guide development to less hazard-prone locations or limit future growth in these areas in the first place is rarely done." We have also added some citations which deepen the discussion around approaches to retreat and policy related to those techniques.
Juanita	Constible	Text Region	22. Southeast		12	12	25	29	Consider including compensation as one of the equity-related questions. In many areas, fair market value is not sufficient to pay for comparable, safer housing (see, e.g., community member's comments in https://www.washingtonpost.com/climate-environment/2022/10/25/flood-zone-homes-buyouts/).	We thank the reviewer for pointing out this particular equity framing to buyouts. We have added this to our narrative surrounding buyout programs: "to include whether the purchase of their home at its fair market value allows them to move to a similar size home located outside the floodplain..."

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Ariela	Zycherman	Text Region	22. Southeast		12	12	33	36	I do not feel that the Miami climate gentrification studies adequately acknowledge that gentrification and increasing property values in higher elevation areas was already occurring prior to widespread recognition of sea level rise. Just as in other cities, increasing interest in living in historic central city neighborhoods began fueling rising property values in the late 90's - early 2000's. As property became prohibitively expensive on the coast, more inland Black and Brown neighborhoods, which happen to be on higher ground because of patterns of development and segregation beginning early in the 1900's, became targets for gentrification because of lower property values and encouragement from local officials who wanted to revitalize urban core neighborhoods. While SLR may be a contributor now, there is debate over how much, and it is most likely exacerbating rather than the primary driver of displacement. Even if the end result is the same, it's important to acknowledge more nuanced drivers to avoid an environmentally deterministic perpsective. See https://theconversation.com/whats-really-driving-climate-gentrification-in-miami-it-isnt-fear-of-sea-level-rise-191737	Thank you for this comment. We have added "although the exact pressures driving gentrification within any community are complex in both time and geography" and added references to Melix et al., 2022 and Anguelovski et al., 2022, which discuss these differential pressures across geographies in Florida.
Juanita	Constible	Text Region	22. Southeast		12	13	37	11	The paragraphs about resource clearinghouses and resilient design principles do not include any discussion of equity. Consider explaining how these paragraphs fit under the header of Uneven Use of Tools at Hand to Ensure Equitable Adaptation. For example, is it because not all communities have access to these tools, is it because equity considerations are not incorporated into the tools themselves, is it because they are applied unevenly, etc.	We thank the reviewer for this comment. Our intent was to simply identify that there are clearinghouses for resilience information as well as design strategies for resilience, but lacked any specific call-out to equity-centered frameworks that may exist. We have now added a reference to: American Public Health Association & Centers for Disease Control and Prevention. (2021). "Climate Change and Health Playbook: Adaptation Planning for Justice, Equity, Diversity and Inclusion." Which we will also now reference in our Health-related KM. Also, we have added a sentence to this discussion that reads: "However, inequitable access to resources and constraints on workforce capacity to effectively use these tools can also lead to unequal progress toward implementing strategies across communities."
Jenny	Brennan	Whole Page	22. Southeast		14				The chapter generally covers the disproportionate burden climate change places on communities already facing other social or financial stressors very well, and it does an excellent job covering the perspective of Indigenous communities. While the draft chapter makes references to Black communities facing climate challenges, it misses the opportunity to detail the distinct story of Gullah-Geechee peoples and heirs,Âô property communities. These communities are unique to the culture and history of the Southeast, and therefore are an important part of the region,Âõs climate adaptation. Gullah-Geechee and heirs,Âô property residents face an outsized threat from climate change due to their concentration along the coast, and these communities increasingly face development pressures threatening their land. The Southeast NCA5 chapter is a chance to elevate their voice and concerns. Gullah-Geechee communities were historically found along sea islands from Jacksonville, Florida to Wilmington, North Carolina, and are made up of descendants of formerly enslaved peoples who made their living connected to the land and water. Many Gullah-Geechee residents pass down land as heirs,Âô property, although heirs,Âô property is found outside of the Gullah-Geechee corridor as well. It is estimated that heirs,Âô property constitutes approximately 3.5 million acres in the South, representing nearly a third of the total area of Black-owned land. Studies in North Carolina, Alabama, and coastal South Carolina counties found that heirs,Âô property can make up between 50 and 88 percent of Black-owned land. These historic communities are under compounded threats from rising waters and impinging development. Forced partition sale of heirs,Âô property often leads to land loss because a partial owner does not need to secure the consent of the other owners to force a sale, and owners are often unable to compete with offers from developers. Several notable developments in coastal South Carolina, for example, lie on former heirs,Âô property. Many remaining heirs,Âô property communities lie in unincorporated areas, an additional barrier that can make it difficult to access resources such as disaster recovery assistance and wastewater treatment. While the chapter has a breakout box (page 22-14) on the buyouts and managed retreat of Princeville, NC, an heirs ÂÔ property community though it is not specifically named as such in the text, the box	We thank the reviewer for suggesting this important addition to our narrative. We have brought on an additional Gullah Geechee Technical Contributor to provide context on how their ad-hoc subcommittee on natural resources teamed up with FEMA to change policy related to heirs' property disaster aid. Also, we have added a bit more context to the Princeville case study to highlight the unique combination of approaches used to move people out of harm's way.
Juanita	Constible	Text Region	22. Southeast		16	16	8	9	The use of the term of communities of color in the last sentence of the paragraph is confusing, given that the rest of the text is about the disproportionate harms felt by Black people with respect to OTHER communities of color.	We thank the reviewer for this attention to detail. We have changed "communities of color" to be more specific and refer to "Black communities in the Southeast."
Juanita	Constible	Text Region	22. Southeast		16	16	9	11	The sentence starting on line 9 is misleading because it makes it seem like there are federal occupational heat standards, which there are not. In fact, the link that Shire et al originally accessed in 2019 now dissuades employers from using the heat index at all. The more accurate way to phrase the sentence would be something along these lines: Most work-related heat illnesses across five Southeast states occurred below the heat index range designated as dangerous by the National Weather Service in the southernmost part of the Southeast.	We thank the reviewer for this critical specificity. We have taken their suggestion nearly verbatim.
Juanita	Constible	Text Region	22. Southeast		16	16	11	15	Please consider including pregnant people in the list of those at particular risk. There is accumulating evidence of the link between extreme heat and negative birth outcomes across the country and in the southeast. E.g., Ji-Young Son et al., Exposure to heat during pregnancy and preterm birth in North Carolina: Main effect and disparities by residential greenness, urbanicity, and socioeconomic status, Environmental Research, Volume 204, Part C (2022), 112315. David A. Savitz, Hui Hu, Ambient heat and stillbirth in Northern and Central Florida, Environmental Research, Volume 199 (2021): 111262.	Thank you for pointing this out. We agree with your comment and have made adjustments to be more inclusive of these populations.
Jim	Titus	Text Region	22. Southeast		16	16	24	27	The sentence would be accurate if the authors cut the following text "such as redlining,Âîthe New Deal-era practice of classifying communities with significant Black, Asian, and immigrant populations as hazardous for financial investment". Alternatively, the sentence could be rewritten to make two separate points. Redlining was not really a segregation policy--it was a financing policy based in part on pre-existing segregation. Whether that financing policy left lingering effects, those effects are on the subsequent investments; by contrast the other policies in the sentence channeled who lived there.	We thank the reviewer for this comment but disagree that redlining was not a form of de jure segregation, or segregation that was mandated in some ways by law; and it was at best an example of de facto segregation. We have added both of these qualifiers here for specificity.
Thomas	Knutson	Text Region	22. Southeast		19		1		Add here that an anthropogenic influence on summertime WBGT has been detected over parts of the southeast U.S., based on increasing trends over 1973-2012; WBGT trends were more detectable than temperature trends alone. (See Fig. 5a of Knutson and Ploshay 2016, supported by attributable human influence on WBGT over eastern North America in Li et al. 2017, their Fig. 4). WBGT trends over 1973-2012 were more detectable than surface temperature trends in these studies. Large increases of summer WBGT are projected for the coming century for the eastern North America region (Li et al. 2017). This is notable because the southeast U.S. is a relatively hot and humid region to begin with. References: Knutson, T.R., Ploshay, J.J. Detection of anthropogenic influence on a summertime heat stress index. Climatic Change 138, 25-39 (2016). https://doi.org/10.1007/s10584-016-1708-z Li, C., Zhang, X., Zwiers, F., Fang, Y. and Michalak, A.M. (2017), Recent Very Hot Summers in Northern Hemispheric Land Areas Measured by Wet Bulb Globe Temperature Will Be the Norm Within 20 Years. Earth's Future, 5: 1203-1216. https://doi.org/10.1002/2017EF000639	We thank the reviewer for these additional important references, and have added them appropriately within our discussion of WBGT trends in the region.
Juanita	Constible	Text Region	22. Southeast		21	22	35	8	It is important to mention that there is a lot of uncertainty about future case counts of tick-borne illnesses in the Southeast. The suitable range may shrink in some areas under hotter, dryer conditions. Southeast ticks also have unique questing behavior and host preference. E.g., these references: Ginsberg et al. (2021) Why Lyme disease is common in the northern US, but rare in the south: The roles of host choice, host-seeking behavior, and tick density. PLoS Biol 19(1): e3001066. Couper et al.¬†Impact of prior and projected climate change on US Lyme disease incidence.¬†Glob Change Biol.¬†2021;¬†27:¬†738-754.¬†Alkishe A, Raghavan RK, Peterson AT. Likely Geographic Distributional Shifts among Medically Important Tick Species and Tick-Associated Diseases under Climate Change in North America: A Review.¬†Insects. 2021; 12(3):225.	Thank you for your comment. The language has been adjusted to include details about the variation in tick models and factors that can affect disease abundance.
Ariela	Zycherman	Text Region	22. Southeast		25	25	12	19	The Southeast has many migrant farmworkers, most of whom are Latino, many live in substandard housing, are more exposed to heat and can't access relief after disasters. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8168948/	We thank the reviewer for this important context, and have added the Castillo et al. reference to our citations as well as added to the narrative that farm workers tend to be Latino migrants.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Juanita	Constible	Text Region	22. Southeast		25	25	13	14	Please consider adding some assessment of current labor losses due to heat, and projections of future labor losses. E.g., the Lancet Countdown and the 2021 EPA report titled Climate Change and Social Vulnerability in the United States.	We thank the reviewer and have added a short assessment of three available lines of evidence, all of which point to future labor loss due to extreme heat becoming worse.
Jim	Titus	Figure	22. Southeast		26		1		Figure 22.14. The units are not clear at all. Annual costs per what? Annual cost per mile of rail or road? Annual cost per square mile of land? Even with units, it is hard to know what to think unless one knows what the baseline costs are. So it might be better to show this as incremental cost due to climate changes as a percentage of the total cost of maintainenance.	We thank the reviewer for their interest in this figure and helpful comment. We have added detail to the figure and the caption which describe that these costs are additional annual average costs relative to the 1986-2005 time period, in line with the study from which the figure was adapted.
Jenny	Brennan	Figure	22. Southeast		26	26	1	6	This figure will be helpful but the current description makes it hard to determine the differences/actions between the "no adaptation" and "proactive adaptation" panels.	Thank you to the reviewer for the helpful comment. We have added considerably to this caption to further explain what is meant by and particular examples of Proactive Adaptation, including: "Proactive adaptation – or anticipating climate risks and investing up front in strengthening these systems before damage occurs - could reduce, but not eliminate, these damages costs significantly (bottom panels). Proactive adaptation could include temperature sensors for rail road track and reducing disruption times for roads undergoing repairs."
Juanita	Constible	Text Region	22. Southeast		27	28	6	3	Please consider adding at least a few sentences to this section about the impacts of climate change on the people in supply chains, not just the transportation systems. E.g., the impact of heat and wildfire smoke on supply chain workers such as those engaged in last mile delivery or on airplane tarmacs.	We thank the reviewer for the comment. We have added language to this section of our narrative that speaks to additional impacts on livelihoods related to supply chains, worker exposure, and last-mile delivery considerations, adding several more references to our citation list.
Juanita	Constible	Text Region	22. Southeast		29	29	10	13	Please consider expanding the thought in the last sentence with a phrase or sentence about how the job opportunities will be particularly meaningful if they contribute to wealth-building in economically marginalized communities that are also facing disproportionate climate risks.	We thank the reviewer for this comment. We believe this to be outside of our chapter's scope. We are not assessing whether a particular economic policy will be perceived as relatively more meaningful versus another potential policy. We thank the reviewer for suggesting this change but have retained our present narrative.
Benita Lily	Cheng	Text Region	22. Southeast		29	29	12	13	please add that providing local job training in these areas of expertise will be key to providing meaningful job opportunities in a just transition.	We appreciate the reviewer's comment, and believe that this is a good point. Upon review of the Economics Chapter (Ch. 19), we feel that the topic is covered in much more detail there than we can in the Southeast Chapter given space constraints. We have added a parenthetical reference for readers to check out Chapter 19.
Thomas	Knutson	Text Region	22. Southeast		29	29	15	17	Droughts have been occurring but is drought hazard expected to worsen due to anthropogenic climate change in the southeast? Is there high confidence in this assessment? There are some differing results in the literature on this topic. For example, Su et al (2021) find that there has been a significant decreasing trend in dry area coverage in the southeast U.S. over the past century, based on the reconstructed column soil moisture analysis of Su et al. 2021 (See their Fig. 4). Meanwhile Apruv et al. (2019) find evidence for an increase in drought severity (not frequency) in the southeast in recent decades, with their drought severity index at its maximum for the 20th century in the period since about the mid-1980s. Refs: Su, L., Cao, Q., Xiao, M., Mocko, D. M., Barlage, M., Li, D., Peters-Lidard, C. D., & Lettenmaier, D. P. (2021). Drought Variability over the Conterminous United States for the Past Century, Journal of Hydrometeorology, 22(5), 1153-1168. https://journals.ametsoc.org/view/journals/hydr/22/5/JHM-D-20-0158.1.xml; Apurv, T., Cai, X., & Yuan, X. (2019). Influence of Internal Variability and Global Warming on Multidecadal Changes in Regional Drought Severity over the Continental United States, Journal of Hydrometeorology, 20(3), 411-429. https://journals.ametsoc.org/view/journals/hydr/20/3/jhm-d-18-0167_1.xml	We thank the reviewers for their comments. Su el al. (2021) looked primarily at major droughts, but many lesser droughts and flash droughts also occur and these are expected to become more severe, as discussed in Apurv et al. (2019) and others. This is expected to lead to an overall increase in harm to agriculture and food systems. We have adjusted the confidence on changes of drought as presented in our narrative and Traceable Accounts to recognize that recent studies show differing results. We have added a sentence to acknowledge the increase in drought intensity shown by Apurv et al.: "Longer-term droughts in the Southeast appear to be increasing in severity but do not appear to be occurring more frequently (Apurv et al. (2019)." We have also added a discussion around assigning likelihood and severity of impacts within our Traceable Accounts for KM22.4.
Cathy	Day	Text Region	22. Southeast		29	29	20	21	Key Message 22.4 Food Systems and Agriculture clearly omits the potential for organic,Äîand indeed other agroecological approaches,Äîto help food systems adapt to climate impacts. We might recommend the following modification to this statement: o‚Äúhowever, innovative agricultural techniques such as organic farming, advanced grazing management and silvopasture, agroforestry, and other agroecological systems, as well as precision farming show promise for adapting to future climate changes in the region.‚Äù	We appreciate the reviewers' comments about the value of organic farming, agroforestry, etc. to improve our adaptation to climate change. We have added a sentence to the section on "How Agriculture and Food Systems Are Adapting to Climate Change" to recognize the importance of all of these methods as listed above, including a new reference added to our citation list.
Emma	Conrad-Rooney	Text Region	22. Southeast		29	29	32	32	The sentence "Climate change stresses agriculture and food systems" should cite Chapter 11, the Agriculture chapter.	We appreciate this comment and have added a parenthetical reference to the Agriculture chapter.
Jenny	Brennan	Whole Page	22. Southeast		29				A significant percentage of poultry and swine Concentrated Animal Feeding Operations (‚ÄúCAFOs‚Äù) and their associated waste lagoons are located in Southeast states subject to extreme rainfall from unnamed storms and hurricane systems. The chapter discusses the socioeconomic impacts of climate change on agriculture (page 22-29), but does not discuss the outsized hazard of certain agricultural facilities being subject to increased flooding. We suggest adding a reference to the need for CAFO systems to prepare for larger storms driven by climate change. CAFOs threaten surrounding communities in two ways in large storms. First, swine CAFOs pump excessive amounts of untreated waste from their lagoons in anticipation of heavy storms in an effort to prevent lagoon overflows or breaches. That waste then runs off of saturated fields during the storm. Second, even those extreme efforts fail to protect all lagoons. During Hurricanes Matthew and Florence in North Carolina, CAFO lagoon breaches caused a significant public health and environmental hazard that drew national attention to the state.5 By planning for these events and mitigating for hazards before a disaster strikes, such as by increasing the rainfall capacity of waste lagoons or transitioning to actual waste treatment systems that would not be vulnerable to heavy rainfall, the farmers, residents, and ecosystem would benefit.	We thank the reviewer for this comment and have added a sentence and a citation to our discussion of climate stressors that: " For example, Following Hurricane Florence, swine feces markers were detected in surface waters in North Carolina, suggesting that management practices should be explored in areas at risk of increased extreme precipitation (Harris et al., 2021)."
Meredith	Muth	Text Region	22. Southeast		30	30	11	14	This sentence on drought refers to Figure 22.16. However, that figure is not relevant to this statement.	We thank the reviewer for their comment. We have removed the reference to the figure since it has been removed from the current document due to space considerations.
Cathy	Day	Text Region	22. Southeast		31	31	12	16	It is worth mentioning here that the organic method is well suited to smaller scale operations, and that the USDA National Organic Certification Cost-share and the new Organic Transition Initiative (OTI), combined with NRCS financial support for conservation practices through EQIP and CSP can make organic more feasible for those with limited resources. Soil health-based organic systems can also reduce input costs.	Thank you for your comment. We have added a sentence to the end of the paragraph to address the usefulness of techniques such as organic farming for small-scale farmers, citing two new references.
Juanita	Constible	Figure	22. Southeast		31				This figure does not seem to support the intended point. There are no data in the figure to back up the assertion in the title that Black farmers are more common in the Southeast than other regions in the country. Furthermore, the worst exposures in the left panel generally do not seem to line up with the highest concentrations of Black-owned farms in the right panel of the figure. It seems that either the wording in the title and the caption should be changed or that a different dataset is needed. Also, if you keep the right panel, please add more detail to the legend (i.e., what is included in the percentage of total farms, as well as the year(s) of the data underlying the map).	We thank the reviewer for this comment and have significantly improved this figure with their feedback. We have updated the figure to be a bivariate choropleth map which shows more clearly where high percentages of Black farmers overlap with areas that have higher counts of drought events. We have also updated our caption to reflect that these data on percentage of Black farmers is from the USDA and that the South is in fact the region with the highest percentage of Black farmers.
Meredith	Muth	Text Region	22. Southeast		32	32	7	15	The recent record low river levels in the lower Mississippi (Fall 2022) were incredibly significant in terms of economic impacts on navigation and shipping. These low river levels were caused by several factors including a multi-year drought in the Missouri River Basin and a more recent ‚Äòflash drought,Äô in the Ohio River Basin. This is a very compelling example of 'regional dependencies' and would be worth highlighting if you can find the supporting statements. This webinar recap provides some additional details: https://www.drought.gov/webinars/lower-mississippi-river-basin-special-drought-webinar.	We thank the reviewer for reminding us of the impact of the 2022 low flows on the Mississippi and its impact on navigation and transport. While there is little published research on this topic yet, we have added "droughts" to the sentence on the impacts of flooding to recognize the potential negative impact of future droughts upstream on transportation of food and other products into and out of the area and have added three references, including two government studies about the impacts of these conditions on the economy, to the end of the sentence to highlight this. Furthermore, we have added an image of these droughts' impact on river navigation in the Economics Key Message, Figure 22.14 Panel D. Also, we have added that low-flow condition research is an important knowledge gap and uncertainty in our Traceable Accounts.
Cathy	Day	Text Region	22. Southeast		32	32	27	27	The text states that, ‚ÄúGenetically modified organisms and new cultivars of perennial crops,Äù can provide additional resilience to climate impacts in the Southeast. How do GMOs provide resilience? Most GMO crops are engineered for herbicide resistance and/or Bt bioinsecticide content, both of which pose some resilience concerns.	We thank the reviewer for their comments. GMOs can help reduce greenhouse gas emissions through reduced inputs like fertilizers and reduced changes to land use. We have edited the sentence to make this clearer and added a reference to support it.
Cathy	Day	Whole Page	22. Southeast		33				We appreciate the inclusion of stories about Indigenous communities,Äîboth their increased vulnerability and their knowledge, skill, experience, and history with land management and with native plants. These stories are revealing and provide a roadmap toward increased climate justice, including racial justice, GHG mitigation, and resilience. These stories should be elevated as a call for support for reparations and returning land to Indigenous communities.	Thank you for your comment however we cannot prescribe or advocate for a particular policy

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Thomas	Knutson	Traceable Account	22. Southeast		39	39	13	36	With respect to drought, this text contains only a vague traceable account statement, without references, supporting the notion of increased drought risk in the southeast region due to anthropogenic climate change. Perhaps it is referring to drought intensity and not frequency? This seems to be a low or medium confidence result in any case, and could be a topic mentioned under "Major Uncertainties and Research Gaps". For example, the historical drought reconstruction study of Su et al. (2021) suggests there has been a significant decreasing trend in dry area coverage in the southeast U.S. over the past century, according to their column soil moisture-based analysis (See their Fig. 4). Meanwhile Apruv et al. (2019) find evidence for an increase in drought severity in the southeast in recent decades, with their drought severity index at its maximum for the 20th century in the period since about the mid-1980s. Refs: Su, L., Cao, Q., Xiao, M., Mocko, D. M., Barlage, M., Li, D., Peters-Lidard, C. D., & Lettenmaier, D. P. (2021). Drought Variability over the Conterminous United States for the Past Century, Journal of Hydrometeorology, 22(5), 1153-1168.https://journals.ametsoc.org/view/journals/hydr/22/5/JHM-D-20-0158.1.xml; Apurv, T., Cai, X., & Yuan, X. (2019). Influence of Internal Variability and Global Warming on Multidecadal Changes in Regional Drought Severity over the Continental United States, Journal of Hydrometeorology, 20(3), 411-429. https://journals.ametsoc.org/view/journals/hydr/20/3/jhm-d-18-0167_1.xml	We thank the commenter for their remarks. We have considered the suggested research and added additional references to the text of the chapter and to the traceable accounts to indicate the expected trends and uncertainties in drought severity in the region in the future.
Cathy	Day	Text Region	22. Southeast		40	40	1	3	Under the discussion of uncertainties and research gaps in food systems and agriculture, ‚Äúuncertainty in the knowledge of carbon interactions between soil and crops,Âù is cited. This statement would be strengthened by specifically addressing the central role that soil microbiomes play in this interaction, in soil carbon sequestration (especially conversion of root exudate carbon into mineral associated organic matter). In addition, this is yet another opportunity for legitimate promotion of organic as part of the solution, e.g.: o‚Äúthe organic agriculture method codified in the USDA National Organic Standards protects the soil microbiome by excluding the use of most synthetic inputs and mandating the use of crop rotations, cover crops, and plant and animal materials to nourish both soil microbes and crops. This approach can help to optimize the soil,Âôs biological functions of sequestering and stabilizing soil organic carbon and delivering nitrogen and other nutrients to crops more efficiently with minimal losses to leaching and N2O emissions.‚Äù	We thank the reviewer for their comments. We recognize the value of organic farming techniques to improve the soil and have included organic farming and other innovative techniques in the text of the chapter as well as in the traceable account. However, a complete discussion of this topic is beyond the scope of NCA5 due to its complexity and so we have not expanded on it here.
Cathy	Day	Text Region	22. Southeast		40	40	4	5	Text cites ‚Äúchanges in market pricing and availability of inputs such as fertilizer,Âù as uncertainties related to climate adaptation. It is worth mentioning here that organic nutrient management strategies that take full account of the capacity of healthy, biologically active soils to provide nitrogen and other crop nutrients through mineralization of organic matter can greatly reduce fertilizer needs and hence reduce both production costs and vulnerability to fertilizer market fluctuations.	We thank the reviewer for their comments about the value of organic farming to climate adaptation. We have added references to highlight this to the Traceable Accounts as well as in the chapter text.
Juanita	Constible	Text Region	22. Southeast		41	41	6	7	The Alesch et al. citation needs additional information.	Thank you for this comment. We added a URL to the citation in the reference list.
Juanita	Constible	Text Region	22. Southeast		42	42	35	36	The link to Becker and McKibben directs to a login page. The citation also seems incomplete.	Thank you for this comment. The citation has been updated in the reference list.
Juanita	Constible	Text Region	22. Southeast		43	43	11	12	The Binder and Greer citation needs additional information.	Thank you for this comment. The citation has been updated in the reference list.
Juanita	Constible	Text Region	22. Southeast		50	50	37	37	The Harvard citation would benefit from additional information.	Thank you for this comment. The citation has been updated in the reference list.
Glenn	Branch	Whole Chapter	22. Southeast						A discussion of climate change education and outreach efforts in this region is needed. (Note that the chapter on the Southern Great Plains includes a brief discussion of climate change education on ch. 26, pp. 31-32.) Education and outreach efforts are foundational to topics discussed in this chapter, including: * livelihoods and economies, since a goal of education is to prepare the workers and consumers of the future, which will be transformed by the effects of climate change; * human health and well-being, since educators play a role in ensuring the intellectual, psychological, and social health of their students in the face of climate change; and * planning and adaptation, which require policymakers and voters to grasp the scientific and social issues involved in meeting the challenges posed by climate change. While it would be best for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change, it would help for this chapter to discuss the situation specifically in its region.	We thank the reviewer for the careful review of our chapter and suggesting we add information about education. We have added a sentence with several new citations that reads: "A growing number of communities throughout the Southeast are working out how to communicate about climate change science across a variety of societal applications in both formal (classroom) and informal (outside of classrooms) learning contexts (Buckley and Moore-Driskell, 2021; Bartels et al., 2012; Stewart, 2022; Panos and Sherry, 2023; McNeal et al., 2014; Monroe et al., 2013;),"
Charles	Keeling	Whole Chapter	22. Southeast						A discussion of climate change education should be included similar to the one in chapter 26, pp. 31-32.	We thank the reviewer for the careful review of our chapter and suggesting we add information about education. We have added a sentence with several new citations that reads: "A growing number of communities throughout the Southeast are working out how to communicate about climate change science across a variety of societal applications in both formal (classroom) and informal (outside of classrooms) learning contexts (Buckley and Moore-Driskell, 2021; Bartels et al., 2012; Stewart, 2022; Panos and Sherry, 2023; McNeal et al., 2014; Monroe et al., 2013;),"
Emma	Conrad-Rooney	Whole Chapter	22. Southeast						Key messages 1 and 2 should be revised to follow the Risk-Based Framework.	Response: We thank the reviewer for the input on developing our Key Messages to reflect Risk-Based Framing. From our author guidance document, "The RBF approach...[lays] out the areas of vulnerability and then examining the probability that climate changes over the next 100 years (together with other factors) could reach levels that result in serious consequences. Risk-based framing encourages authors to consider complex, interconnected risks that can cascade across systems and regions." Both Key Messages 22.1 and 22.2 begin with discussions of unique regional characteristics that are complex and interconnected to climate risks in the Southeast. We have updated our KMs to address other comments, but we strongly believe we have adequately presented this material in a risk-based framing already.
Brittany	Gutermuth	Whole Chapter	22. Southeast						Climate change education is explicitly discussed in ch. 26, pp. 31 (line 18-27)- 32 (line 1-2), it should be addressed here as well.	Policy relevant, not policy prescriptive.
Salil	Mahajan	Whole Chapter	22. Southeast						While the effect of ENSO is discussed in the report, the diversity and changing nature of ENSO and thus the challenges it poses for quantifying its teleconnections in the present and the future has attracted little attention here. Future climate projections suggest that with warming of the Eastern Pacific, the frequency of Eastern Pacific flavor of ENSO is likely to increase (e.g. Williams and Patricola 2018). The plausible impacts of these changes, particularly over Southwest US and Southeast US (e.g. Patricola et al. 2020) have not been reported here. Also, the capability of state-of-the-art models in capturing ENSO teleconnections are not included. For example, a recent study shows that the global high-resolution version of E3SM can capture the observed ENSO teleconnection to precipitation mean and extremes over the Southeast-US better than its low-resolution counterpart (Mahajan et al. 2022). Although model resolution sensitivity is not always clear (Molteni et al. 2021). References: Mahajan, S., Tang, Q., Keen, N. D., Golaz, J., & van Roekel, L. P. (2022). Simulation of ENSO Teleconnections to Precipitation Extremes over the United States in the High-Resolution Version of E3SM, Journal of Climate, 35(11), 3371-3393 Molteni, F., and Coauthors, 2020: Boreal-winter teleconnections with tropical Indo-Pacific rainfall in HighResMIP historical simulations from the PRIMAVERA project. Climate Dyn., 55, 1843,Äì1873, https://doi.org/10.1007/s00382-020-05358-4. Patricola, C. M., J. P. O‚ÄôBrien, M. D. Risser, A. M. Rhoades, T. A. O‚ÄôBrien, P. A. Ullrich, D. A. Stone, and W. D. Collins, 2020: Maximizing ENSO as a source of western US hydroclimate predictability. Climate Dyn., 54, 351,Äì372, https://doi.org/10.1007/s00382-019-05004-8. Williams IN, Patricola CM (2018) Diversity of ENSO events unified by convective threshold sea surface temperature: A nonlinear ENSO index. Geophys Res Lett 45:9236,Äì9244	Response: We thank the reviewer for pointing out our lack of ENSO-related We have added the Patricola and Mahajan references to our discussion on precipitation in the South "There have been significant improvements in understanding how non-tropical systems (Bishop et al., 2019), atmospheric rivers (Gershunov et al., 2017; Mahoney et al., 2016; Maxwell et al., 2017; Miller et al., 2018, 2019), past and future El Niño-Southern Oscillation patterns (Patricola et al., 2020; Mahajan et al., 2022); flash flooding (Alipour et al., 2020; Khajehei et al., 2020), and urban environments (Debbage & Shepherd, 2019; Forney et al., 2022; Liu & Niyogi, 2019; McLeod et al., 2017; Naylor & Kennedy, 2021) add to the Southeast's extreme precipitation and flood risk."

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Juanita	Constible	Whole Chapter	22. Southeast						Thank you for the strong emphasis on equity through this chapter, including the connection to historical drivers of climate vulnerability.	We thank the reviewer for this comment.
Juanita	Constible	Whole Chapter	22. Southeast						It is confusing to have the adaptation discussion split up. Furthermore, encountering the first part of the adaptation discussion before the health impacts section reinforces the view that adaptation mostly requires structural solutions instead of a mix of structural solutions and social infrastructure (including better governance). Please consider combining the adaptation pieces together in one section that appears after the discussion of climate impacts.	We thank the reviewer for this comment, but have chosen to retain our original structure. We have received a lot of support and praise for how we have chosen to interweave climate stressors with climate impacts into a cohesive narrative.
Juanita	Constible	Whole Chapter	22. Southeast						In addition to our specific comments on this chapter, we urge the authors to consider the comments submitted by the Southern Environmental Law Center. Their comments raise several additional topics that are important to include when describing the effects of climate change in this region.	We thank the reviewers for submitting this and other comments. We have incorporated many of the SELC's suggestions throughout the chapter.
Richard	McNider	Whole Chapter	22. Southeast						You would be well served by reading this excellent summary for Alabama. https://www.nsstc.uah.edu/aosc/climatechangePDF/AlabamaClimatePracticalGuide_hires.pdf	Thank you for this comment. However, without any action recommended by the commenter, we have not changed anything in response to this comment.
Jenny	Brennan	Whole Chapter	22. Southeast						The National Climate Assessment is a resource of national and global significance, and its products are useful for a wide array of researchers, non-governmental organizations, state and local governments, and community members. We have found that, in application, federal agencies are not always utilizing the information from this assessment in their own work, which results in inconsistencies with the implementation of climate action. Several U.S. Army Corps of Engineers districts in our region, for example, choose to utilize sea level rise scenarios from an older 2013 study that can significantly underestimate sea level rise rates compared to the NOAA estimates incorporated into the assessment. It is important that the Administration ensures that the latest assessment is being incorporated into the work of federal agencies, for everything from policy creation, to infrastructure planning, to permitting	We thank the reviewer for this comment. While we also hope that this chapter is used to improve the resilience of our communities, we cannot prescribe policy as part of our assessment.
Jenny	Brennan	Whole Chapter	22. Southeast						Expanding upon a firm foundation from the 2018 4th National Climate Assessment, the Southeast Chapter of NCA5 explores the primary climate challenges facing communities in the region and the uneven response to these stressors to-date. The focus on social justice and equitable adaptation threaded throughout the chapter helps highlight the experiences and unique stressors faced by diverse groups within our region, including Black, Indigenous, and People of Color (‚ÁúBIPOC‚Äù) communities as well as renters, rural residents, and small farmers, among other residents. The chapter details issues not heavily featured in the previous regional assessment, including health impacts from extreme heat, economic vulnerabilities, threats to water supply, harmful algal blooms, food systems and agriculture, and community adaptation pathways. While we recognize that the chapter is not meant to cover every climate issue at play in the Southeast, there are a few notable examples not covered in the chapter that are particularly relevant to the region. We suggest that the following issues are incorporated into the final draft of the NCA5 Southeast chapter.	We thank the reviewer for this comment and have sought to include as many of these suggestions as possible.
Cathy	Day	Whole Chapter	22. Southeast						Throughout this chapter, racial equity issues are featured front and center ‚Äì both for Black and for Indigenous farmers and communities. The whole chapter gives an eloquent message regarding the history of colonialism, enslavement, dispossession, etc, as well as the wisdom embodied and carried by BIPOC agriculturists and communities. We thank the authors for this, and reflect that the imperatives cited here for the Southeast apply to all regions across the US, although the details of history and agricultural tradition vary with region.	We thank the reviewer for this comment.
Jim	Titus	Whole Chapter	22. Southeast						It would be helpful for this chapter to provide more specific facts at the state level, including tables or maps that quantify impacts and location-specific expectations. It is important to do so because some federal agencies will create state-specific fact sheets about the impacts of climate change. To avoid the accusation of cherry picking, these agencies are often limited to using the facts presented by IPCC, NAS, and the National Assessment, which as a practical matter, usually means that NCA is the main source.	We thank the reviewer for this comment, but state-level summaries of the regional information are beyond the scope of the NCA5 mandate. However, the NCEI already provides state climate summaries in an annually-updated format that can be used alongside NCA5 for their expressed purposes.
Reid	Sherman	Text Region	23. US Caribbean		5	5	5	5	Suggest rewording the sentence beginning in line 5 to "These islands are particularly vulnerable to extreme weather events that are being exacerbated by human-driven climate change, and there is increased potential for impacts because people, cities, and critical infrastructure are often located in the most vulnerable locations."	We appreciate the reviewer's suggestion. The authors reworded the sentence to incorporate the suggestion.
Ariela	Zycherman	Text Region	23. US Caribbean		5	6	28	18	I appreciate the detailed discussion of the social factors that contribute to increased exposure and susceptibility to disasters and climate change. Suggest coordinating with Ch. 20 and others on the phrasing used for "social vulnerability."	Thank you for this comment. The authors discussed the phrase "social vulnerability" with ch. 20. They advised the authors to keep using the concept and add a definition. They also recommended to add text refering to their wording of exposure, hazards and overburden. These changes were added and the chapters will cross-reference for consistency.
Reid	Sherman	Text Region	23. US Caribbean		5	5	29	29	"is" should be "are"	After consideration, the author team determined that the verb should be is because it refers to social vulnerability.
Reid	Sherman	Text Region	23. US Caribbean		6	6	24	24	Update citation to "Puerto Rico Climate Change Council. 2022"	We have updated the citation to Puerto Rico Climate Change Council, 2022, and added additional citations/references to relate to the assessment of observed and projected climate-related trends.
Thomas	Knutson	Text Region	23. US Caribbean		7	7	3	4	Suggested rewording, based on WMO team assessment of Knutson et al. 2020 for the Atlantic basin TCs (see their Fig. 5): "Tropical cyclone rainfall rates and intensities are projected to increase, and the number of intense tropical cyclones (Categories 4 and 5) may increase as well." (If you want to added numbers for these projections, for a 2 deg global warming scenario and the Atlantic basin, the TC rain rate is projected to increase about 15% and the average TC wind intensity is projected to increase about 3%. As a caveat, that assessment was for the Atlantic basin as whole and not the U.S. Caribbean region in particular.) You may also add the following: "There is some observational evidence from some observing stations in Puerto Rico for a long-term climate change influence on tropical cyclone rainfall (1956-2016), increasing the likelihood of extreme events like Hurricane Maria's rainfall (Keellings and Ayala 2019)." (The reference is already in your list, but this aspect is not well-elaborated in the draft chapter.)	We appreciate the reviewer's comments about tropical cyclones. The text was changed to reflect more specific changes regarding rainfall rates and wind intensities within the Atlantic basin with global warming. We also added a statement about observed rainfall associated with tropical cyclones within Puerto Rico increasing over the climatological record.
Emma	Conrad-Rooney	Text Region	23. US Caribbean		8	8	10	19	Key Message 23.1 should be revised to follow a Risk-Based Framework.	The authors discussed this recommendation. The adaptation and response efforts are still limited and we could not find any evidence-based literature to support this part of the request. The authors to maintain the current content and focus on the main key message.
kottie	christie-blick	Text Region	23. US Caribbean		9	9	13	14	Increased education for all stakeholders is imperative, including the youth. The US Caribbean has adopted the Next Generation Science Standards. These standards are designed to create scientifically literate Americans. As such, they help learners understand ways in which humans impact Earth's resources and environment. There is a great need for schools to fully adopt and implement these standards, and for educators to be trained to teach the core ideas, concepts, and practices to their learners at an age-appropriate level. https://www.nextgenscience.org/search/node/Earth%20and%20Human%20Activity https://www.cga.ct.gov/2019/ba/pdf/2019HB-07083-R011014-BA.pdf	We appreciate the reviewer's comment about the approach selected by the authors, One Health, which calls for greater communication and cooperation to solve and prevent challenges. Climate education applies to formal education (public schools and classrooms) and to informal and outreach education. Currently, the Next Generation Science Standards (NGSS) focuses mainly on formal education. Many existing informal science outreach, teaching, and learning modes might also accomplish the NGSS goals given their experiential climate education focus.
Thomas	Knutson	Text Region	23. US Caribbean		13		24		You could add here: "A detectable human influence on increasing summertime heat stress including humidity effects (wet bulb globe temperature) has been reported over parts of the Caribbean over 1973-2012 (Knutson and Ploshay 2016)." (See their Figure Sa.) Reference: Knutson, T.R., Ploshay, J.J. Detection of anthropogenic influence on a summertime heat stress index. Climatic Change 138, 25-39 (2016). https://doi.org/10.1007/s10584-016-1708-z	Thank you for suggesting this interesting manuscript. We were not aware of it. We read it and enjoyed the information. However, the authors of the study never mentioned or showed detailed results for the Caribbean region in this manuscript, nor for Puerto Rico or USVI. By citing this article, we might be risking citing qualitative information based on maps and figures.
Emma	Conrad-Rooney	Text Region	23. US Caribbean		16	16	9	16	To follow the Risk-Based Framework, Key Message 23.2 should include what can and should be done about these highlighted problems.	We thank the reviewer for the comment, but this report assesses existing and available information sources.
Reid	Sherman	Text Region	23. US Caribbean		17	17	15	15	Update citation to "Puerto Rico Climate Change Council. 2022"	We appreciate the reviewer's comments. The citation and reference has been revised and updated.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Gabriel	Oppler	Text Region	23. US Caribbean		19	19	17	20	The following sentence, ‚ÄúReestablishing habitat connectivity to restore biodiversity is key to helping ecosystems adapt to a changing climate,Äù, may be adjusted for increased emphasis and clarity to: ‚Äúbroad scaling of ecological connectivity and corridors into planning and management of conservation and restoration is key to helping ecosystems adapt to climate change,Äù (IPCC Sixth Assessment. 2021. https://www.ipcc.ch/assessment-report/ar6/).	We appreciate the reviewer's suggestions. The text was revised to highlight the importance of conserving and restoring ecosystems and biodiversity as a climate change adaptation technique. The sentence now reads as: "Maintaining, enhancing, and/or restoring ecological connectivity and corridors as conservation strategies are key to helping ecosystems adapt to climate change (Figure 23.7)."
Emma	Conrad-Rooney	Figure	23. US Caribbean		21				Given that most of the details in the wet and dry scenario seem to directly compare, as a reader, I was confused by the septic system in the wet scenario and what appears to be a coastal aquifer with soil to the right in the dry scenario. I was curious why these details only existed in one but not both of the scenarios, and wonder if this could be explained in the figure caption.	The reviewer brings up an excellent point. The authors understand why the confusion between scenarios and have decided to revise the figure to adjust/include some details. We have submitted to TSU a revised version.
Thomas	Knutson	Text Region	23. US Caribbean		26		14		Knutson et al. (2021) is cited here but there is no such reference listed in the chapter. I think you mean Knutson et al. (2020). While that assessment does not deal with the 2017 TC season in particular, it provides future TC projections for the Atlantic basin as a whole. Reference: Knutson, T., Camargo, S. J., Chan, J. C. L., Emanuel, K., Ho, C.-H., Kossin, J., Mohapatra, M., Satoh, M., Sugi, M., Walsh, K., & Wu, L. (2020). Tropical Cyclones and Climate Change Assessment: Part II: Projected Response to Anthropogenic Warming. Bulletin of the American Meteorological Society, 101(3), E303-E322.https://doi.org/10.1175/BAMS-D-18-0194.1	We thank the reviewer for the comment. We agree with the reviewer and have updated the citation and reference.
Thomas	Knutson	Text Region	23. US Caribbean		28		17		Change "Damage from more hurricanes will increase..." to "Damage from increased rainfall rates from hurricanes and increased hurricane intensities are projected to increase..." Reason: increased hurricane frequency is not a robust model projection for the Atlantic basin while increased hurricane rainfall rates are hurricane wind intensities are relatively robust projections. Source: Fig. 5 from Knutson et al. (2020). Reference: Knutson, T., Camargo, S. J., Chan, J. C. L., Emanuel, K., Ho, C.-H., Kossin, J., Mohapatra, M., Satoh, M., Sugi, M., Walsh, K., & Wu, L. (2020). Tropical Cyclones and Climate Change Assessment: Part II: Projected Response to Anthropogenic Warming. Bulletin of the American Meteorological Society, 101(3), E303-E322. https://doi.org/10.1175/BAMS-D-18-0194.1	After reviewing the journal article suggested by the reviewer, the authors have revised the text and references/citations.
Thomas	Knutson	Traceable Account	23. US Caribbean		36		5		Add: "There is some observational evidence for a long-term climate change influence on increasing likelihood of extreme rainfall from tropical cyclones over Puerto Rico (Keellings and Ayala 2019)."	Thank you for the insight into the likelihood of extreme rainfall from tropical cyclones within Puerto Rico. We have added a statement to add this important observational evidence.
Reid	Sherman	Text Region	23. US Caribbean		37	37	1	1	Perhaps update "confusing" to "confounding and important" or "indefineable, but important"	We appreciate the reviewer's comments. The phrasing has been revised to "confounding and important."
Reid	Sherman	Text Region	23. US Caribbean		44	44	21	21	Update citation to: "Puerto Rico Climate Change Council (PRCCC). 2022. Puerto Rico's State of the Climate 2014-2021: Assessing Puerto Rico's Social-Ecological Vulnerabilities in a Changing Climate. Puerto Rico Coastal Zone Management Program, Department of Natural and Environmental Resources, NOAA Office of Ocean and Coastal Resource Management. San Juan, PR."	We appreciate the reviewer's comments. The citation and reference has been revised and updated.
Glenn	Branch	Whole Chapter	23. US Caribbean						A discussion of climate change education and outreach efforts in this region is needed. (Note that the chapter on the Southern Great Plains includes a brief discussion of climate change education on ch. 26, pp. 31-32.) Education and outreach efforts are foundational to topics discussed in this chapter, including: * livelihoods and economies, since a goal of education is to prepare the workers and consumers of the future, which will be transformed by the effects of climate change; * human health and well-being, since educators play a role in ensuring the intellectual, psychological, and social health of their students in the face of climate change; and * planning and adaptation, which require policymakers and voters to grasp the scientific and social issues involved in meeting the challenges posed by climate change. While it would be best for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change, it would help for this chapter to discuss the situation specifically in its region.	The content covered by each chapter was determined by the chapter authors of each individual chapter and not prescribed by the Federal Steering Committee beyond what is outlined in the Congressional mandate (see Appendix 1). Authors were instructed to prioritize content based on limited space. Each individual chapter has considered these comments and determined whether they are appropriate and relevant, and whether they are a priority to include given the space constraints and scope of their chapter. Key messages 23.1 and 23.3 do contain text regarding some education and outreach programs specific to these messages. We have also identified education and outreach as a gap in our traceable accounts.
Charles	Keeling	Whole Chapter	23. US Caribbean						A discussion of climate change education should be included similar to the one in chapter 26, pp. 31-32.	The content covered by each chapter was determined by the chapter authors of each individual chapter and not prescribed by the Federal Steering Committee beyond what is outlined in the Congressional mandate (see Appendix 1). Authors were instructed to prioritize content based on limited space. Each individual chapter has considered these comments and determined whether they are appropriate and relevant, and whether they are a priority to include given the space constraints and scope of their chapter. Key messages 23.1 and 23.3 do contain text regarding some education and outreach programs specific to these messages. We have also identified education and outreach as a gap in our traceable accounts.
Brittany	Gutermuth	Whole Chapter	23. US Caribbean						Climate change education is explicitly discussed in ch. 26, pp. 31 (line 18-27)- 32 (line 1-2), it should be addressed here as well.	The content covered by each chapter was determined by the chapter authors of each individual chapter and not prescribed by the Federal Steering Committee beyond what is outlined in the Congressional mandate (see Appendix 1). Authors were instructed to prioritize content based on limited space. Each individual chapter has considered these comments and determined whether they are appropriate and relevant, and whether they are a priority to include given the space constraints and scope of their chapter. Key messages 23.1 and 23.3 do contain text regarding some education and outreach programs specific to these messages. We have also identified education and outreach as a gap in our traceable accounts.
Ariela	Zycherman	Whole Chapter	23. US Caribbean						great job integrating the socioeconomic, colonial/postcolonial, environmental, governance, infrastructure, and other factors that shape how climate change is manifested and experienced in the US Caribbean	We greatly appreciate the reviewer's comment about the chapter and hope that the content is useful.
Isabel	Pares	Whole Chapter	23. US Caribbean						Social Vulnerability and Resilience There is no mention about the ongoing fiscal crisis in Puerto Rico (more than ten-years of economic recession) and its connection to the inability of the island to tackle climate change systematically. This context and framing is important because the fiscal crisis is one of the main causes of increased social vulnerability and a crucial obstacle for building resilience and implementing climate adaptation solutions. Climate change exacerbates the island‚Äôs underlying inequities and the austerity policies used to solve the economic crisis hinder the capacity of the local government to allocate resources for climate action and resilience measures. Many in Puerto Rico are still struggling to meet their basic needs such as access to food, clean water, energy security, education and job opportunities. Smart climate investments such as solar energy and investments in building a green workforce, sustainable agriculture and nature-based climate solutions could have both environmental and socioeconomic benefits. Adaptation Barriers and Opportunities ---Capacity building: even if federal funding streams are available to PR and USVI, the lack of local technical capacity for applying for federal aid grants, including language barriers, often keep local governments and communities from seeking grants. More awareness and training is needed to access federal funds, specially for disaster preparedness and community resilience projects. ---Community-based resilience: the island‚Äôs geography requires the establishment of decentralized community-led Resilience Hubs in urban and rural areas, with solar panels and battery backup systems, that can provide services such as electricity, water, food, communications, cooling, and shelter during emergencies. ---Coastal resilience: there is a need to develop sustainable land use regulations and sea level rise zoning ordinances and policies that require rising waters due to climate change to be taken into account during coastal development projects.	Thank you for your comment. The authors added a bullet specific to the fiscal crisis in Puerto Rico and additional text such as the impact of heat on the agricultural work force.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Glenn	Branch	Whole Chapter	23. US Caribbean in Spanish						A discussion of climate change education and outreach efforts in this region is needed. (Note that the chapter on the Southern Great Plains includes a brief discussion of climate change education on ch. 26, pp. 31-32.) Education and outreach efforts are foundational to topics discussed in this chapter, including: * livelihoods and economies, since a goal of education is to prepare the workers and consumers of the future, which will be transformed by the effects of climate change; * human health and well-being, since educators play a role in ensuring the intellectual, psychological, and social health of their students in the face of climate change; and * planning and adaptation, which require policymakers and voters to grasp the scientific and social issues involved in meeting the challenges posed by climate change. While it would be best for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change, it would help for this chapter to discuss the situation specifically in its region.	The content covered by each chapter was determined by the chapter authors of each individual chapter and not prescribed by the Federal Steering Committee beyond what is outlined in the Congressional mandate (see Appendix 1). Authors were instructed to prioritize content based on limited space. Each individual chapter has considered these comments and determined whether they are appropriate and relevant, and whether they are a priority to include given the space constraints and scope of their chapter. Key messages 23.1 and 23.3 do contain text regarding some education and outreach programs specific to these messages. We have also identified education and outreach as a gap in our traceable accounts.
Omar	Gates	Text Region	24. Midwest		3	3	7	9	Please clarify if the percentages are for all five Great Lakes, or are the percentages for the four aforementioned lakes.	These are for all five lakes. This has been clarified.
Omar	Gates	Text Region	24. Midwest		3	3	15	17	For consistency with the RCP 4.5 temperature range, it is suggested to add the upper range of the RCP 8.5 temperature projections.	We thank the reviewer for this comment. We have revised this section of the Introduction and referred the reader to specific temperature and precipitation changes illustrated in Chapter 2, Figure 2.4. Thus, this sentence has been removed from the Introduction.
kottie	christie-blick	Text Region	24. Midwest		3	4	32	4	In addition, Midwest states have education standards influenced by the Framework for K-12 Science Education or the Next Generation Science Standards (with the exception of Ohio, which has yet to follow these nationally recognized science standards). These standards are designed to create scientifically literate Americans. As such, they help learners understand ways in which humans impact Earth's resources and environment. There is a great need for schools to fully adopt and implement these standards, and for educators to be trained to teach the core ideas, concepts, and practices to their learners at an age-appropriate level. https://ngss.nsta.org/about.aspx https://www.nextgenscience.org/search/node/Earth%20and%20Human%20Activity	We thank the reviewer for this comment. Education is mentioned throughout the assessment and within the cited references. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. As far as our chapter suggesting that schools should adopt and implement these standards, this is inconsistent with the Congressional mandate as a technical report and this report does not include policy recommendations, evaluate specific policies, prescribe nor advocate against policies. Discussion of policy options is beyond the defined scope of the National Climate Assessment (see About NCA5 at https://www.globalchange.gov/nca5). We have added Box 24.1 to at least provide links to the status of NGSS and state developed standards in formal climate education to help guide the reader to additional information.
Abigail	Aderonmu-Omunu	Whole Page	24. Midwest		3				Great work examining and synthesizing the extent of climate research as well as identifying gaps in the region. The introduction describes characteristics of the Midwest, and although it is implied in later parts of the chapter (with maps and a graph on lyme disease), it will be helpful in this section to list the states that make up the Midwest as defined for the purpose of this report.	We thank the reviewer for their comment. We empathize that the regional boundaries can blur and it is important in this context to know precisely the states we are addressing as the Midwest. Currently, a map is provided in the front matter. A map will be included in the final document and will accompany the chapter on the website as well, which will be the primary mode of delivery for this report.
Omar	Gates	Text Region	24. Midwest		4	4	2	4	Please add specific tools used by local communities for drought and harmful algal blooms. This will help bring more awareness of the current work with smaller and frontline communities.	We thank the reviewer for this comment. We approach the introduction as a preview of what is to follow in the body of the chapter. As stated on the last line of the Introduction, we point the reader to KM 25.5 for specific tools as the reviewer requests here.
Thomas	Knutson	Text Region	24. Midwest		4	4	23	26	You could mention here: "There is some evidence from climate models that the observed annual precipitation increases over the Midwest is detectable (distinguishable from natural variability) and at least partly attributable to anthropogenic influence (Knutson and Zeng 2018)." (Note: see their Fig. 3c). Reference: Knutson, T. R., & Zeng, F. (2018). Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends, Journal of Climate, 31(12), 4617-4637. https://journals.ametsoc.org/view/journals/clim/31/12/jcli-d-17-0672.1.xml	We thank the reviewer for this great comment. We have incorporated the human attribution into the conversation here as it is important to distinguish from natural variability and part of our overall approach to increasing this distinction in our chapter. We have also noted an additional citation here with similar lines of evidence showing an increased confidence in the human attribution to precipitation trends.
Abigail	Aderonmu-Omunu	Figure	24. Midwest		5		1		This figure (24.1) depicts historic and future projections of extreme precipitation transitions in the Midwest; it will be valuable to have a similar figure for temperature. Additionally, the spatial extent of the Midwest in this figure differs from subsequent maps in the chapter.	The authors thank the reviewer for their comment. The authors recognize that rapid temperature changes are important for the region. However, due to scales, scope, and a different approach needed to capture these extreme oscillations, the authors have decided not to include this in this report. Here, the authors relied on published results that could be adapted for the Midwest. Further research is needed to evaluate at scale extreme temperature oscillations.
Rachel	Licker	Text Region	24. Midwest		5	5	12	13	This sentence was confusing. Are the authors describing a trend, or do they mean that as a result of excessive water and extreme drought, there were corn yield losses in the range of 17-37% for the entire Midwest for individual years between 1981-2016, or something else?	Thank you for the comment. We have re-written the sentence to be clear.
Rachel	Licker	Text Region	24. Midwest		5	5	20	21	This sentence was confusing - suggest breaking up into 2-3 sentences. One about snowmelt, one about dry summer soils, and one about what scenarios show. Otherwise, this sentence needs to be edited for clarity.	Thank you for the comment and suggestion. We agree and have rearranged/reorganized the text as suggested.
Omar	Gates	Text Region	24. Midwest		6	6	14	16	Please clarify if the statement suggests that only croplands lead to cooler environments around the Midwest.	Thank you for the comment. We have specified cropland intensification specifically.
Thomas	Knutson	Text Region	24. Midwest		11	11	24	26	An important question is whether the increase in Midwest flash drought over 1980-2015 is highly unusual compared to natural internal variability. Christian et al. (2021) did not claim to have established this, citing the shortness of the record they analyzed. This limitation/uncertainty could be mentioned.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Molly	Woloszyn	Text Region	24. Midwest		11	11	24	26	Flash droughts are characterized by rapid intensification only - it could be onset of drought, but doesn't have to be from the start of an event. It could be rapid intensification within an ongoing drought as well. https://journals.ametsoc.org/view/journals/bams/103/10/BAMS-D-21-0288.1.xml	We thank the reviewer for the comment, however, we believe that we are using terminology consistent with the recent literature. For instance, Pendergrass et al. (2020) write: "Flash droughts are a recently recognized type of extreme event distinguished by sudden onset and rapid intensification of drought conditions with severe impacts." Otkin et al. (2022) note "Flash drought has captured the attention of researchers, practitioners, and the general public due to the suddenness with which it appears as well as its major and diverse impacts on agriculture, natural ecosystems, and society." Additionally, the National Integrated Drought Information System (https://www.drought.gov/what-is-drought/flash-drought) indicates, "Flash drought is simply the rapid onset or intensification of drought."
Thomas	Knutson	Text Region	24. Midwest		15	15	1	9	You could mention here that "A detectable human influence on increasing summertime heat stress including humidity effects (wet bulb globe temperature, WBGT) has been inferred over much of the Midwest region for the period 1973-2012 (Knutson and Ploshay 2016, their Fig. 5a), and an attributable anthropogenic contribution to past WBGT trends has been quantified over central North America, along with large projected future trends over the coming century (Li et al. 2017). WBGT trends over 1973-2012 were more detectable than surface temperature trends in these studies. Large increases of summer WBGT are projected for the coming century for the central North America region (Li et al. 2017)." References: Knutson, T.R., Ploshay, J.J. Detection of anthropogenic influence on a summertime heat stress index. Climatic Change 138, 25-39 (2016). https://doi.org/10.1007/s10584-016-1708-z Li, C., Zhang, X., Zwiers, F., Fang, Y. and Michalak, A.M. (2017), Recent Very Hot Summers in Northern Hemispheric Land Areas Measured by Wet Bulb Globe Temperature Will Be the Norm Within 20 Years. Earth's Future, 5: 1203-1216. https://doi.org/10.1002/2017EF000639	We thank the reviewer for their comment and for bringing these citations to our attention. However, with regard to both of these citations (Knutson et al., 2016 and Liu et al., 2017), the US Midwest region is not defined as to which states are considered as part of the region, nor any discussion of the specific relationship between human influence on humidity among the specific states included as part of the NCA5 Midwest chapter. We recognize that both articles have figures that do provide some coarse visual representation of this relationship, but in both cases the visual depiction is too geographical broad, and it is difficult to determine if other regions (e.g., North or South Great Plains) are also included in this representation. In addition, both articles are not very recent publications (2016 & 2017). To summarize, these citations do not provide enough detail specific to the Midwest chapter states to be included as evidence of anthropogenic influence over rising humidity in this region.
Ariela	Zycherman	Text Region	24. Midwest		18	18	9	17	Increases in extreme rainfall will also affect non-urban centers. The amount of tile drains in the agricultural areas along with the dependence on septic systems will also affect water bodies. Consider adding those impacts.	We thank the reviewer for this comment. First, we agree that all practices on the landscape, from how we farm, to tile drains, to urban storm water will impacts our water bodies. We revised the sentence here to refer to urban and rural landscapes. We also included a sentence in KM 24.5 to mention the best management practices that are taking place across the landscape in diverse environments. As for tile drains in agricultural settings, the author team has concluded that this is a knowledge gap in terms of the number or drains and especially connections to septic systems and impacts on water flow across the Midwest and have added this to our traceable accounts.
Ariela	Zycherman	Text Region	24. Midwest		19	19	11	22	Thank you for including the mental health aspects. This connection is sometimes overlooked and the statistics on death by suicide among farmers is distressing	We thank the reviewer for the kind comment.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Benita Lily	Cheng	Text Region	24. Midwest		20		27		Please add blue green infrastructure alongside green infrastructure may help mitigate losses from flood damage	Thank you for this comment. The authors have aligned language throughout the report and are updating the language to align with chapter 12 (built environment). In climate adaptation and stormwater management practice literature and practice in the United States blue and green infrastructure fall under the category of green infrastructure. Introducing blue infrastructure does not add clarity for the reader and use of the term blue infrastructure is not reflected in water management best practices literature or practice guides in the United States. Author's review of literature on nature based solutions to flooding in the United States found that the most appropriate term to use is green infrastructure, rather than blue infrastructure.
Omar	Gates	Text Region	24. Midwest		23	24	14	2	This is an excellent point to make about extreme precipitation and chronic smaller rainfall affecting many systems. Still, it is unclear how much rain is reported in smaller events compared to the heavy rainfall reported in NOAA's Billion-Dollar Disaster data. Please clarify if there is a rainfall threshold difference between extreme rainfall events and chronic smaller events.	We thank the reviewer for this comment. This is a thoughtful but difficult question to answer. First, the NOAA Billion Dollar Disasters are not based on a precipitation threshold but are based on the value of loss. Second, not all extreme precipitation events lead to small or even catastrophic flooding. Much of this is determined by intensity, duration, geography, soil conditions, topography, infrstructure, and mitigation implementation. Therefore, we have updated our text to reflect back to the increased observed trends in precipitation as noted by Figure 2.7 and make note that not all events lead to catastrophic cases (those that would like reach NOAA's economic threshold).
Rachel	Licker	Figure	24. Midwest	10	23	23			I thought the dam figure was a great example of the kind of synthetic figures that this chapter would benefit from more of.	The authors thank the reviewer for this comment. We indeed are grateful for the opportunity to synthesis a lot of information into an impactful figure for this section. However, the authors have equally given careful thought and planning to all figures throughout the Chapter to help them tell the story of the Midwest and utilize the risk-based framing in telling this story. Where additional synthesis is possible, we have made changes to strengthen this story.
Jim	Titus	Text Region	24. Midwest		24	24	3	20	In spite of the difficulties mentioned here, it would be relevant to point out that in the Midwest (unlike most regions) the population of floodplains has been decreasing slightly over the last 30 years. In thousands: OH (178 to 166), IN(110 to 121), IL (134 to 127), WI (52 to 57), MN (20 to 26), MO (70 to 65). Titus 2023, Environmental Research Letters, Table S4-J and Figure 3. In Alexander County, Illinois, the population in the 100-year floodplain declined by 1200 during the last decade and 2400 since 1990, which is more than 20% of the population of the entire county. Table S8-E	Thank you for this comment and pointing the authors to this reference. After reviewing the reference we found the data indicates that in 8 of 9 Midwest states there has been a positive percent change in total population living in floodplains. Based on this finding, we are not inclined to change the content of the chapter. The population change in Alexander County is an interesting case study, but anecdotal, not significant. https://iopscience.iop.org/article/10.1088/1748-9326/acadf5#erlacadf5s5
Ariela	Zycherman	Text Region	24. Midwest		24	24	14	16	Perhaps cross reference Chapter 20, Box 20.2. Quinault Indian Nation Relocation and Sovereignty	We thank the reviewer for their comment. We have revised our language around managed retreat to refer to these measures as equitable relocations. We have also accepted the suggestion here to reference Box 20.2
Ariela	Zycherman	Text Region	24. Midwest		24	24	21	21	Perhaps mention the Bipartisan Infrastructure Law that will hopefully address these issues: https://www.congress.gov/bill/117th-congress/house-bill/3684	We thank the reviewer for this comment. We have changed the text to reflect that recent federal funding has been infused into the economy to address climate change and infrastructure moving forward.
Benita Lily	Cheng	Text Region	24. Midwest		25	25	3	5	Careful placement and design of blue green infrastructure provide benefits beyond flood reduction, such as reducing the urban heat island effect and providing relief to city residents during heatwaves. Blue green infrastructure can include floodable multi-purpose recreational spaces, retention and detention ponds in open green spaces, bioswales, and rain gardens.	Thank you for this comment, we have incorporated additional examples of green infrastructure and stormwater best management practices into the chapter.
Sean	Fleming	Figure	24. Midwest		26	26	1	11	Figure 24.11 doesn‚Äôt actually show runoff. It‚Äôs showing the net water balances of grid cells in a land surface model. The maps are useful but need to be named more appropriately, something like ‚Äòlocal water balances‚Äô or ‚Äòlocal runoff generation‚Äô with an explanation in the caption that this is output of a LSM (in this case, the VIC‚Äôs LSM) depicting cell-by-cell ability of the landscape to generate excess water potentially available for downstream river runoff. To actually create runoff projections, the routing components of VIC would have had to been used, which they clearly weren‚Äôt because this is a raster image with no correspondence to any actual river or watershed. Also make sure all the sources for the figure are fully referenced, not just ‚Äúa NOAA NCEI,‚Äù for example.	Thank you for these comments. The authors have adjusted the caption to specifically mention the VIC LSM and to note that this is approximate, cumulative, and gridded runoff projections.
Thomas	Knutson	Text Region	24. Midwest		28	28	14	15	Figure 24.11 does not strongly support the notion of an increase in Midwest drought in summer based on runoff. Rather, Figure 24.11 points to larger increases in runoff during winter and spring over most of the Midwest, and relatively little change during summer. The small changes during summer raise the question of whether the summer changes shown are statistically significant and/or robust across a clear majority (say, 70%) of models used to construct it.	Section was rewritten to clarify seasonal aspects of runoff and drought risk to address reviewers comments.
Rose	Daily	Table	24. Midwest		29	29	3	3	Table 24.1 We are overall confused with Table 24.1 for a few reasons: 1) when groundwater is listed as a Great Lakes indicator with a status of "good", what exactly does this mean? Does this mean the water QUALITY of the groundwater tables are good? The VOLUME of groundwater tables? The TEMPERATURE of groundwater tables? It would be really helpful if more information is provided on each of the indicators. 2) it would be helpful to have a definition for each of the statuses (i.e. good, fair, poor, etc.) and the trends (i.e. unchanging, improving, etc.). For example, the table states that the impact of invasive species is "poor & unchanging." If the impact is listed as "poor", does this mean that invasive species are having a significant, negative impact on the ecosystem? Or does "poor" mean they are having an insignificant impact (i.e. the fridge did a poor job of keeping my food cold)? Because multiple interpretations are possible here, I believe more clarity and explanation of the content of this table would be beneficial to the reader.	The authors thank the reviewer for this comment. A column has been added to Table 24.1 to indicate what the metrics are used for each indicator and additional details in the caption to define what the definitions of "poor", "fair", and "good" mean. The reader is referred to the State of the Great Lakes Report for additional details. For example, the groundwater indicator was deemed "good" based on chloride/nitrate concentrations.
Omar	Gates	Text Region	24. Midwest		29	29	14	17	The current passage provides some insight into the effects of precipitation, evaporation, and runoff on future water levels; however, please provide more context for how the climate models simulate these variables. The following suggested text provides additional context for the current passage: Climate processes in the Great Lakes region are difficult to simulate due to the complexity of lake-land-atmosphere interactions (Briley et al. 2015, Briley et al. 2021). Even the most sophisticated climate models for the Great Lakes region have deficient physical representations of the key hydrological components that make up a lake's net basin supply (i.e., precipitation, evaporation, and runoff) (Briley et al. 2021, Channell et al. 2022). Therefore, high levels of uncertainty are associated with future lake-level projections that are based on simulated changes to these hydrological components. However, higher variability in future water levels is anticipated, which will impact the entire ecosystem (KM 24.2), ports (KM 24.4), and coastlines (Gronewod and Rood 2019, Seglenieks and Temgoua 2022). References: Briley, L., Ashley, W., Rood, R., Krmenec, A. 2015. ¬iThe Role Of Meteorological Processes In The Description Of Uncertainty For Climate Change Decision-Making¬î. Theoretical And Applied Climatology 127 (3-4): 643-654. doi:10.1007/s00704-015-1652-2. Briley, L., Rood, R., Notaro, M. 2021. ¬iLarge Lakes In Climate Models: A Great Lakes Case Study On The Usability Of CMIP5¬î. Journal Of Great Lakes Research 47 (2): 405-418. doi:10.1016/j.jglr.2021.01.010. Channell, K., DelPizzo, J., Briley, L., Rood, R., Jorns, J., Hutchens, K. 2022. ¬iLake Superior: a Summary of Anticipated Future Climate Conditions.¬î Great Lakes Integrated Sciences and Assessments. https://glisa.umich.edu/wp-content/uploads/2022/09/Superior_Prospective_Report_2022.pd Gronewold, A., Rood, R. 2019. ¬iRecent Water Level Changes Across Earth¬is Largest Lake System And Implications For Future Variability¬î. Journal Of Great Lakes Research 45 (1): 1-3. doi:10.1016/j.jglr.2018.10.012. Seglenieks, F., Temgoua, A. 2022. ¬iFuture Water Levels Of The Great Lakes Under 1.5 ¬∞C To 3 ¬∞C Warmer Climates¬î. Journal Of Great Lakes Research. doi:10.1016/j.jglr.2022.05.012.	We thank the reviewer for their comment and have utilized the references to frame the conversation around lake level variability and models. Based on our assessment, and adhering to our mission to provide a high-level view assessment, we do expound in high detail the complexity and uncertainty associated with modeling lake levels. However, the reviewer will see that this is the first item mentioned in the traceable accounts under Major Uncertainty and Research Gaps.
Rose	Daily	Figure	24. Midwest		30	30	8	8	Figure 24-13. For ease of comparison between the Great Lakes, I suggest ensuring the minimum and maximum values on each of the four y-axes are identical (i.e. all figures could have a minimum y-value of 40 and a maximum of 80). This would help the reader quickly see how the average temperatures of each of the four lakes compare to each other, and the degree of variability of the annual summer temperatures in each lake. Additionally, our group is interested in learning more about how temperature increases in the Great Lake is currently affecting the diversity of aquatic life, species migration, and specie populations. Since the Great Lakes make up the largest bodies of freshwater in the United States, we feel this is important to highlight in the report.	We thank the reviewer for their comments. We selected different absolute ranges on the plots to emphasize trends, rather than as an intercomparison of the temperature differences between lakes. The relative size of the ranges are the same on each plot to facilitate this comparison of trends. We added a short comment in the figure caption to address this as well. On the second point, we have added references to address loss of coastal habitat due to lake level change, and loss of thermal habitat due to warming waters. We rely on the State of the Great Lakes report (referenced) for further details, but have included metrics from that report into Table 24.1 for more understanding on the condition status of the various Great Lake Indicators.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Abigail	Aderonmu-Omunu	Text Region	24. Midwest		33	33	1	24	A knowledge gap identified by similar synthesis of climate research (by the Midwest Climate Collaborative) in the Midwest is the impact of changing climate on agriculture for BIPOC farmers.	We thank the reviewer for this comment. We have added discussion to our traceable accounts to note this important knowledge gap.
Jim	Titus	Traceable Account	24. Midwest		36	36	33	35	While there may be a lack of research totally on point concerning climate-driven migration, there is certainly plenty of information on migration into and out of hazardous areas with state and county-specific results. Whether migration is consistent with adaptation to climate change or going in the opposite direction and thus making it harder is a question that can be addressed.	We thank the reviewer for their comment. As they recognize, available evidence regarding climate-driven migration is inconsistent at this time, and furthermore there are very few, if any, studies on climate-driven migration specific to the Midwest region states. We do acknowledge that climate-driven migration is an emerging topic in the Midwest in the Traceable Accounts section. Given the lack of region-specific evidence that adequately characterizes climate impacts on migration into or out of the Midwest region, we respectfully decline to expand discussion of this topic until this evidence becomes available.
Sean	Fleming	Text Region	24. Midwest		39	39	5	6	Add ‚Äúin the Midwest,‚Äù after ‚Äúmore comprehensive than streamflow research,‚Äù	Thank you for your comment. We have made the suggested included here and provided a key citation to support this statement.
Glenn	Branch	Whole Chapter	24. Midwest						A discussion of climate change education and outreach efforts in this region is needed. (Note that the chapter on the Southern Great Plains includes a brief discussion of climate change education on ch. 26, pp. 31-32.) Education and outreach efforts are foundational to topics discussed in this chapter, including: * livelihoods and economies, since a goal of education is to prepare the workers and consumers of the future, which will be transformed by the effects of climate change; * human health and well-being, since educators play a role in ensuring the intellectual, psychological, and social health of their students in the face of climate change; and * planning and adaptation, which require policymakers and voters to grasp the scientific and social issues involved in meeting the challenges posed by climate change. While it would be best for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change, it would help for this chapter to discuss the situation specifically in its region.	We thank the reviewer for their comment. We agree that climate education is linked to livelihoods, economies, human health, etc. and make this statement in our Health Key Message. We have added Box 24.1 detailing some but not all the climate education and climate services resources available in the Midwest. However, we remain consistent with the Congressional Mandate as a technical report and this report does not include policy recommendations, evaluate specific policies, prescribe nor advocate against policies. Therefore, this chapter does not suggest such policy. Discussion of policy options is beyond the defined scope of the National Climate Assessment (see About NCA5 at https://www.globalchange.gov/nca5)
Bharat	Balyan	Whole Chapter	24. Midwest						In Minnesota on the week of January 9th, 2023, a significant air pollution event occurred in which the warm winter temperatures and stagnant air causes the AQI to reach Unhealthy levels for multiple hours. These warmer temperatures are an impact of climate change, and this type of air pollution event should be highlighted as something that can happen in the Midwest. Here are some relevant links https://www.mprnews.org/story/2023/01/09/its-50-degrees-just-above-us-air-quality-alert-through-noon-tuesday https://www.pca.state.mn.us/air-water-land-climate/condition-details-and-past-aqi-data	Thank you for the thoughtful comment. We do address the issue of degraded air quality in the Midwest in the Health section of the chapter with numerous peer-reviewed citations. The comment suggests citations that refer to news articles which does not meet the NCA5 criteria for inclusion.
Charles	Keeling	Whole Chapter	24. Midwest						A discussion of climate change education should be included similar to the one in chapter 26, pp. 31-32.	We thank the reviewer for their comment. We have added Box 24.1 detailing some but not all the climate education and climate services resources available in the Midwest. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside the development of NCA5.
Brittany	Gutermuth	Whole Chapter	24. Midwest						Climate change education is explicitly discussed in ch. 26, pp. 31 (line 18-27)- 32 (line 1-2), it should be addressed here as well.	We thank the reviewer for their comment. We have added Box 24.1 detailing some but not all the climate education and climate services resources available in the Midwest. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside the development of NCA5.
Molly	Woloszyn	Whole Chapter	24. Midwest						Most recent reference for flash drought and what it is would be Otkin et al 2022 - this is more recent than Pendergrass which is from 2020. https://journals.ametsoc.org/view/journals/bams/103/10/BAMS-D-21-0288.1.xml	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Steve	Rissing	Whole Chapter	24. Midwest						Comments on Chapter 24, Midwest. I appreciate the general thrust of the chapter and the efforts of the authors. Given the likely impact of climate change on the Midwest (and elsewhere), I encourage the addition of a discussion of the mitigation and adaptation benefits of formal and effective climate change education, especially in middle and high school curricula. Some, but not all states, have included climate change education in their formal science content standards. Many of the risk statements and mitigation and adaptation efforts discussed in the draft chapter require a basic understanding of climate change by the citizens and policymakers of any region. K-12 formal science education seems the obvious and logical place to build this base of climate science literacy. For example, Ohio,Äôs current Science Content Standards and Model Curriculum have been updated recently to include explicitly the impacts of climate change and the Anthropocene period our environment (found here: https://education.ohio.gov/Topics/Learning-in-Ohio/Science/Ohios-Learning-Standards-and-MC; see pages 251-253) I served as a higher education biology consultant on the working groups that developed these standards and model curriculum. Our groups, consisting mainly of in-service K-8 teachers and high school biology teachers, enthusiastically supported these additions to the Ohio standards and model curriculum. I was impressed to see the conviction and sincerity of K-12 teachers for such an approach to climate change education to provide Ohio high school graduates the baseline understanding of the many issues and key messages discussed in the draft chapter. I courage the authors to incorporate such mitigation and adaptation resources in their final draft. Steve Rissing, Professor Emeritus Department of Evolution, Ecology, and Organismal Biology The Ohio State University Columbus, OH	We thank the reviewer for their comment. We have carefully discussed and formalized how to address education in this chapter. We thank the reviewer for their comment. We agree that climate education is important for adaptation and mitigation success, and many of the authors on this chapter are devoted to this endeavor. We have added Box 24.1 detailing some but not all the climate education and climate services resources available in the Midwest. However, it is important to note that additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside the development of NCA5.
Jim	Titus	Whole Chapter	24. Midwest						It would be helpful for this chapter to provide more specific facts at the state level, including tables or maps that quantify impacts and location-specific expectations. It is important to do so because some federal agencies will create state-specific fact sheets about the impacts of climate change. To avoid the accusation of cherry picking, these agencies are often limited to using the facts presented by IPCC, NAS, and the National Assessment, which as a practical matter, usually means that NCA is the main source.	We thank the reviewer for their comment. Our charge as a regional chapter is to balance the evidence across the region as a whole, providing specificity where confidence allows. However, within the boundaries of our Chapter, we cannot possibly provide all the quantitative details for each state. As part of our assessment process, we have multiple tools are our disposal include NOAA State Climate Summaries (https://statesummaries.ncics.org/). This information is a better resources for finding some specific data for each state and again, this information was also used by authors here to assess the Midwest region as a whole.
Rachel	Licker	Whole Chapter	24. Midwest						This chapter would be strengthened by including more specific and more quantitative information where possible, especially in the initial paragraphs. This will be critical for planners and decision makers who turn to the NCA for information. An example of where specificity would be useful is on page 24-4, lines 23-25 - where is precipitation increasing, and where is it decreasing?	We thank the reviewer for their comment. We understand the burden placed on planners and decision makers in light of the climate challenges we face in all our communities. Our charge as a regional chapter, is to balance the evidence across the region as a whole. This does not mean we cannot compare and contrast across the region, and indeed we make these comparisons throughout the Chapter. In the example that you pointed out, we refer the reader to Chapter 2 Fig. 2.4 which shows the annual, winter, and summer changes in precipitation. As the website will be the primary mode of delivery for this document, cross referencing to other figures throughout the document allow us to gain some of the specificity you are looking for while keeping the document succinct and clear. As for precipitation, this variable has much more uncertainty in both observed and projected changes due to the heterogenous nature of precipitation. Much research has been conducted on the variability in precipitation changes across the Midwest, especially at sub-seasonal scales and downscaled model exercises are on-going throughout many of the states in the Midwest (e.g., https://climate.umn.edu/climate-data).
Rachel	Licker	Whole Chapter	24. Midwest						This chapter would benefit from being professionally edited. There are many small grammatical errors and wording choices that make it difficult to follow at times.	We thank the reviewer for their comment. Of course, we will continue to refine the language for clarity and fix grammatical errors. The full report will be edited several more times before the final report is distributed.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Licker	Whole Chapter	24. Midwest						The chapter would benefit from more figures and tables that can help to synthesize and distill the information in a systematic manner. For example, for the agricultural information, I could imagine a table that breaks out the different, potential impacts to Midwestern agriculture (e.g., pest impacts to crops, heat impacts to crop, heat impacts to livestock, etc.) with any quantitative information about the impacts projected if possible. The chapter provides a lot of important information, but a lot of that information is likely to get lost as the chapter currently mostly lists out information about impacts vs. providing a true synthesis. The authors need to identify for the readers the key issues of concern out of the big list of information.	We thank the reviewer for this comment but respectfully disagree that we merely list out impacts vs providing a true synthesis. Indeed, the process to get to this point has involved numerous discussions among many topics that did not rise to the level of priority or where authors did not reach consensus on the impacts in the Midwest. The topics that are covered in this chapter are expanded in each section and are the result of the author team analyzing previous NCAs and judging where sufficient literature exists to make and assessment and conversations have moved forward since the previous NCA. Our key messages have been carefully crafted to entice the reader to read the various section of interest as they see fit. We have judiciously selected our figures and limited number of tables as to not simply regurgitate information, but rather develop a narrative following a risk-based framing that tells the story of the Midwest and its climate complexity. Several figures throughout the Chapter do precisely as the reader suggests, synthesize information in a way that presents the material clearly and in an accessible manner (Figs. 24.4, 24.5, 24.6, 24.10, Table 24.2).
Rachel	Licker	Whole Chapter	24. Midwest						In general the key messages should be more specific. There's a lot of great information in the chapter that needs to be synthesized and pulled out - more judgments need to be made by the authors. For example, there is a lot of really interesting quantitative information on infrastructure that doesn't end up in the respective key message section.	We thank the reviewer for their comment. Per USGCRP guidance, Key Messages are high-level overview statements that describe the main issues discussed in a chapter. Indeed, there is a large volume of information presented in the body of the Chapter, as pointed out here for instance in the Built Environment section. Quite a bit of it is quantitative, and these quantitative evaluations help us assess the likelihood of these impacts which are noted in the key message. Therefore, we are not likely to add specific details on the quantitative information in the key message itself. However, we are reevaluating the titles of each of the key messages and will continue to refine the messages to be as clear as possible.
Amy	Symstad	Figure	25. Northern Great Plains			5		1	What is the definition of ‚Äúrural and remote‚Äù in Figure 1's caption?	We thank the reviewer for the comment. The figure text has been revised to incorporate the suggestion. The map displays FAR code (frontier and remote) Level 4, defined as: "ZIP code areas with majority populations living 60 minutes or more from urban areas of 50,000 or more people; and 45 minutes or more from urban areas of 25,000-49,999 people; and 30 minutes or more from urban areas of 10,000- 24,999 people; and 15 minutes or more from urban areas of 2,500-9,999 people." USDA Economic Research Service FAR Codes https://www.ers.usda.gov/data-products/frontier-and-remote-area-codes/ Replace "Tribal Reservation and Trust American Indian trust Lands and remote areas, measured at the zip code level, in the region demonstrate the rurality and presence of Indigenous cultures and governments in the region. Rural and historically marginalized communities often lack capacity with "Tribal reservations and American Indian trust lands (red outlines) overlap rural areas remote from urban areas (dark gray; measured at the zip code level) across the Northern Great Plains. Rural and historically marginalized communities, such as tribal and Indigenous governments and cultures, often lack capacity"
Amy	Symstad	Text Region	25. Northern Great Plains			6	6	11	12 The natural variability of the climate does not make it difficult to QUANTIFY trends. It makes it difficult to DETECT trends.	We thank the reviewer for the comment. Due to the subtle but important distinctions between "quantify" and "detect," the author team has chosen to leave the wording as is. By literal definition, "detect" includes discerning something that is tangible or barely perceptible. "Quantify" is to measure the amount. It is important to note that sometimes we can discern a barely perceptible change before we are able to measure its amount.
Thomas	Knutson	Text Region	25. Northern Great Plains			6	6	12	19 You could mention here: "The warming over much of the region since 1900 has been attributed in part to anthropogenic influence (Vose et al. 2017; their Fig. 6.6). Over parts of the region an increase in summertime wet bulb globe temperature over 1973-2012 has been attributed in part to anthropogenic influence (Knutson and Ploshay, 2016; their Fig. 5a). An attributable anthropogenic contribution to past WBGT trends has been quantified over central North America, along with large projected future trends over the coming century (Li et al. 2017). References: Vose, R.S., D.R. Easterling, K.E. Kunkel, A.N. LeGrande, and M.F. Wehner, 2017: Temperature changes in the United States. In: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 185-206, doi: 10.7930/J0N29V45. Knutson, T.R., Ploshay, J.J. Detection of anthropogenic influence on a summertime heat stress index. Climatic Change 138, 25-39 (2016). https://doi.org/10.1007/s10584-016-1708-z Li, C., Zhang, X., Zwiers, F., Fang, Y. and Michalak, A.M. (2017), Recent Very Hot Summers in Northern Hemispheric Land Areas Measured by Wet Bulb Globe Temperature Will Be the Norm Within 20 Years. Earth's Future, 5: 1203-1216. https://doi.org/10.1002/2017EF000639	We thank the reviewer for this comment. A detailed comment about WBGT is outside the scope of this regional chapter, though heat impacts certainly are a concern in future warming scenarios. Additional peer-reviewed literature is needed to document observed changes in WBGT or other heat stress indicators for the Northern Great Plains.
Amy	Symstad	Text Region	25. Northern Great Plains			6		21	Soil moisture available to PLANTS, not just CROPS.	We thank the reviewer for the comment. In the course of revisions, this sentence was removed from the narrative, and so this useful comment has not been incorporated.
Thomas	Knutson	Figure	25. Northern Great Plains			7	7	1	7 Fig. 25.2: I suggest to show the precipitation projections as difference maps (warm climate minus control). One cannot discern the changes from the present Figure. Temperature is OK to do either way--as it is now or as difference maps.	We thank the reviewer for the comment. The figure and figure text have been revised to incorporate the suggestion and now show an accurate depiction of the temperature and precipitation gradients. These figures and the message have evolved since their initial inceptionto show precipitation only in the introduction section (not predictions of precipitation). This highlights the east-west gradient in precipitation across the plains and the different regime in mountainous areas. The changes in predicated precipitation are not dramatic across the area and do not show well at this regional scale. It is the experience of the authors that maps of the change values are much more difficult to communicate than total amounts. The temperature plots will remain as shown in the key message, and the author team will show temperature and predictions as actual values, rather than the changes in temperature (to show the actual temperature gradients).
Amy	Symstad	Text Region	25. Northern Great Plains			7	7	8	13 This paragraph is disjointed and sometimes unclear, and the information questionably useful. Is the first sentence supposed to mean that all states in the region reported their wettest 5-yr period on record (since when?) during the 1995-2019 period? Given this 25-yr period over a relatively short historical record (at best 150 years of reliable information for some states in the region), how unlikely is this? In other words, is this occurrence tied to anthropogenic climate change? What is ‚ÁúWest‚Ù and ‚ÁúEast‚Ù (the capitalization makes it seem like these are official geographic names)? The fourth sentence conveys little useful information and is taking up space that could be used on something more important.	We thank the reviewer for the comments. We had lower case west and east in an earlier version, but an editor changed it to upper case - we defer to the editors of the document on that issue. The report text has been revised to incorporate the suggestion. Althought definitive attribution of climate change on precipitation over the last 150 years is beyond the scope of this report, the author team has revised the text to "All states in the Northern Great Plains Region recorded their wettest five-year period between 1995 and 2019 (Frankson et al. 2022a-e). However, precipitation increases do not have a one-to-one relation with flooding. Observations show that annual peak streamflow is decreasing in the West and increasing in the East (Sando et al. 2022). Temporal and spatial variability continues to be a dominant factor with precipitation, and temperature."
Reid	Sherman	Text Region	25. Northern Great Plains			7	7	18	18 Suggest changing 'melting height' to 'melting level height'.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Amy	Symstad	Text Region	25. Northern Great Plains			8	8	27	29 Delete the first part of this sentence. It seems irrelevant to the fact that these flood events were within the natural range of variability.	We thank the reviewer for the comment. The author team has determined to leave the text as is due to the important fact that future runoff is projected to decline in the Missouri River Basin. Large recent floods have raised questions about that prediction and the effects of climate change; therefore, we feel it is important to state that they were within the range of natural variability.
Amy	Symstad	Text Region	25. Northern Great Plains			8	8	33	35 Does this distinction regarding flooding costs stem from the values at risk from flooding being high, or the actual flooding increase being high for this region compared to others?	We thank the reviewer for the question. The EPA study cited is titled "Climate Change and Social Vulneratbility in the United States." They projected changes in the frequency of flooding events with an average return period of two to 500 years associated with global warming, then modeled flooding damates at the building level, compared projected damages to total property value, and calculated the likelihood that individuals who are socially vulnerable live in the high-impact areas. Therefore, the study took an approach that integrated increases in flood risk, increased damages, and several metrics of social vulnerability. Given the lenght restrictions we have, we are not able to go into all of these details. There is a project increase in both floods and costs, but the costs are not simply infrastructure, but consider social vulnerability.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Sean	Fleming	Figure	25. Northern Great Plains		9	9	1	9	Figure 25.3 is potentially useful but has basic terminology and referencing problems that need to be fixed. It purports to give the ‚Äúlikelihood‚Äù of changes in streamflow, which according to the caption are calculated as 1 ‚Äì p-value/2. This is a basic statistics mistake, which appears to reflect a misinterpretation of what the p-value from a null hypothesis significance test actually means, and perhaps a failure to understand that ‚Äúlikelihood‚Äù has a specific and widely known technical meaning in statistics. There‚Äôs nothing wrong with using that (1 - p-value/2) metric are a rough indication of confidence in the presence of a trend, but it has to be explained as such. It takes a lot more work to actually estimate the likelihood that a trend is present, requiring Bayesian or information theoretic techniques for example. That is, the map can be left as-is but replace ‚Äúlikelihood‚Äù with ‚Äútrend clarity‚Äù or "trend strength" or something similar. The caption should also explain what statistical trend detection method was used (there are several in common use) and the assumptions made in its application (statistical distributions, serial correlation, trend linearity, etc.) Additionally, this figure obviously requires a more specific literature citation than ‚Äúsource: USGS‚Äù, which is useless to the reader.	We thank the reviewer for the comment. The credit statements are based on guidance provided by the Technical Support Unit for the 5th National Climate Assessment. Based on the data and literature, the author team has confirmed that this is not a basic statistics mistake and the use of likelihood is intentional. Technical details are provided in the metadata for the figure. Also, please see the following information... Trend Analysis Method A nonparametric test, based on Kendall's tau (Kendall, 1938), was used to test for the presence of a monotonic (gradual, but not strictly linear) trend. The trend was calculated using the Theil-Sen estimator (Sen, 1968; Theil, 1992) for the slope and the Conover equation (Conover, 1999) for the intercept. Trends were calculated in R (R Core Team, 2021), using the R package EnvStats (Millard, 2013). This trend method is robust to outliers and skew and is therefore generally preferable to linear regression for trends in annual peak streamflow. The trend model is log(annual peak streamflow) = water year + intercept + error. Logarithmic transformation of annual peak streamflow is not necessary when using a nonparametric method, but this transformation allows one to represent the trend as a percent per year, which is appropriate for comparing sites of varying drainage areas and streamflow magnitudes. The transformation to trend in percent per year is calculated as 100 * (exp(b)-1), where b is the slope computed by the Mann-Kendall method (Helsel et al., 2020). Trends were also calculated using simple linear regression as a check of the results. The results of simple linear regression and Mann-Kendall using logged annual peak streamflow should be approximately the same, varying at sites with outliers or substantial skew even after transformation. The results were similar and produced a similar spatial pattern. The Mann-Kendall method remains the better choice methodologically. As a further note on these likelihoods and p-values (in fact some journals have banned them) because of the arbitrary nature of their use as cut-off points. The overreliance on p-values is a problem. However, reducing our reliance on them is not a new idea; it is getting back to their original purpose. What we now know as Null Hypothesis Significance Testing (NHST) came out of the work of three major statisticians, Fisher, Neyman, and Pearson. However, they did not intend NHST to be the straightforward, rule-based method that it is today (Lehmann, 1993). Fisher criticized Neyman and Pearson's use of 1% & 5% significance levels (even though they got the idea from Fisher who originally advocated for 5% and published tables that reflected these values). Fisher thought of p-values as a tool to rule out models and then proceed to other analyses, not as a final statement of findings
Amy	Symstad	Text Region	25. Northern Great Plains		9	9	3	9	‚Äúchange in percent per year,‚Äù for peak streamflow doesn‚Äôt make sense. Should this be ‚Äúpercent change per year,‚Äù? The delineation of water resource regions is confusing. Perhaps use polygons on the map instead of the lines outside the map. The description of the likelihood approach is probably unnecessary and just confusing for the audience. ‚Äúsmaller blue dots...,‚Äù Dot size varies for both blue and red dots. Don‚Äôt the black dots indicate ‚Äúno trend,‚Äù using the 0.85 threshold? Provide more details about the source of the information beyond ‚Äúusgs,‚Äù.	We thank the reviewer for the comment. The figure text has been revised to incorporate the suggestion.
Amy	Symstad	Text Region	25. Northern Great Plains		9	9	16	17	Not clear how ‚Äúthis basin,‚Äù differs from ‚Äúthe entire basin,‚Äù.	We thank the reviewer for the comment. The report text has been revised to incorporate the suggestion. The text "this basin" was replaced with "the upper Colorado River basin" for more clarity.
Amy	Symstad	Text Region	25. Northern Great Plains		12		12		Should be ‚Äúhistorically, snow...,‚Äù not ‚Äúhistoric snow ...,‚Äù.	We thank the reviewer for the comment. The report text has been revised to incorporate the suggestion.
Jim	Titus	Text Region	25. Northern Great Plains		13	13	21	22	It might be worth noting here (or somewhere) the population of floodplains in this region, and how it is changing. One estimate has populations increasing during 2010-2020 from 124,000 to 134,000 (100-year floodplain) and 246,000 to 261,000 (500-year floodplain). See Titus (2023) Environmental Research Letters. Table S4-J	We thank the reviewer for the comment. The author team decided not to include additional detail on floodplain population data due to the subsequent requirements for including detailed explanations regarding methods and constraints of data collection.
Amy	Symstad	Text Region	25. Northern Great Plains		13		34		The ‚Äúeven while,‚Äù part of this sentence is confusing, perhaps superfluous.	We thank the reviewer for the comment. The report text has been revised to incorporate the suggestion. Specifically, the author team replaced the sentence with "the distress specifically caused by environmental change while still in a home environment." The two citations are still valid.
Amy	Symstad	Text Region	25. Northern Great Plains		13	13	36	37	What is the difference between land-based peoples and people who are connected to the land? Aren‚Äôt ranchers and farmers land-based?	We thank the reviewer for the comment. The report text has been revised to incorporate the suggestion. The text now reads: "Most often associated with Indigenous communities, who share collective ancestral ties to the lands and natural resources where they live or previously lived and which are inextricably linked to their identities, cultures, livelihoods, as well as their physical and spiritual well-being, " (https://www.worldbank.org/en/topic/indigenouspeoples. The World Bank), solastalgia can also affect others who are connected to the land, such as ranchers and farmers (Ellis and Albrecht 2017)."
Amy	Symstad	Text Region	25. Northern Great Plains		14		11		Be more explicit as to what ‚Äúacres affected by,‚Äù means. Acres where the species occurs? Acres where the species is dominant?	We thank the reviewer for the comment. The caption text has been revised to incorporate the suggestion for more clarity. The caption now reads: "Acreage in the Northern Great Plains where at least 50% of the soil surface is covered by two representative invasive plant species, cheatgrass (Bromus tectorum) in the western part of the region and Kentucky bluegrass or Canada bluegrass (Poa pratensis; Poa compressa) in the eastern part of the region, comparing 2004–2010 (middle) with 2011–2015 (bottom) and demonstrating the change in extent of invasion between 2004-2010 and 2011-2015 (top)."
Amy	Symstad	Text Region	25. Northern Great Plains		15		6		Explain ‚Äúfarmers have shifted to crop monoculture,‚Äù. The reference cited describes the conversion of perennial grasslands to monoculture, often annual, crops. This differs from farmers shifting from many crops to a single (monoculture).	We thank the reviewer for the comment. The report text has been revised to incorporate the suggestion. The text now reads: "Within the Northern Great Plains, conversion of perennial grasslands to monocultures of annual crops results in a loss of biodiversity."
Amy	Symstad	Text Region	25. Northern Great Plains		15	15	14	15	The region likely encompasses the entire BREEDING-SEASON range of these vulnerable species, not their entire range.	We thank the reviewer for the comment. The report text has been revised to incorporate the suggestion for more clarity. Specifically, the text was changed to state "entire breeding-season range."
Amy	Symstad	Text Region	25. Northern Great Plains		15		36		Does the amount of income for ‚Äúfarming,‚Äù include ranching? If so, be clear on that (change to ‚Äúfarming and ranching,‚Äù), as they are differently susceptible to climate change. If not, add statistics for ranching.	We thank the reviewer for the comment. The report text has been revised to incorporate the suggestion.
Amy	Symstad	Text Region	25. Northern Great Plains		16		8		Croplands and intensified agriculture aren‚Äôt expanding on their own. People are making active decisions to convert land to these uses. Reword.	We thank the reviewer for the comment. The report text has been revised to incorporate the suggestion. The author team revised the text to read: "Farmers are expanding and intensifying croplands into less productive lands in the region (Lark et al. 2020; Vick et al. 2016; Rosenzweig and Schipanski 2019) while climate change alters growing conditions. "
George	Ott	Figure	25. Northern Great Plains		17	18	15	3	In the Top Right Panel, "Selected protected lands" is unclear. Are these Federally protected through the BLM, Forest Service, National Park Service? The caption seems to indicate public vs. private land ownership. Perhaps replace "Select protected lands" with "Public lands" In the Bottom Left Panel, "Sedimentary basins" is unclear. Perhaps replace the basins with actual oil wells, gas wells and coal mines. Also, match the color of the dot in the key (now black) with the color of coal mines in the map. In the Bottom Right Panel, include a definition of, or reference for Social Vulnerability Index. Also, in the footnote section replace "text" with "Community Infrastructure and Quality of Life section below" General Comments 1. Consider adding a 5th panel showing the location of wind turbines or all renewable sources. 2. Consider putting the notation that "Tribal lands are outlined in all maps" to the right of the panels rather than in the footnotes.	We thank the reviewer for the comment to improve this figure. In the top right panel, "Selected protected lands" was changed to read "Public and other protected lands" and was defined in the caption as "federally-owned public lands which includes lands managed by the National Park Service, Bureau of Land Management, Bureau of Reclamation, US Forest Service, US Fish and Wildlife Service, Department of Defense, and other federal agencies. In addition to public lands, voluntarily provided private protected areas are also included but make up a very small minority of the overall public and other protected land area." The bottom left panel was redone. Sedimentary basins were replaced by active oil and gas wells. Coal mine coloration in the key was updated. Wind turbine installations were added as requested. In the bottom right panel, we clarified the caption to indicate where the capital letters are referenced in the text. We also specified that higher values near 1 have higher social vulnerability. Further defining of social vulnerability by readers can be referenced in the dataset citation. We did not include "Tribal lands are outlined in all maps" next to the panel but did move that note up to the beginning of the caption to capture readers' attention.
Amy	Symstad	Figure	25. Northern Great Plains		17	18	15	3	The captions in the figure itself do not match the caption text. Upper left, Farmland in pasture is NOT the same as row- and forage-based agriculture. The values seem to reflect the former, but it isn‚Äôt clear. A better figure would show both row- and forage-based agriculture but distinguish between them. Upper right, the tan areas encompass much more than ‚Äúparks,‚Äù. Is it all federal lands? Lower left, Explain ‚Äúsedimentary basins,‚Äù in the context of coal mines. Lower right, Is a higher index more vulnerable? Move the figure to be closer to where it is first referenced in the text.	We thank the reviewer for the comment. The caption text has been revised to incorporate the suggestion. The author team removed the reference to farmland in the caption and figure and instead specified the figure as depicting pasture or crop based agriculture. The upper right figure was labeled as "Public and other protected lands" and was further defined in the caption as "federally-owened public lands which includes lands managed by the National Park Service, Bureau of Land Management, Bureau of Reclamation, US Forest Service, US Fish and Wildlife Service, Department of Defense, and other federal agencies. In addition to public lands, voluntarily provided private protected areas are also included but make up a very small minority of the overall public and other protected land area. " Sedimentary basins were removed and replaced with active oil and gas wells to provide information on where current energy sourcing activities are occurring in the region. A higher SoVI value indicates greater vulnerability. This was defined in the caption. Figure is currently located between the "Food and Agriculture" and "Energy" sections to readily accessible to readers of both sections.
Amy	Symstad	Text Region	25. Northern Great Plains		18	18	16	18	What about increased energy costs in summer due to warming night-time temperatures?	We thank the reviewer for the comment. The report text has been revised to incorporate the suggestion. Annual household energy costs in 2080-2099 as compared to 2008-2012 are expected to decline in the Northern Great Plains states according to Huang and Gurney 2017. As this change in annual household energy costs includes both higher winter temperatures as well as warmer summers (both in the daytime and nighttime), any increased energy costs in the summer are offset by warmer winters. To clarify this, the term "annual" was added to the text so that it reads "Higher winter temperatures and fewer cold snaps are expected to decrease energy demand for heating, potentially lowering annual household energy costs in this region."

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Amy	Symstad	Text Region	25. Northern Great Plains		19	19	12	13	The reference cited supporting the statement that warmer winters contributed to the recent Mountain Pine Beetle outbreak in the Black Hills relies on personal communication from a park employee for its threshold temperature. Weed et al. 2015 (doi: 10.1007/s10980-015-0170-z) found no significant relationship between winter temperatures and MPB in the Black Hills, but did find a significant relationship in the Rocky Mountains of western Montana. Revise.	We thank the reviewer for the comment. The report text has been revised to incorporate the suggestion. The author team now references Weed et al. 2015 and have adjusted this statement to read as follows: "Warmer winter temperatures in recent decades are correlated with mountain pine beetle outbreaks in western Montana but were not significantly correlated with mountain pine beetle outbreaks in other forests within the region, such as the Black Hills (Weed et al. 2015)."
John	Driscoll	Text Region	25. Northern Great Plains		20	20	17	18	Encourage formation of Research, Development and Demonstration Cooperative Associations of divergent classes of membership, such as agricultural members, housing members and builder members so as to balance costs and benefits between classes of members and hasten incorporation of new lessons learned into actual operations.	We thank the reviewer for this comment. Consistent with its Congressional mandate, this assessment is a technical report and does not include specific policy recommendations.
kottie	christie-blick	Text Region	25. Northern Great Plains		21	22	12	2	Increased education for all stakeholders is imperative, including the youth. All of the Northern Great Plains states have education standards influenced by the Framework for K-12 Science Education or the Next Generation Science Standards. These standards are designed to create scientifically literate Americans. As such, they help learners understand ways in which humans impact Earth's resources and environment. There is a great need for schools to fully adopt and implement these standards, and for educators to be trained to teach the core ideas, concepts, and practices to their learners at an age-appropriate level. https://ngss.nsta.org/about.aspx https://www.nextgenscience.org/search/node/Earth%20and%20Human%20Activity	We thank the reviewer for the comment. The report text (KM4) has been revised to incorporate this suggestion. In addition, this comment also suggests the need for an overarching education focused chapter that is beyond the NGP chapter.
John	Driscoll	Figure	25. Northern Great Plains		22	22	32	33	In Montana fund local entities through Resource Conservation and Development (RC&D) committees, where they exist, to encourage collaboration among people, entities and governments with experience-based practical knowledge.	We thank the reviewer for this comment. Consistent with its Congressional mandate, this assessment is a technical report and does not include specific policy recommendations. Also note that the reference (Look et.al., 2022) in the same paragraph (line 25 to 27) speaks to the need to fund regional institutions and entities to build capacity, including governmental entities such as RC&Ds, without making a specific recommendation.
Amy	Symstad	Text Region	25. Northern Great Plains		22		35		A serious limitation in converting areas currently in row-crop agriculture to grassland in the northern Great Plains, if the endpoint desired is native species, is the lack of seed sources for those species. Native species tend to store more carbon underground than many non-native species, so this should be acknowledged as an important limitation (or opportunity for economic growth) on this strategy for adaptation.	We thank the reviewer for the comment. The report text has been revised to incorporate the suggestion for additional clarity around the need to identify seed sources for native species, yet the author team has chosen not to expand on the economics of the seed market due to strict word limit requirements.
Gabriel	Oppler	Text Region	25. Northern Great Plains		23	23	13	18	In addition, a renewable energy grid will require construction of new transmission lines and associated infrastructure, which can further fragment ecosystems (e.g., mowed right of ways replacing grassland or forest; direct bird/bat/insect mortality) (see: https://doi.org/10.1016/j.eiar.2018.04.010). We suggest that construction of solar and other renewables be sited, wherever possible, on existing degraded lands (i.e., brownfields; former mines) (see: https://www.brookings.edu/wp-content/uploads/2020/01/FP_20200113_renewables_land_use_local_opposition_gross.pdf and https://www.nature.org/en-us/what-we-do/our-insights/perspectives/clean-green-renewable-energy-buildout/)	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. The suggested resources were reviewed. In addition, the impact of transmission lines was emphasized by incorporating "harvesting and transmitting" in the current text as follows: "Fragmentation of these tracts by energy infrastructure involved in harvesting and transmitting energy can reduce wildlife populations and provide conduits for invasive species (Ott et al. 2021)." The concept of placing existing energy development on degraded land was incorporated by adding this sentence: "Siting of energy infrastructure on areas already disturbed by row-crop agriculture or other activities may help prevent further fragmentation in some areas but may not be a possibility in the more intact grasslands of the northern Great Plains. (Hise et al. 2022; Ott et al. 2021; Scholtz and Twidwell 2022)." The author team added the Hise et al. 2022 to the current references in this section as collectively they offered more specificity to the northern Great Plains than the citations provided and therefore were used as references when highlighting these concepts.
John	Driscoll	Text Region	25. Northern Great Plains		28	28	9	9	This tradition needs to extend to investigate carbon sequestration synergies by, for example, coordinating annual rotation of deep-rooted high carbon crops, such as hemp, with shallow rooted crops, such as wheat, and while expanding markets for sequestered excess surface carbon as compressed agricultural fiber building components.	We appreciate this reviewer comment, although it is beyond the scope of this report to include additional detail about specific mechanisms associated with sequestration pathways and different agricultural management practices.
Amy	Symstad	Figure	25. Northern Great Plains		31		1		The soggy, flooding image for the ‚ÁúA bit wetter‚Äù does not match the title of that scenario.	We thank the reviewer for the comment. The figure image has been revised to incorporate the suggestion for more clarity.
Glenn	Branch	Whole Chapter	25. Northern Great Plains						A discussion of climate change education and outreach efforts in this region is needed. (Note that the chapter on the Southern Great Plains includes a brief discussion of climate change education on ch. 26, pp. 31-32.) Education and outreach efforts are foundational to topics discussed in this chapter, including: * livelihoods and economies, since a goal of education is to prepare the workers and consumers of the future, which will be transformed by the effects of climate change; * human health and well-being, since educators play a role in ensuring the intellectual, psychological, and social health of their students in the face of climate change; and * planning and adaptation, which require policymakers and voters to grasp the scientific and social issues involved in meeting the challenges posed by climate change. While it would be best for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change, it would help for this chapter to discuss the situation specifically in its region.	We thank the reviewer for the comment. The report text has been revised to incorporate this suggestion. This comment also suggests the need for an overarching education focused chapter that is beyond the NGP chapter.
Charles	Keeling	Whole Chapter	25. Northern Great Plains						A discussion of climate change education should be included similar to the one in chapter 26, pp. 31-32.	We thank the reviewer for the comment. The report text has been revised to incorporate this suggestion, specifically in the Ch. 25, Key Message 4. This comment also suggests the need for an overarching education focused chapter that is beyond the scope of the NGP chapter.
Emma	Conrad-Rooney	Whole Chapter	25. Northern Great Plains						All key messages should be revised to make sure they follow the Risk-Based Framework	The author team has reviewed the potential issue areas and have ensured that risk-based framing is being used in our key messages to illustrate what is of value and how climate change impacts it. For instance, in KM 25.2 the author team states "Climate-related hazards, such as drought, wildfire, and flooding, are already harming the physical, mental, and spiritual health of Northern Great Plains region residents (virtually certain, high confidence), as well as the ecology of the region (very likely, medium confidence). As the climate continues to change, it is expected to have increased and cascading negative effects on human health and the lands, waters, and species on which people depend (very likely, medium confidence)." This focuses on the values (human/ecological health) that residents care about.
Brittany	Gutermuth	Whole Chapter	25. Northern Great Plains						Climate change education is explicitly discussed in ch. 26, pp. 31 (line 18-27)- 32 (line 1-2), it should be addressed here as well.	We thank the reviewer for this comment. A paragraph on climate change education was included in KM4.
Amy	Symstad	Whole Chapter	25. Northern Great Plains						Given that this chapter include the mountainous regions of the states in the geography covered by this chapter, all references to ‚Áúthe Northern Great Plains‚Äù would be better phrased as ‚Áúthe NCA Northern Great Plains region‚Äù or something similar. ‚ÁúGreat Plains‚Äù is a geographic area of the United States known to the public to be an area of vast plains, and that does NOT include the Rocky Mountains. Similar comments are appropriate for the NCA Southern Great Plains region. For the next assessment, consider renaming these to ‚ÁúNorth Central‚Äù and ‚ÁúSouth Central‚Äù to be consistent with all the other regions‚Äô names, which do not include the names of actual geographical features. The evidence provided to support the ‚Áúvery likely, high confidence‚Äù rating for increased flooding in the region is weak. Recent trends do not ensure continued similar trends in the future, particularly with the evidence that increased evapotranspiration will decrease runoff efficiency and that snowpack will decrease.	We thank the reviewer for the comment. It is not in the scope of this chapter to be able to change the official names of the regions, but the authors have changed references to the region to "Northern Great Plains region" when it is talking about the region as a whole and "Northern Great Plains" when it is talking specifically about the plains specifically. The team has noted this region change for future iterations of the NCA.
Jim	Titus	Whole Chapter	25. Northern Great Plains						This chapter does a pretty good job of providing some specific facts at the state or local level. It is important to do so because some agencies will create state-specific fact sheets about the impacts of climate change. To avoid the accusation of cherry picking, these agencies are often limited to using the facts presented by IPCC, NAS, and the National Assessment, which as a practical matter, usually means that NCA is the main source.	We thank the reviewer for the comment. No additional edits have been needed.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Amy	Symstad		25. Northern Great Plains					The evidence provided to support the "very likely, high confidence" rating for increased flooding in the region is weak. Recent trends do not ensure continue	Thank you for the comment. We agree that trends in observed data cannot be extrapolated into the future. However, there is significant evidence for increased flooding trends into the future as evidenced by a variety of factors. Extreme precipitation events are projected to increase, as well as seasonal amounts of precipitation. From the North Dakota State Climate Summary for 2022, "Although current observations do not show a positive trend in cold-season precipitation, projections suggest that winter precipitation will increase (Figure 8), even under a lower emissions pathway... Extreme precipitation events are also projected to increase in frequency and intensity, potentially leading to increased runoff and flooding, which can reduce water quality and erode soils." From the South Dakota State Climate Summary for 2022, "Annual precipitation is projected to increase, with the largest increases occurring during spring and winter ... Increases in the frequency and intensity of extreme precipitation events are also projected, potentially leading to increased runoff and flooding, which can reduce water quality and erode soils. Increased winter snowfall, rapid spring warming, and intense rainfall can combine to produce devastating floods." From the Nebraska State Climate Summary for 2022, "Although projections of overall annual precipitation are uncertain, winter and spring precipitation are projected to increase across the state... Extreme precipitation events are also projected to increase, leading to increased runoff and flooding, which can reduce water quality and erode soils." From the Wyoming State Climate Summary for 2022, "Winter and spring precipitation is projected to increase... Heavier spring precipitation, combined with a shift from snow to rain, could increase the potential for flooding." From the Montana State Climate Summary for 2022, "Although projections of overall annual precipitation are uncertain, winter and spring precipitation is projected to increase... Heavy spring precipitation could increase the potential for flooding." https://statesummaries.ncics.org/ From NASA, "In 2019, the Great Plains experienced unprecedented catastrophic flooding. Large flood events are predicted to increase in frequency and severity, posing risks to communities in this region, particularly Tribal Nations." This can be accessed at https://develop.larc.nasa.gov/2021/spring/NorthernGreatPlainsDisasters.html. Research published since this was drafted continues to point to increases in extreme precipitation in this region	
Rachel	Riley	Text Region	26. Southern Great Plains		3	3	5	6	The sentence states "cleaner" and "healthier". Cleaner and healthier compared to what? It is unclear from the text. Is it supposed to say "clean" and "healthy"?	The text has been revised to incorporate this suggestion.
Rachel	Riley	Text Region	26. Southern Great Plains		3	3	6	8	It would be helpful to reference the time period in which the tribal nations were forcibly relocated. The way the sentence currently reads makes it seem like the relocation was a recent event.	The text has been revised to incorporate this suggestion/information.
Ariela	Zycherman	Text Region	26. Southern Great Plains		3	3	10	12	This sentence would make more sense inserted on Line 6 before the sentence about the federally recogized tribes.	After consideration, the author team determined that the narrative flows best as written; the chapter has not been restructured in the proposed way. The sentence is intended to summarize why the information in the paragraph is relevant for discussing climate change.
Ariela	Zycherman	Text Region	26. Southern Great Plains		3	3	16	18	This sentence would convey the concepts more clearly by splitting the geography of the surface waters from their utility.	The sentence identified has been split into two sentences to incorporate the reviewer's suggestion.
Thomas	Knutson	Text Region	26. Southern Great Plains		4		5		The following could be added here: "Warming trends since 1900 over western and northern parts of the Southern Great Plains region as well as much of the western Gulf of Mexico (a source of moisture and energy for hurricanes in the region) has been attributed in part to anthropogenic influence (Vose et al. 2017; their Fig. 6.6). Over parts of the Southern Great Plains region an increase during 1973-2012 in summertime wet bulb globe temperature (WBGT), which affects human comfort, has been attributed in part to anthropogenic influence (Knutson and Ploshay, 2016; their Fig. 5a). An attributable anthropogenic contribution to past WBGT trends has been quantified over central North America, along with large projected future trends over the coming century (Li et al. 2017). The WBGT changes are notable because much of the Southern Great Plains is a relatively hot and humid region to begin with. WBGT trends were more detectable than surface temperature trends in the above studies." References: Vose, R.S., D.R. Easterling, K.E. Kunkel, A.N. LeGrande, and M.F. Wehner, 2017: Temperature changes in the United States. In: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 185-206, doi: 10.7930/J0N29V45. Knutson, T.R., Ploshay, J.J. Detection of anthropogenic influence on a summertime heat stress index. Climatic Change 138, 25-39 (2016). https://doi.org/10.1007/s10584-016-1708-z Li, C., Zhang, X., Zwiers, F., Fang, Y. and Michalak, A.M. (2017), Recent Very Hot Summers in Northern Hemispheric Land Areas Measured by Wet Bulb Globe Temperature Will Be the Norm Within 20 Years. Earth's Future, 5: 1203-1216. https://doi.org/10.1002/2017EF000639	We appreciate this suggestion, but space is limited. The author team has deliberated and prioritized the information to include. KM 2.2 and A4.2 address warmer nighttime temperatures or higher humidities on human health outcomes in general. Based on these agreed priorities, the chapter has not been revised.
Rachel	Riley	Figure	26. Southern Great Plains		4	4	5	6	Regarding Fig 26.1 and accompanying text that describes that figure: The trend in Kansas appears to be very small so saying that the "days with two or more inches have become more frequent" in Kansas is a bit of an overstatement. Rewording is needed here. (I am personally a bit surprised by this data. I thought an increase would be more apparent. Perhaps limited observations is a reason considering a lot of the region's precipitation occurs during small scale convective events.)	We thank the reviewer for this comment. We are working with the Technical Services Unit to revise Fig. 26.1 to create a trend map surrounded by 6 graphs of Annual Number of Days with over 2 Inches of Precipitation (1900-2021) for: western KS, eastern KS, western OK, eastern OK, western TX, and eastern TX. We believe such a graphic will better highlight the east/west differences.
Rachel	Riley	Figure	26. Southern Great Plains		4	4	5	21	Figure 26.1 caption: I recommend changing ",Ä¶indicating an increase in heavy precipitation event." to ",Ä¶indicating a slight increase in heavy,Ä¶", depending on how the comment about how the trend in Kansas is only a very slight increase is resolved.	We thank the reviewer for this comment. We are working with the Technical Services Unit to revise Fig. 26.1 (see comment 175042) and will revise text appropriately.
Ariela	Zycherman	Text Region	26. Southern Great Plains		4	4	9	11	Be consistent with the categories of drought and how they are descibed. As written a reader without prior knowledge of the NDMC drought categoeis does not know if the descriptions used have the same meaning.	The section identified has been reworded to incorporate the reviewer's suggestion. We replaced "severe or worse" to "severe to exceptional" to ensure the two sentences are consistent.
Rachel	Riley	Text Region	26. Southern Great Plains		4	4	16	16	Swap "flow" and "generally" so the sentence reads, "Rivers generally flow from,Ä¶".	The words identified have been rearranged to incorporate the reviewer's suggestion.
Thomas	Knutson	Text Region	26. Southern Great Plains		4	4	26	28	Some reference supporting the statement about precipitation projections should be included here. In addition, observed and CMIP5 modeled historical precipitation trends since 1901 have been compared (Knutson and Zeng 2018, see their Fig. 3). These show for much of the Southern Great Plains region (eastern parts of the region) a significant discrepancy, with models simulating a decreasing trend while a significant increase occurred in observations. This may introduce some uncertainty into future projections of precipitation, and even flood and drought risk, for this subregion in particular. To explore this further, you might try to include in Fig. 26.2 additional panels for precipitation historical and projected future changes for Kansas, Oklahoma, and Texas (in addition to temperature). These might also show the sign reversal in precipitation change in late 21st century shown in Fig. 26.10, which is an interesting feature for Texas precipitation 21st century projections in Fig. 26.10. Ref: Knutson, T. R., & Zeng, F. (2018). Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends, Journal of Climate, 31(12), 4617-4637. https://journals.ametsoc.org/view/journals/clim/31/12/jcli-d-17-0672.1.xml	We thank the reviewer for this comment. We are working with the Technical Services Unit to revise Fig. 26.1 to create a trend map surrounded by 6 graphs of Annual Number of Days with over 2 Inches of Precipitation (1900-2021) for: western KS, eastern KS, western OK, eastern OK, western TX, and eastern TX. We believe such a graphic will better highlight the east/west differences.
Reid	Sherman	Text Region	26. Southern Great Plains		4	4	29	29	"2021)Figure 26.17" should read "2021) in Figure 26.17"	The sentence typo identified has been removed to address the reviewer's concern.
Ariela	Zycherman	Text Region	26. Southern Great Plains		5	5	17	17	It's unclear who "we" is.Something like "residents of the Southern Great Plains" would be more clear.	The sentence identified has been reworded to address the reviewer's concern.
Rachel	Riley	Text Region	26. Southern Great Plains		5	5	19	22	"Hazards" is a broad term. Not all hazards that the region experiences are expected to become more frequent and intense. Please add some specificity here. Also, this sentence doesn't connect very well with the prior sentence.	The sentences identified have been reworded to address the reviewer's concern.
Rachel	Riley	Text Region	26. Southern Great Plains		6	6	12	12	I recommend the following grammatical revision to the sentence. ",Ä¶estimated to cause 3-10 times more damage to buildings and be $9.2 billion (in 2019 dollars) more costly than,Ä¶"	The sentence identified has been reworded to address the reviewer's concern.
Ariela	Zycherman	Text Region	26. Southern Great Plains		6	6	12	12	This sentence needs contextual informationa about the relative size of 9.2 billion to current costs.	The sentence identified has been reworded to address the reviewer's concern.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Riley	Text Region	26. Southern Great Plains		6	6	32	33	"Exemplifies" is a rather strong word considering the lack of land use and zoning codes in Houston and the fact that the February 2021 storm "crippled ... energy and water systems" as noted on page 7. Also, some locations flooded in Hurricane Harvey because they were locations that should never have been developed in the first place. I'm glad Houston is incorporating climate-smart actions now, though. Please reword the sentence to better reflect the reality of prior poor land use and zoning decisions but acknowledges that the city aims to improve.	The sentence identified has been reworded to incorporate the reviewer's suggestion.
Rachel	Riley	Text Region	26. Southern Great Plains		7	7	6	9	I disagree that a lack of available cash is solely due to social inequities and historic racism. Connecting the sentence in line 6 to the sentence that begins in line 7 is a very bold claim and the wording needs to be changed. There is some evidence that policies from many decades ago (e.g., redlining, banks not willing to sell black people mortgages) have influenced ability to build generational wealth. However, there are other factors. Not every demographical disparity that is observed in this country is due to racism. Cultural norms, children born out of wedlock, and fatherless homes (which lead to lack of earning power) are some other reasons. Please see the book Please Stop Helping Us by Jason L. Riley, particularly chapter 2.	After consideration, the author team determined that the narrative flows best as written; the chapter has not been restructured in the proposed way. The sentence identified includes "social inequities and historical racism"; it does not exclude other challenges that are related to climate risks. See Chapter 20 for additional peer-reviewed literature on this subject.
Rachel	Riley	Text Region	26. Southern Great Plains		8	8	22	24	This is not necessary to include if you are up against word limitations, but City of Oklahoma City is also at immediate risk of violating federal air quality standards: https://www.okc.gov/home/showpublisheddocument/18892/637299977752630000. Their adaptOKC plan puts forth ideas for how to reduce ground level ozone and CO2.	We appreciate this suggestion, but space is limited. The author team has deliberated and chose to focus on counties that were categorized as Severe under the EPA 2008 8-h ozone standard. Other counties were Mariginal under the 2015 8-h ozone standard, but no county in Oklahoma was in either category. Hence, we clarified the level of ozone we used but did not change the intent of the sentence.
Rachel	Riley	Figure	26. Southern Great Plains		9		3		Figure 26.4: Nice figure. For a response example in the Shortage of drinking water section I suggest you add text such as "Increase water use efficiencies and reduce water usage through residential and business actions." (E.g., odd/even watering schedule, more efficient appliances, checking sprinkler systems for leaks, etc.)	We thank the reviewer for the comment. The graphic identified has been reworded to address the reviewer's concern.
Rachel	Riley	Text Region	26. Southern Great Plains		10		8	11	These sentences link the February 2021 storm to climate change. That is a logical fallacy. The Feb 2021 storm was shown to not be unprecedented. Rare, yes, but not unprecedented. Therefore, it is not appropriate to infer that it was caused by climate change. A better point to make might be that the storm showed that infrastructure and businesses aren't prepared to deal with existing threats, and climate change will likely cause additional negative impacts or challenges to people and infrastructure.	We thank the reviewer for the comment. The original wording did not link the February 2021 storm to climate change; rather it linked it to exposing resilience gaps. To ensure that there is no appearance of conflating these concepts, the chapter text has been revised slightly.
Ariela	Zycherman	Text Region	26. Southern Great Plains		12	12	17	17	WHY?!? This doesn't just happen and Ithe text should not naturalize disproportionate impacts on minority populations. Someone made choices likely involving historical context or policy that led to this result.	After consideration, the author team had changed some of the text in the chapter to note the broader context of equity and justice issues, including referring readers to Chapter 20. Space is limited, however, so we used our judgment on where to update the text.
Ariela	Zycherman	Text Region	26. Southern Great Plains		13	13	5	6	This phrasing again naturalizes greater exposure of non-White populations to blackouts as though it's the result of melanin as opposed to policy or historical context.	After consideration, the author team had changed some of the text in the chapter to note the broader context of equity and justice issues, including referring readers to Chapter 20. Space is limited, however, so we used our judgment on where to update the text.
Rachel	Riley	Text Region	26. Southern Great Plains		13	13	13	15	I agree with this statement, but it contradicts statements in other parts of the chapter that say "extremely cold days" will decrease (page 4). Maybe instead of saying extremely cold days will decrease in frequency it would be more scientifically appropriate to talk about how warm nights have been increasing.	We thank the reviewer for the comment. The sentence identified has been reworded to clarify the linkage between the jet stream and extremely cold days. The statements that extremely cold days are becoming less frequent and there still will be extremely cold days in the future are not incongruent. Both are supported by the peer-reviewed literature.
Rachel	Riley	Text Region	26. Southern Great Plains		14	14	5	8	I see that this is a placeholder for NCA5 LOCA2/STAR downscaling so perhaps this comment will become invalid. However, based on the existing figure, approximately 85% of the projection map goes against the message you are communicating in lines 5 to 8. Also, at a certain latitude does a "false spring" become irrelevant due to the growing season being year-round? I understand the point (false springs can be a problem), but the projection data don't show it to be a big problem. At least not yet. Some more nuanced language in lines 5 to 8 might help. How about "Texas and Oklahoma pandhandles" instead of "western Oklahoma"? I commiserate with you in trying to figure out how to communicate the findings. This region is challenging.	We thank the reviewer for the comment. The graphic identified is a placeholder and we will update our wording after the map is created with the LOCA2 data.
Rachel	Riley	Text Region	26. Southern Great Plains		15		7		A revision is needed for the sentence so it says, "When drought occurs it reduces the capacity.Â¶" This change is recommended to reflect that drought is also a natural part of the region's climate. That's not to say it can't get worse given climate change, though.	After consideration, the author team determined that the narrative flows best as written; the chapter has not been restructured in the proposed way. The current verb form is intentional and consistent with guidance provided by the NCA5 Technical Services Unit.
Rachel	Riley	Figure	26. Southern Great Plains		15	15	14	20	Figure 26.10 and caption: Based on what is shown in the projection maps I think the bigger message is that there is not a strong signal either way (drier or wetter), but the models are trending towards the drier parts of the region getting drier. Is the overall change significant, though, given that there is likely some uncertainty in the model? The caption focuses on the dry trend in the western part of the region but fails to acknowledge the wet trend in the rest of the region. Again though, the changes are pretty small, around 5%. Is that really enough of a trend to lead to a strong conclusion since annual rainfall is highly variable anyway?	We thank the reviewer for the comment. The graphic identified was created with global climate model output before the LOCA2/STAR downscaled data were available. We are working with the Technical Services Unit to update the graphic and will revise the text appropriately.
Rachel	Riley	Figure	26. Southern Great Plains		15	15	16	17	Figure 26.10 caption: Add "by late century" to the end of the first sentence.	The text has been revised to clarify this point.
Rachel	Riley	Text Region	26. Southern Great Plains		17	17	8	14	Regarding Key Message 26.3: Chapter 2 Figure 2.4 shows summer temperature have actually cooled in parts of the SGP. This is surprising to me, but summer precipitation also increased, so an increase in precipitation means more clouds and cooler high temperatures. That said, the climate of the region has always been hot, so the impacts to recreation and sports has always been an issue and will get worse even with population increases alone (or blackouts due to high energy demands). And, nighttime temperatures *have* increased. So, a better message here might be that the additional human health stressors are more likely going to be due to higher nighttime temperatures and increased cooling demands (if air conditioner doesn't work at night that's a problem).	We appreciate this suggestion, but space is limited. The author team has deliberated and prioritized the information to include. KM 2.2 and A4.2 address warmer nighttime temperatures or higher humidities on human health outcomes in general. Based on these agreed priorities, the chapter has not been revised.
Rachel	Riley	Figure	26. Southern Great Plains		18		13	17	Figure 26.12: The focus of this figure is on climate change impacts, but the stated impacts have already been occurring in the region without climate change. I recommend a nuanced re-wording of the figure header. Alternatively, you could move what is currently Figure 26.13 and its accompanying text ahead of 26.12 so the reader readers about the projected increase in extremely hot days first.	The caption and title identified have been reworded to address the reviewer's concern.
Ariela	Zycherman	Figure	26. Southern Great Plains		18				I am unsure if conveying this information as a figure is helpful.	After consideration, the author team determined that the graphic supports our message; the chapter has not been restructured in the proposed way.
Ariela	Zycherman	Text Region	26. Southern Great Plains		20	20	4	4	There is no specific link to sex or gender discussed in the following text. Since it is not pertinent there is no need to specify potentially exclusve sex/gender categories. A phrase such as "ragardless of sex or gender" would be more appropriate if the intent is to remind the reader that not all young athletes are male.	The text has been revised to incorporate this suggestion.
Ariela	Zycherman	Text Region	26. Southern Great Plains		24	24	5	8	The order of the words used implies the exposure to pollution and environmental degradation are not caused by marginalization, discrimination, or government policies.I would suggest "suffering disproportionately from climate-related hazrads and exposure to pollution and environmental degradation because of informal and government policy based marginalization and disrimmination" more accurately reflects reality.	After consideration, the author team had changed some of the text in the chapter to note the broader context of equity and justice issues, including referring readers to Chapter 20. Space is limited, however, so we used our judgment on where to update the text.
Reid	Sherman	Text Region	26. Southern Great Plains		24	24	15	15	Suggest changing 'KM 15.2, KM 20.6' to 'KMs 15.2 and 20.6'	The sentence identified has been reworded to address the reviewer's concern.
Ariela	Zycherman	Text Region	26. Southern Great Plains		24	24	20	20	The term "older senior" should be clarified or not used. What exactly is an "older senior adult" and how is that different from "seniors" or "older adults"	The sentence identified has been reworded to address the reviewer's concern and to be consistent with new guidance from the Technical Services Unit.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Riley	Text Region	26. Southern Great Plains		24	24	26	34	While I don't personally want anyone to suffer, and I have compassion on anyone that is, there is an economic reality that housing stock that serves lower-income individuals might be lacking in quality or older (before higher building standards were put in place). This isn't necessarily anyone's fault, it's simply basic economics. Various groups (individuals, non-profit organizations, foundations, etc.) should work to increase standards, but the way the text currently reads is very idealistic and not based in reality. It takes money to build quality infrastructure and literature and experience indicates that people and politicians often don't want to pay a short-term cost for the long-term gain. I implore you to integrate an economic perspective into this section or elsewhere in the chapter. I personally know of people who work in government who strive to make positive changes but the money to do so simply doesn't exist (yet). Blaming the government and systems for every disparity and hardship stems from erroneous critical theory and ignores one's personal agency to make changes. That's not to say that the government and systems don't have any role to play. For example, local government can deny developer applications to build in known floodplains. But blaming only those systems isn't helpful nor productive.	This comment does not appear to raise a question or suggest a revision. The paragraph identified is based on substantial peer-reviewed literature.
Ariela	Zycherman	Text Region	26. Southern Great Plains		25	25	6	7	Again. DO NOT naturalize chemical exposure of marginalized communities following weather events. This requires explanation.	After consideration, the author team had changed some of the text in the chapter to note the broader context of equity and justice issues, including referring readers to Chapter 20. Space is limited, however, so we used our judgment on where to update the text.
Rachel	Riley	Text Region	26. Southern Great Plains		26	26	3	4	This is a very strong statement. Historically speaking atrocities have occurred and people have been treated terribly. That can be said for any nation on this earth. However, the settlers that originally immigrated from Europe have been incredibly productive and have, along with immigrants from other locations, made the United States the most productive in the world. This continually negative rhetoric is very depressing and not helpful. While it is important to acknowledge past wrongs, it isn't helpful nor productive to repeat them over and over and over again. So many positive changes have occurred over the last 50 to 100 years.	This comment does not appear to raise a question or suggest a revision. For additional clarity on the substantial, peer-reviewed literature related to the identified sentence, we have added two additional citations.
Rachel	Riley	Text Region	26. Southern Great Plains		26	26	5	8	When tribal nations were forcibly relocated (which was terrible), anthropogenic climate change didn't exist. Therefore, it is not scientifically appropriate to connect the relocation of tribes to climate change impacts. Not to mention, in the Southern Great Plains, tribal nations and people with indigenous ethnicities live in the same areas as the people who have different ethnic origins. This Key Message reference is not relevant to the Southern Great Plains chapter. The sentence is also a run-on sentence.	The text has been revised to clarify this point. We have inserted "now" to clarify that higher risk for climate-change impacts is current and not during relocation. We also removed ", specifically drought," to simplify the sentence.
Ariela	Zycherman	Figure	26. Southern Great Plains		28				This figure should be placed closer to the text focused on hurricanes (page 25).	We appreciate the suggestion, but all adaptation/mitigation options figures are intended to connect to the discussion on adaptation and mitigation at the end of each Key Message. We have not moved the figure.
Ariela	Zycherman	Text Region	26. Southern Great Plains		30	30	7	19	This discussion of state water plans is more closely aligned with the later discussion of plans for adaptation and mitigation (pg 32 lines 13-27). It may be more effective to group them.	The text has been revised to incorporate this suggestion.
Ariela	Zycherman	Text Region	26. Southern Great Plains		31	32	18	2	This paragraph needs something to tranistion it from the previous ones. The topic is mentioned in the KM, but does not naturally flow from the preceding topic as written.	The text has been revised to incorporate this suggestion.
kottie	christie-blick	Text Region	26. Southern Great Plains		31	32	20	2	Increased education for all stakeholders is imperative, including the youth. Oklahoma and Kansas have education standards influenced by the Framework for K-12 Science Education or the Next Generation Science Standards, as do most of the other states in the US. Texas has yet to follow these nationally recognized science standards. These standards are designed to create scientifically literate Americans. As such, they help learners understand ways in which humans impact Earth's resources and environment. There is a great need for schools to fully adopt and implement these standards, and for educators to be trained to teach the core ideas, concepts, and practices to their learners at an age-appropriate level. https://ngss.nsta.org/about.aspx https://www.nextgenscience.org/search/node/Earth%20and%20Human%20Activity	We thank the reviewer for this comment. State curriculum standards are reviewed in KM 26.5.
Reid	Sherman	Text Region	26. Southern Great Plains		32	32	16	16	Reference should be included correctly	The citation error identified has been fixed to address the reviewer's concern.
Rachel	Riley	Text Region	26. Southern Great Plains		32		24		Change "more" to "very"	The sentence identified has been reworded to address the reviewer's concern.
Rachel	Riley	Figure	26. Southern Great Plains		33	33	1	12	Figure 26.22: It is unclear from the figure and caption as to whether "mitigation" refers to hazard mitigation (i.e. hazard risk reduction) or climate mitigation (GHG reduction). Clarity is needed as different professions use the term mitigation to mean different things. Also, I recommend indicating somewhere that the actions included on the map are not necessarily a comprehensive representation of all actions that have occurred in the region. It's encouraging to see all the locations that are acting in some way, though.	The caption and figure legend identified have been reworded to address the reviewer's concern.
Rachel	Riley	Figure	26. Southern Great Plains		33	33	3	4	Figure 26.22 caption: Recommended revision for the first sentence of the caption: "Communities and tribes across the Southern Great Plains are acting in response to the challenges associated with climate variability and change."	The sentence identified has been reworded to address the reviewer's concern.
Rachel	Riley	Whole Page	26. Southern Great Plains		34				It's encouraging to see how the Greensburg, KS plan has come along.	We greatly appreciate the reviewer's comment.
Rachel	Riley	Figure	26. Southern Great Plains		35		4	11	These are nice graphics. That said - The response, "...including meal delivery" is ideal but logistically impossible. If it's not safe enough for kids to get to school, it's not safe for school officials to be out driving delivering meals. Not to mention, having the people-power to make such deliveries does not seem feasible. I recommend removing "including meal delivery" from the graphic. Investing in road treatment capabilities could be added to the graphic in the "stresses to the transportation system" section.	We thank the reviewer for the comment. The graphic identified has been reworded to address the reviewer's concern.
Bob	Randall	Whole Chapter	26. Southern Great Plains						The sections on agriculture I think neglect an urgent and important subject--namely the effect of hotter temperatures on the growth of food plants. In the Upper Gulf Coast temperatures have increased enough already that it is necessary to adjust planting schedules for annual cool season food plants forward 4-8 weeks in autumn. Broadly, all plants have optimal temperature ranges and struggle (slow growth or pests), don't grow, or die depending on how much hotter (or colder) than optimal temperatures are. In the case of food crops, they need optimal temperatures long enough to harvest. On the Texas Gulf Coast, not only are the planting schedules changing rapidly with little public or agricultural awareness, but in some cases crops that formerly grew easily no longer do. You should look at the effects of temperatures in the 90's on common food crops. Adaptation will require an entirely different understanding by nurseries, landscapers, and farmers because of heat, not just water availability. What I say here about food plants is also true about most landscaping plants and even some native trees. So, it isn't just mangroves!	Due to the breadth of the topics and the page limit for the chapter, we focused on areas that were new since NCA4 or not covered well in the past. We have attempted to briefly address your concern.
Xiaomao	Lin	Whole Chapter	26. Southern Great Plains						SGP is located at US agricultural heartland along with irregular, intensive, and frequent extreme climate events. Such extreme events when simutaneously combined, namely compound extreme events, could cause significant negative impacts for crop production, livestock, and pasture conditions in SGP. For examples, in terms of compund hot-dry-windy events in the US Great Plains, there are a few findings as: 1. Windblown dust had dubled during last a few decades, which influences human health and provides potential risks to agricultral land and agricultral production systems. 2. Compound hot-dry-windy events have been significantly increased during past four decades in SGP. 3. The compound hot-dry-windy events caused winter wheat loss significantly in SGP. 4. The severely affected and fastest increased compound hot-dry-windy event areas are the same area footprinted by the Dust Bowl of the 1930s. These findings are from a recent paper "U.S. winter wheat yield loss attributed to compound hot-dry-windy events" published in Nature Communications in 2022 (https://www.nature.com/articles/s41467-022-34947-6)	We added a rough draft of new text to address these comments

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Glenn	Branch	Whole Chapter	26. Southern Great Plains						It is good to see the brief discussion of climate change education on ch. 26, pp. 31-32: climate change education is a critical component of any plan for responding to climate change, since future generations will face, and thus need to be equipped with the requisite knowledge and knowhow to cope with, the challenges of climate change. Unfortunately, the other regional chapters lack a counterpart of this discussion. In any case, it would be best for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change.	We greatly appreciate the reviewer's comment. This issue has been referred to the Federal Steering Committee for future consideration.
Jim	Titus	Whole Chapter	26. Southern Great Plains						The Chapter Title is misleading. While definitions of the Great Plains vary, neither Houston nor the Gulf Coast are part of the Great Plains. The chapter title needs to be tweaked, and the text needs to explain early on what the region is.	We thank the reviewer for this comment, but the title and geographic scope was set by the Federal Steering Committee of the National Climate Assessment. Changing the title is out of the scope of the author team. A map of the states will be included for clarity.
Rachel	Riley	Whole Chapter	26. Southern Great Plains						I appreciate the framing of the chapter: How we live, how we work, how we play, how we heal, how we serve. I think it is a framework that will resonate with readers.	We greatly appreciate the reviewer's comment.
Rachel	Riley	Whole Chapter	26. Southern Great Plains						Unless they will be defined elsewhere in NCA5 materials, please provide definitions of the words equity and justice. Those words are used a lot these days but mean different things to different people. The words are used substantially throughout the chapter.	We agree that a definition would be helpful. We have requested that the Technical Services Unit include "equity" and "justice, social" in the accompanying glossary.
Rachel	Riley	Whole Chapter	26. Southern Great Plains						A significant message missing from this chapter is that climate change impacts in this region are very nuanced compared to other regions of the U.S. and the world, and the region experienced many hazards prior to the existence of anthropogenic climate change. It's important to not dismiss the hazards that the region experiences due to high natural variability. The climate of the region is complicated due to local climate dynamics and being in the transition zone between the dry/semi-arid/arid western U.S. and wet eastern U.S. Essentially, the climate change signals are not as strong as they are in other U.S. regions. That's not to say that climate change isn't impacting the U.S. or happening on the global scale. It is. And I personally think we need to take action to mitigate its impact, both with GHG reduction and adaptation actions. But some of the statements in the chapter make it seem like climate *change* is a bigger cause of the variability and extremes that the region experiences than what the data have actually shown so far. Some of the chapter wording needs to be tightened up to reflect this reality.	We thank the reviewer for this comment. We focus in the Key Messages primarily on the future changes and have been careful in our language to not attribute all extremes/hazards to climate change. We use extremes/hazards to draw attention to risk, as prior events provide tangible examples of impacts, consequences, and actions. The text has been revised in the introduction to remind readers of the high natural climate variability of the region.
Don	Haas	Whole Chapter	26. Southern Great Plains						This chapter includes the most substantive reference to the climate education research literature in the entire 1,695 page document, and it is appreciated. It is primarily in a single paragraph on pages 31 and 32, so more depth would be appreciated and warranted, but the attention is appreciated.	We greatly appreciate the reviewer's comment. Little literature is available for the region, but we did add a sentence regarding informal education.
Jim	Titus	Whole Chapter	26. Southern Great Plains						It would be helpful for this chapter to provide more specific facts at the state level, including tables or maps that quantify impacts and location-specific expectations. It is important to do so because some federal agencies will create state-specific fact sheets about the impacts of climate change. To avoid the accusation of cherry picking, these agencies are often limited to using the facts presented by IPCC, NAS, and the National Assessment, which as a practical matter, usually means that NCA is the main source.	We appreciate this suggestion, but space is limited. The author team has deliberated and prioritized the information and illustrations to include. Based on these agreed priorities, the chapter has not been revised.
Holly	Prendeville	Text Region	27. Northwest		3	8	1	27	The introduction does not set up the entire chapter rather it just provides a summary of climate change. Revision of this section would better set up the reader for contents within the chapter while still providing a summary of climate change information.	Thank you for this comment. Authors were directed to provide a summary of climate science projections for the NCA, and thus decided to keep the similar structure. However, we revised the introduction based on this comment to include more cross references directly to key messages to illustrate how climate change affects various aspects. Additionally, we added a table in the traceable accounts that did a similar exercise on how topics were included and/or not included, relative to content covered in prior NCAs.
Thomas	Knutson	Text Region	27. Northwest		3	3	10	11	Suggest to expand here that: "Annual average temperatures in the region have risen by almost 2 degF since 1900, and the warming is consistent with climate model historical runs, detectable compared to natural variabilty and partly attributable to anthropogenic forcing (Vose et al. 2017, their Fig. 6.6). There is some evidence for detectable human influence on increasing summertime wet bulb globe temperatures--a measure of heat stress combining temperature and humidity-- for the period 1973-2012 over parts of the Northwest (Knutson and Ploshay 2016) and for western North America as a whole (Li et al. 2017)." Refs: Vose, R.S., D.R. Easterling, K.E. Kunkel, A.N. LeGrande, and M.F. Wehner, 2017: Temperature changes in the United States. In: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 185-206, doi: 10.7930/J0N29V45. Knutson, T.R., Ploshay, J.J. Detection of anthropogenic influence on a summertime heat stress index. Climatic Change 138, 25-39 (2016). https://doi.org/10.1007/s10584-016-1708-z Li, C., Zhang, X., Zwiers, F., Fang, Y. and Michalak, A.M. (2017), Recent Very Hot Summers in Northern Hemispheric Land Areas Measured by Wet Bulb Globe Temperature Will Be the Norm Within 20 Years. Earth's Future, 5: 1203-121	Thank you for this comment. We have added the Vose et al. 2017 citation. However, the authors believe we do not need to add the additional citations. Specifically, we chose not to add the references referring to wet bulb temperatures since we have other citations on extremely hot day and warm nights, which also can be used to measure heat stress and experience. Additionally the other citations (Knutson and Ploshay 2016 and Li et al. 2017) are focused on wide-reaching geographies that include areas outside the Northwest. Most citations in this sentence are more regionally-specific to the Northwest region.
Thomas	Knutson	Text Region	27. Northwest		3	3	23	25	In addition to projected decrease of summer precipitation by what appears to be a narrow majority of models (8 of 15?) on the UW/Rogers and Mauger website, another indicator of likely increasing drought risk for the Northwest during summer is the summer multi-model runoff projection from IPCC AR6 (their Fig. 8.18 f). Note that a decrease is not projected for winter. Also see the annual mean total column projected soil moisture change (Fig. 2.12) but note based on IPCC AR6, Fig. 8.19(i) that less than 80% of IPCC models agree on a projection of decreasing column soil moisture in the Northwest U.S. region.	Thank you for this comment. We have revised this sentence to reflect this comment.
Ned	Ende	Text Region	27. Northwest		3	3	26	31	This paragraph is written in terms of expected changes, when in fact, the Puget Sound basin is already experiencing lower summer stream flows at significantly more gaged locations than were historically recorded. Analysis of observational summer stream daily flows in the Puget Sound basin show that over forty percent of the daily summer flows studied between the years 1999 to 2021 were below historic 25th percentiles. Between 2015 to 2021 the portion of summer flows in the study bump up to about two thirds or 67 percent of daily flows which fall below the 25th percentile (Shedd, 2022). Citation: Shedd, Jim. 2022 A Look at Summer Flows in the Puget Sound Basin, Presentation at the Environmental Assessment Program Science Conference, Washington Department of Ecology, November 16, 2022.	Thank you for this comment. We have amended this sentence to also reflect observations of reduced summer flows in streams. However, did not include this reference as there are other peer-reviewed references that support similar conclusions.
Jessica	Halofsky	Text Region	27. Northwest		6	6	1	3	I suggest rewording to "Sea level rise projections vary geographically across the Northwest, but range from 0-3 feet by 2100. This is because of differences in vertical land movement and long-term change in land surface from processes like tectonic forces."	This sentence has been revised based on this comment.
Ned	Ende	Text Region	27. Northwest		6	6	7	9	Suggest making clear that this text region is in reference to the California Current System. Second part of sentence is a bit confusing, deep water where? Siedlicki et al (2021) states: Spatially, the SST (sea surface temperature) increases most offshore and increases least near the coast in all simulations of this eastern boundary upwelling system, as a result of upwelling. At the bottom, the temperature increases the most near the coast. The abyssal regions show little to no change in temperature.	Thank you for this comment. We have revised this sentence to reflect this citation, though feel like the level of specificity reflects the components of this comment.
Ned	Ende	Text Region	27. Northwest		6	6	13	17	Note that Pelletier et al (2017) does not delve into the synergies of ocean acidification and hypoxia. However, this is a fitting text region to insert the following: In the Salish Sea, nutrients derived from local human activities can exacerbate changes to marine water carbonate chemistry caused by human induced atmospheric carbon dioxide increases, particularly in bottom waters.	Thank you for this comment. We have added considerations of nutrient loading and other anthropogenic inputs. However, we decided not to call out the Salish Sea specifically as citations reference areas beyond this area.
Jessica	Halofsky	Text Region	27. Northwest		6	6	28	28	In RCP 8.5 or RCP 4.5 or is it an average of both of them?	This comment has been addressed. The table caption has been amended to be more descriptive.
Holly	Prendeville	Table	27. Northwest		7	7	1	1	Table 1.2 is on the next page where 'vertical land movement' is mentioned. Is there a more accessible phrase that could be used that the public will understand more readily? A sentence providing the why and connection to climate change would be helpful to a general audience.	The table caption has been amended to be more descriptive and have added qualification to vertical land movement.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Emma	Conrad-Rooney	Text Region	27. Northwest		7	7	2	8	Key message 27.1 should be revised to follow a Risk-Based Framework.	Thank you for this comment.This key message has been revised using risk-based framework.
Holly	Prendeville	Text Region	27. Northwest		7	7	19	19	delete 'are'	This comment has been addressed.
Jessica	Halofsky	Text Region	27. Northwest		7	7	19	19	Grammar vc¬Ã¬ì should read "while many types of frontline communities exist"	This comment has been addressed.
Jessica	Halofsky	Text Region	27. Northwest		7	7	19	20	Why are young children and the elderly grouped? Should it be "young children, the elderlyvc¬Ã¬¶"?	We addressed this comment, by rewriting it to: "young children, the elderly".
Jim	Titus	Text Region	27. Northwest		8	8	4	7	This sentence is needs a bit of reworking because it slightly mischaracterizes redlining. Actually, this chapter does a better job than most or all of the other chapters at describing the causes of disproportionate impacts, so this is the only one of several sentences mentioning redlining that need to revised. Redlining did reinforce racial discrimination, as the first part of the sentence says. It also reinforced discrimination against owners of property in floodplains or near polluting factories. But the second half of the sentence is wrong about redlining (though not about the other factors listed at the beginning of the sentence). Properties in areas with alot of racial minorities, certain ethnic white minorities, or in hazardous of polluted areas all were coded red in the Home Owners Loan Corporation maps. The redlining resulted in more restricted availability of loans. So it **reflected** the pre-existing situation in which factories were sited near minority residents and/or minorities were channeled to the hazardous areas. But the redlining did not cause these collinearities.	Thank you for this comment. We have revised this sentence to reflect this comment.
Jessica	Halofsky	Text Region	27. Northwest		9	9	11	15	These ideas should possibly be two sentences. Lumping the negative with the positive deemphasizes the point of there being two possibly different futures	Thank you for this comment. We have re-wrote this sentence to demonstrate both positive and negative outcomes.
Jessica	Halofsky	Text Region	27. Northwest		9	9	15	19	What is the importance of calling out that certain communities may not associate climate change with human action?	Thank you for this comment. We have rewrote this sentence to include their heightened perceived risks yet diminished climate adaptation and behavior response.
Jessica	Halofsky	Text Region	27. Northwest		9	9	15	17	"Weather- and climate-service providers provide these communities with tools and resources to help them be more resilient (Roesch-McNally et al. 2020; Lavoie et al. 2021; Wardropper et al. 2021), although some rural community residents may not associate significant extreme weather events with long-term, human-caused climate change (Boag et al. 2018; Fischer 2018; Maas et al. 19 2020)." Please consider defining the term "climate-services" as this term is new for some and perhaps just starting to be consistently defined.	Thank you for this comment. "Climate services" is defined in the glossary, and thus we have not re-defined it here.
kottie	christie-blick	Text Region	27. Northwest		10	10	16	20	In addition, increased education for all stakeholders is imperative, including the youth. Washington, Oregon, and Idaho have education standards influenced by the Framework for K-12 Science Education or the Next Generation Science Standards. These standards are designed to create scientifically literate Americans. As such, they help learners understand ways in which humans impact Earth's resources and environment. There is a great need for schools to fully adopt and implement these standards, and for educators to be trained to teach the core ideas, concepts, and practices to their learners at an age-appropriate level. https://ngss.nsta.org/about.aspx https://www.nextgenscience.org/search/node/Earth%20and%20Human%20Activity	Thank you for this comment. There are several places in the chapter that we mention how education is a powerful climate response, including how education can connect people - especially students and youth - to sense of place, and how education programs can lead to benefits like water incentives. Further discussion on specific K-12 policies and programs is outside the scope of the chapter.
Jessica	Halofsky	Text Region	27. Northwest		10	10	24	25	This sentence could be read a couple of ways, but some human activities (e.g., fire management) have positive ecosystem effects	We modified the key message to recognize that some human actions aim to facilitate ecological adaptation
Jessica	Halofsky	Text Region	27. Northwest		11	11	15	16	Wording is a bit confusing. I think the "by" on line 15 should be omitted.	We agree with this comment, and this has been deleted.
Jessica	Halofsky	Text Region	27. Northwest		11	11	18	18	It isn't clear what phenomena are being referred to here.	Added examples: mortality or physiological damage to numerous native species of plants and animals and changes in water availability and wildfire dynamics.
Jessica	Halofsky	Text Region	27. Northwest		11	11	21	21	Needs spaces: "Hille Ris Lambers"	This comment has been addressed.
Holly	Prendeville	Text Region	27. Northwest		11	12	23	10	In the terrestrial ecosystem section, mention of the heat dome and impacts for northwest forests with an estimated 1 million firs dead from drought and extreme temperatures.	The extent of tree mortality from an extreme heat wave in late June 2021 (the "heat dome") has not yet been estimated with certainty. Added a sentence and citation addressing effects of compounded heat and drought on tree stress and mortality.
Jessica	Halofsky	Text Region	27. Northwest		11	11	25	25	It is unclear what is expected to continue... the temps, precip, fire trends in response to these? I think probably the latter so maybe change to "...and these trends are expected to continue."	Yes, the trends. Changed as suggested.
Jessica	Halofsky	Text Region	27. Northwest		12	12	1	2	The cited examples do not provide empirical proof that forests are converting to shrublands in the Northwest. This statement should be edited to suggest that, while these changes are expected, empirical evidence in the Northwest is thus far lacking.	Modified the first sentence marked here to avoid the implication that the citations explicitly include evidence from the Northwest. Added a citation to the second sentence that provides evidence of changes in parts of the Northwest.
Ned	Ende	Text Region	27. Northwest		12	12	12	14	Suggest adding a reference (Elliot et al 2022) specific to stream vertebrate species shift in Washington State: Elliott, J., Passy, S.I., Pound, K.L.,Merritt, G., Polkowske, S. & Larson, C.A. (2022). Strong but heterogeneous distributional responses to climate change are projected for temperate and semi arid stream vertebrates. Aquatic Conservation: Marine and Freshwater Ecosystems, 1 to 15.	We have added this reference.
Jessica	Halofsky	Text Region	27. Northwest		12	12	30	30	Intensity increases	An edit was made to a sentence below the indicated location that indicated that frequency and intensity of marine heatwaves are expected to increase.
Jessica	Halofsky	Text Region	27. Northwest		12	12	32	32	Define the "California Current." It might be helpful to make it clearer that this can happen more commonly in warmer water, but Washington hasn't gotten that warm historically.	We have revised this sentence based on this comment. We have defined the California Current to be a marine ecosystem; furthermore, the detection of domoic acid was linked to the marine heatwave event in 2014-2016, which did cause coastal waters in Washington warm.
Jessica	Halofsky	Text Region	27. Northwest		12	12	37	37	Remove "to low levels" - declined implies low levels	We have revised this sentence based on this comment.
Jessica	Halofsky	Text Region	27. Northwest		12	13	37	1	Awkward wording	We have revised this sentence based on this comment.
Jessica	Halofsky	Text Region	27. Northwest		13	13	3	3	Do we really know how much climate change has contributed to salmon declines? These citations do not provide scientific support for this statement.	We have revised this sentence based on this comment.
Jessica	Halofsky	Text Region	27. Northwest		13	13	10	10	Endangered what?	We have revised this sentence based on this comment.
Jessica	Halofsky	Text Region	27. Northwest		14	14	11	11	Provide more specific detail on which human activities have led to salmon decline. Is it overfishing? land/ water degradation? dams?	We have provided additional examples based on this comment.
Jessica	Halofsky	Text Region	27. Northwest		14	14	16	16	Is there a new population estimate that can be provided here?	Thank you for this comment. We have added a more recent population estimate.
Holly	Prendeville	Text Region	27. Northwest		14	14	22	25	Sharing information about multiple climate change models is confusing to the general public. Though this publication was recent it uses much older global climate change models than are currently being used. This sentence can be revised to provide general impacts and remove the model details.	Thank you for this comment. We have amended this section based on this comment and have used standardized emissions scenario language consistent across NCA5. However, we believe it is crucial to still frame these projections using scenarios, even if it is using CMIP3 models, due to the time lags in the peer-reviewed literature about using models to assess the biological responses under different climate scenarios.
Jessica	Halofsky	Text Region	27. Northwest		14	14	33	33	This section seems a bit disorganized	The authors have worked to improve the flow of this section based on public and peer-reviewed comments.
Jessica	Halofsky	Text Region	27. Northwest		14	14	34	35	Define adaptive capacity	Provided a short definition (genetic, physical, and behavioral ability to respond to environmental change).
Jessica	Halofsky	Text Region	27. Northwest		15	15	1	1	The options for climate adaptation suggested here seem very limited; there are ways to actively manage ecosystems to adapt to climate change that arenvc¬Ã¬ôt necessarily in the "ecological protection and restoration" categories. And the link between climate adaptation and carbon sequestration is not at all clear. It seems like adaptation and mitigation are being conflated here. I suggest that carbon sequestration be removed from this list.	We removed carbon sequestration
Jessica	Halofsky	Text Region	27. Northwest		15	15	15	15	"following expectations of a portfolio concept in aquatic-riparian ecosystem management" vc¬Ã¬ì I donvc¬Ã¬ôt understand this.	Removed the phrase that was causing confusion. The removal did not affect the fundamental observation reported here.
Jessica	Halofsky	Text Region	27. Northwest		15	15	21	22	I believe the wrong Halofsky et al. 2018 manuscript is provided in the literature cited. We believe it should be: Halofsky, J. S., Donato, D. C., Franklin, J. F., Halofsky, J. E., Peterson, D. L., & Harvey, B. J. (2018). The nature of the beast: examining climate adaptation options in forests with standvc¬Ã¬êreplacing fire regimes. Ecosphere, 9(3), e02140.	We have revised the reference based on this comment.
Jessica	Halofsky	Text Region	27. Northwest		15	15	27	35	I believe the wrong Halofsky et al. 2018 manuscript is provided in the literature cited. We believe it should be: Halofsky, J. S., Donato, D. C., Franklin, J. F., Halofsky, J. E., Peterson, D. L., & Harvey, B. J. (2018). The nature of the beast: examining climate adaptation options in forests with standvc¬Ã¬êreplacing fire regimes. Ecosphere, 9(3), e02140.	We have revised the reference based on this comment.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jessica	Halofsky	Text Region	27. Northwest		15	15	28	29	From what I understand defining grass banking as an "exchange" for adopting conservation practices is incorrect. While this does occur, it is not the only way this term is used. Further, I donvc~Ã~ôt see that "exchange" definition in Peck et al. 2020 although it is cited. I offer sympathy as this term has been used in different circumstances. I think the confusion may come from an important difference between "grassbanksTM" and the concept of grass banking. "Grass banking" more generally refers to different strategies to supply important reserved forage during times of drought. This can include "stockpiling forage" as "grass banking" as done in Kachergis et al. 2014. I have found it useful to talk about methods of "reserving forage" or "forage reserves" to avoid this confusion with the term "grass banking."	We have revised this sentence based on this comment.
Jessica	Halofsky	Text Region	27. Northwest		16	16	13	13	What is a "just" transition?	We have cross-referenced to KM 20.6 in the Human Social Systems chapter about just transition.
Jessica	Halofsky	Text Region	27. Northwest		16	16	14	14	Several citations are still under review in this section - from the authors? Is there any other work to cite here?	We will amend these citations if these citations are not published by the literature cut off date.
Jessica	Halofsky	Text Region	27. Northwest		16	16	15	15	I'm not certain about this 40 million acre number. It seems low. At: https://www.wyoextension.org/agpubs/pubs/B-1367_cattle-ranching-web.pdf we estimated 47 million acres in rangelands in Washington, Oregon, and Idaho from both public and private lands. And that's just rangelands. Please provide the source and also specify if this is just private land. Note that public land is an important part of agriculture (especially livestock ranching) in the Northwest. Please provide the reference for the economic activity also. I'm assuming it's from NASS, possibly U.S. Census of Agriculture. U.S. Census Bureau 2021 is cited at another point in the work, so I don't see why this wouldn't be cited too.	We have updated this paragraph to reflect updated numbers based on this comment.
Jessica	Halofsky	Text Region	27. Northwest		16	16	16	16	This doesnvc~Ã~ôt seem appropriate as a "range." What is the metric used for this range? ownership? Citizenship? Tradition? Is "legacy farms" a common enough term? Maybe "multi-generational"? Or "farms and ranches that have been in operation for multiple generations."	Sentence edited to reflect suggestion that the agricultural economy includes "farms and ranches that have been in operaetion for multiple generations, well as a large seasonal migrant workforce ..."
Emma	Conrad-Rooney	Text Region	27. Northwest		16	16	19	20	The sentence "Climate change affects...in projected yields" should reference Chapter 11, the agriculture chapter.	Thank you for this comment. We have made a cross reference to KM 11.1 in this sentence.
Jessica	Halofsky	Text Region	27. Northwest		16	16	25	25	Please find additional sources for Oregon and Washington as this reference is just Idaho. There was exceptional drought in parts of Washington and Oregon in 2021 which can be verified by https://www.drought.gov/drought-status-updates/drought-status-update-pacific-northwest-2. Further, the Northwest chapter in the 4th national assessment discussed the 2014-2015 drought impacts.	We have added a sentence on drought impacts on wheat and barley from the ERS reference.
Emma	Conrad-Rooney	Text Region	27. Northwest		18	18	14	21	The sentence "Northwest's forests are...some native species" should reference Chapter 7, the Forests chapter.	Thank you for this comment. We have now cross-referenced with Chapter 7.
Jessica	Halofsky	Text Region	27. Northwest		18	18	18	18	The Halofsky et al. (2022) citation does not support the statement that climate change is reducing the quantity of forest products. The report instead suggest that it COULD in the future. This is an important distinction that should be reflected in the text.	We have revised this sentence based on this comment.
Holly	Prendeville	Text Region	27. Northwest		18	18	22	30	An Idaho fire factoid needs to be added to this paragraph to help represent the entire area.	Thank you for this comment. We have added an example on fire in the Palouse Prarie-forest ecotone.
Jessica	Halofsky	Text Region	27. Northwest		18	18	22	24	This sentence is poorly worded and difficult to understand. It needs to be broken up into different sentences and explained more clearly. It needs to be specified that any increases in abundance of ponderosa pine will likely occur at higher elevations, as regeneration of pine may decrease with drought at lower elevations. Also, what is west-side Douglas-fir? Douglas-fir occurs on both the east side and the west side of the Cascades.	We have revised this sentence based on this comment.
Jessica	Halofsky	Text Region	27. Northwest		19	19	22	22	The information here is very general. This box might be more effective if it was weaved throughout the rest of the section and the box focused on just one of these examples as a case study.	We have integrated the examples from this box throughout the rest of the section. However, we have kept a small section to highlight tribal agricultural economies' adaptation responses.
Ned	Ende	Text Region	27. Northwest		20	27	34	35	Missing a key reference (Hall et al 2021) specific to the Columbia River Basin vulnerabilities: Hall, S.A., Adam, J.C., Yourek, M.A., Whittemore, A.M., Yorgey, G.G., Scarpare, F., Liu, M., McLarty, S., Asante Sasu, C., McClure, S., Turk, J., Haller, D., Padowski, J., Deshar, R., Brady, M.P., Rajagopalan, K., Barber, M.E., Weber, R., Stockle, C.O., Goodspeed, H.L., Gustine, R.N., Kondal, A., Yoder, J., Deaver, B., Downes, M., Tarbutton, S., Callahan, M., Price, P. Roberts, T., Stephens, J., Valdez, W. 2022. 2021 Washington State Legislative Report. Columbia River Basin Long Term Water Supply and Demand Forecast. Publication No. 21 12 006. Washington Department of Ecology, Olympia, WA. 284 pp.	We have added this reference.
Holly	Prendeville	Text Region	27. Northwest		21	21	20	22	If going to this level of detail than noting the addition of native, drought resilient plants for landscaping would be a water saving measure too.	Thank you for this comment. We have added this example.
Jessica	Halofsky	Text Region	27. Northwest		21	21	24	26	How can references from 2016 and 2019 support a statement about 2021 atmospheric river events?	Clarified that the mechanisms by which atmospheric rivers can disrupt transportation networks were understood before the 2021 storms.
Holly	Prendeville	Text Region	27. Northwest		22	22	8	11	Note efforts to install more solar to help remove more dams is underway as well https://nezperce.org/uncategorized/nez-perce-tribe-to-reveal-plans-for-virtual-power-plant-at-res2022/	This comment has been addressed in text.
Jessica	Halofsky	Text Region	27. Northwest		22	22	10	10	It might be helpful to define cooling degree days here.	This comment has been addressed.
Holly	Prendeville	Whole Page	27. Northwest		23				Lines 1-2 note Washington is emitting the most but Figure 27.8 show Idaho at the top indicating its emitting the most carbon dioxide, which is correct? More information on Idaho is essential. Even if the state isn't going carbon neutral its worth highlighting Boise is https://www.cityofboise.org/programs/climate-action/climate-action-roadmap/	We have amended this figure to be line graphs rather than stacked graphs to be more legible. We have alse added reference to the Boise CAP.
Jessica	Halofsky	Figure	27. Northwest		23				The trend lines are hard to see.	We are revising this figure to be more legible.
Jessica	Halofsky	Figure	27. Northwest		24				I find these types of graphs confusing, they misrepresent the magnitude of individual variables because they are influenced by the ones below them. Would it be possible to have a totals line at the top and have the others just be regular lines at the bottom?	We have amended this figure to be line graphs rather than stacked graphs to be more legible.
Holly	Prendeville	Text Region	27. Northwest		25	25	1	5	Note the use native, drought resistant species versus ornamentals.	Thank you for this comment. We have deleted "ornamental" in this sentence.
Jessica	Halofsky	Text Region	27. Northwest		25	25	35	35	Could you clarify the confidence with which it was attributed to climate change, or make it clearer that it was one paper?	We have now added additional papers supporting this statement.
Jessica	Halofsky	Text Region	27. Northwest		27	27	4	4	Use a different word for "pluvial."	We have revised this sentence based on this comment.
Jessica	Halofsky	Text Region	27. Northwest		27	27	7	8	The link provided for this resource appears to be broken. Also, there are more recent reports (2022).	We have updated this to reflect the 2022 citation.
Holly	Prendeville	Text Region	27. Northwest		27	27	30	38	Statements need to be more clear to the general public so its clear when flow is for streamflow versus debris flow and not confused with each other. Also a topic sentence is needed.	Thank you for this comment. We have a done a cross-reference throughout our whole chapter to ensure we are delineating streamflow from debris flow. Authors think this comment was added in the wrong section, so a topic sentence wasn't included since the sentence this was referring to did not discuss flow or streamflow. However, we have worked with an editorial team to ensure topic sentences are included throughout.
Holly	Prendeville	Text Region	27. Northwest		28	28	21	29	Another place Idaho could be highlighted: https://www.cityofboise.org/programs/climate-action/climate-action-roadmap/ https://www.ci.moscow.id.us/DocumentCenter/View/24259/Climate-Action-Plan-Adopted	Thank you for this comment. We have added the reference to Boise's Climate Action Plan.
Jessica	Halofsky	Text Region	27. Northwest		28	28	21	21	I donvc~Ã~ôt understand the term "targeted universalism."	We have deleted this term.
Jessica	Halofsky	Text Region	27. Northwest		28	28	31	31	"Sense of place" doesnvc~Ã~ôt seem like a readily understood term.	Thank you for the comment. We have provided some additional context in the first sentence of the narrative and decided to keep the term "sense of place", since this is a term used within the evidence base we are citing.
Jessica	Halofsky	Figure	27. Northwest		30				Showing just the 3 focus states with the Bend, Oregon inset is probably more useful.	Thank you for this comment. We have amended this figure in other ways and are working to ensure that inset maps are consistent across the report.
Jessica	Halofsky	Text Region	27. Northwest		32	32	22	26	This sentence is long and hard to read.	Thank you for this comment. We have broken this sentence up to more readable.
Jessica	Halofsky	Text Region	27. Northwest		35	35	38	38	This seems like a very broad statement. Yes, they would be hard to quantify for every species and every population therein, but well-established tools exist for finding all of these things, so it isn't really difficult in that sense.	The fact that "established tools" exist does not mean that it is feasible or easy to quantify these measures for all populations or species. Qualified the statement to acknowledge that feasibility varies.
Jessica	Halofsky	Text Region	27. Northwest		36	36	11	11	Restoration actions are also meant to support ecosystem services and function, not just genetic and species diversity.	This sentence has been revised based on this comment.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Glenn	Branch	Whole Chapter	27. Northwest						A discussion of climate change education and outreach efforts in this region is needed. (Note that the chapter on the Southern Great Plains includes a brief discussion of climate change education on ch. 26, pp. 31-32.) Education and outreach efforts are foundational to topics discussed in this chapter, including: * livelihoods and economies, since a goal of education is to prepare the workers and consumers of the future, which will be transformed by the effects of climate change; * human health and well-being, since educators play a role in ensuring the intellectual, psychological, and social health of their students in the face of climate change; and * planning and adaptation, which require policymakers and voters to grasp the scientific and social issues involved in meeting the challenges posed by climate change. While it would be best for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change, it would help for this chapter to discuss the situation specifically in its region.	Thank you for this comment. There are several places in the chapter that we mention how education is a powerful climate response, including how education can connect people - especially students and youth - to sense of place, and how education programs can lead to benefits like water incentives. Further discussion on specific K-12 policies and programs is outside the scope of the chapter.
Charles	Keeling	Whole Chapter	27. Northwest						A discussion of climate change education should be included similar to the one in chapter 26, pp. 31-32.	Thank you for this comment. There are several places in the chapter that we mention how education is a powerful climate response, including how education can connect people - especially students and youth - to sense of place, and how education programs can lead to benefits like water incentives. Further discussion on specific K-12 policies and programs is outside the scope of the chapter.
Holly	Prendeville	Whole Chapter	27. Northwest						While there are a number of citations that include Idaho, in the body of the text Idaho is only mentioned four times, whereas Washington is mentioned 17 and Oregon 10. More effort to mention Idaho and provide examples from Idaho needs to be made to represent the entire region.	We have discussed this as an author team and have increased Idaho citations and examples throughout the chapter, including adding more case studies, references, and broadened some figures to illustrate Idaho examples.
Holly	Prendeville	Whole Chapter	27. Northwest						Overall this chapter needs major revisions to make it a cohesive piece. As it stands, it comes across that different sections were written by different authors and its very disjointed. Also, this chapter should engage the services of a science delivery specialist to include plain language and remove jargon. Together this will make the information is accessible to a broad audience.	Thank you for this comment. Our team is working closely with the editorial team to ensure this is cohesive and accessible. We have revised this chapter with their support.
Holly	Prendeville	Whole Chapter	27. Northwest						Can't assess images when drafts aren't included.	This comment does not appear to raise a question or suggest a revision.
Holly	Prendeville	Whole Chapter	27. Northwest						"Submitted" not yet accepted publications seems inappropriate since they haven't completed peer review. (Noorazar et al., submitted).	We are adhering to literature cutoff dates and have revised our citations based on pre-approved cuttoff dates.
Brittany	Gutermuth	Whole Chapter	27. Northwest						Climate change education is explicitly discussed in ch. 26, pp. 31 (line 18-27)- 32 (line 1-2), it should be addressed here as well.	A sentence was added emphasizing the importance of education and community outreach, including mention (and linking) of two programs.
Jessica	Halofsky	Whole Chapter	27. Northwest						Northwest Climate Hub staff reviewed this chapter and found it to be lacking in several ways. Overall, we found it difficult to read; the various sections are disjointed and written in different styles, and there were many examples of poorly worded and confusing sentences. The introduction could serve the purpose of introducing the reader to what is covered in the chapter and setting expectations, but it is instead a summary of climate science. We suggest revision of the introduction to provide the needed context for the rest of the chapter. We found several errors in how published literature was cited and many examples of works cited that have not undergone peer review. We suggest the authors carefully review all cited work and replace any citations that have not been peer reviewed. We also found that the chapter lacked examples and coverage of issues in the state of Idaho. We suggest chapter authors add additional content to better address unique issues in this state.	Thank you for this comment. Our team is working closely with the editorial team to ensure this is cohesive and accessible. We have revised this chapter with their support.
Jessica	Halofsky	Whole Chapter	27. Northwest						Northwest Climate Hub staff reviewed this chapter and found it to be lacking in several ways. Overall, we found it difficult to read; the various sections are disjointed and written in different styles, and there were many examples of poorly worded and confusing sentences. The introduction could serve the purpose of introducing the reader to what is covered in the chapter and setting expectations, but it is instead a summary of climate science. We suggest revision of the introduction to provide the needed context for the rest of the chapter. We found several errors in how published literature was cited and many examples of works cited that have not undergone peer review. We suggest the authors carefully review all cited work and replace any citations that have not been peer reviewed. We also found that the chapter lacked examples and coverage of issues in the state of Idaho. We suggest chapter authors add additional content to better address unique issues in this state.	Thank you for this comment. Our team is working closely with the editorial team to ensure this is cohesive and accessible. We have revised this chapter with their support.
Jim	Titus	Whole Chapter	27. Northwest						It would be helpful for this chapter to provide more specific facts at the state level, including tables or maps that quantify impacts and location-specific expectations. It is important to do so because some federal agencies will create state-specific fact sheets about the impacts of climate change. To avoid the accusation of cherry picking, these agencies are often limited to using the facts presented by IPCC, NAS, and the National Assessment, which as a practical matter, usually means that NCA is the main source.	Thank you for this comment. The scope of this comment is outside of the charge of NCA authors. We encourage institutions that provide climate services to continue translating and interpreting the NCA to different audiences.
Thomas	Knutson	Text Region	28. Southwest		3	3	11	14	Add in a few more impacts and references as follows: "Impacts include rising air temperatures (NOAA 2022) and sea surface temperatures, both attributable in part to anthropogenic influence (Vose et al. 2017, Fig. 6.6), changes to the timing.... increases in extreme heat events (Gabbe and Pierce 2020), summertime heat stress (wet bulb globe temperatures; Knutson and Ploshay 2016; Li et al. 2017), and heat-related morality..." Refs: Vose, R.S., D.R. Easterling, K.E. Kunkel, A.N. LeGrande, and M.F. Wehner, 2017: Temperature changes in the United States. In: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 185-206, doi: 10.7930/J0N29V45. Knutson, T.R., Ploshay, J.J. Detection of anthropogenic influence on a summertime heat stress index. Climatic Change 138, 25-39 (2016). https://doi.org/10.1007/s10584-016-1708-z Li, C., Zhang, X., Zwiers, F., Fang, Y. and Michalak, A.M. (2017), Recent Very Hot Summers in Northern Hemispheric Land Areas Measured by Wet Bulb Globe Temperature Will Be the Norm Within 20 Years. Earth's Future, 5: 1203-1216. https://doi.org/10.1002/2017EF000639	We thank the reviewer for the comment. The chapter text has been revised to incorporate the recommended text and citations.
Liza	Leynes	Text Region	28. Southwest		4	4	2	3	Original sentence: Monitoring these indicators help us understand how impacts are experienced and how to adapt to risks. Alternate suggestion: Monitoring these indicators help us understand the effect of impact and adaptation to risk.	After consideration, the author team determined that the narrative flows best as written; the chapter has not been restructured in the proposed way.
Reid	Sherman	Text Region	28. Southwest		4	4	12	12	cities "like" Albuquerque, etc. should be cities "such as" Albuquerque, etc.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Reid	Sherman	Text Region	28. Southwest		4	4	23	23	"over" 300,000 should read "more than" 300,000 members	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Ariela	Zycherman	Text Region	28. Southwest		4	4	32	32	The land the Federal government owns can also play a role in mitigation as well as adaptation.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Ariela	Zycherman	Text Region	28. Southwest		4	4	33	33	This is confusing -- over the past 5 years but published in 2018? Also weird citation placement.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Edited to move citation to end of sentence. Maintained phrasing "over the past five years" to reflect period between 2018-2023.
Reid	Sherman	Text Region	28. Southwest		4	4	33	33	Garfin reference feels misplaced. Move to end of sentence on line 34	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Citation moved as recommended. Also corrected citation to Gonzalez et al. 2018.
Jessica	Evans	Text Region	28. Southwest		4	4	34	36	AMWA and WUCA suggest adding another reference to the statement, "There is improved understanding and modeling of climate change impacts on specific sectors and processes, such as water (Hoerling et al. 2019; Udall and Overpeck 2017." We would add, "Lukas, Jeff, and Elizabeth Payton, eds. 2020. Colorado River Basin Climate and Hydrology: State of the Science. Western Water Assessment, University of Colorado Boulder. DOI:	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Accepted recommendation and added reference to in-text citation and to reference list.
Reid	Sherman	Text Region	28. Southwest		4	4	34	34	Potential replacement for passive construction: "At the same time, understanding and modeling of climate change impacts on specific sectors and processes has improved. For instance in water...	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
kottie	christie-blick	Text Region	28. Southwest		5	5	4	13	In addition, increased education for all stakeholders is imperative, including the youth. All of the Southwest states have education standards influenced by the Framework for K-12 Science Education or the Next Generation Science Standards. These standards are designed to create scientifically literate Americans. As such, they help learners understand ways in which humans impact Earth's resources and environment. There is a great need for schools to fully adopt and implement these standards, and for educators to be trained to teach the core ideas, concepts, and practices to their learners at an age-appropriate level. https://ngss.nsta.org/about.aspx https://www.nextgenscience.org/search/node/Earth%20and%20Human%20Activity	We thank the reviewer for the comment. The authors, Federal Steering Committee, and the US Global Change Research Program agrees that educators and students are an important audience of NCA. NCA5 has been developed with these important audiences and their needs in mind. Development of the NCA is designed to result in a report that is authoritative, timely, relevant, and policy neutral; valued by authors and users; accessible to the widest possible audience; and fully compliant with the GCRA and other applicable laws and policies (see About NCA5 at https://www.globalchange.gov/nca5). To make the findings of the NCA useful and usable to educators and students, we have worked to make the NCA accessible to a broad range of audiences, both in the development of the content and the delivery of the final report materials on the website (see Appendix A1.3). Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside the development of NCA5.
Reid	Sherman	Text Region	28. Southwest		5	5	4	4	"these" impacts is not well connected to previous concept. Suggest changing to "climate"	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Reid	Sherman	Text Region	28. Southwest		5	5	6	6	"Adaptation efforts" is really vague. Could at least one fairly generic example be provided? Something like this? Adaptation efforts such as installing shade structures in public places to decrease the impacts of extreme heat...	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. We added reference to nature-based solutions such as green infrastructure for flood mitigation.
Liza	Leynes	Text Region	28. Southwest		5	5	8	9	Original sentence: There is an awareness of new approaches to equity and environmental justice for marginalized and frontline communities and Indigenous peoples across the Southwest. Alternate suggestion: There is an awareness of new approaches to equity and environmental for justice marginalized and frontline communities as well as Indigenous across the peoples southwest.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Jessica	Evans	Text Region	28. Southwest		5	5	19	19	The authors should consider changing "further stress existing" to "exacerbate" to make the language more concise.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Language change made as suggested.
Jessica	Evans	Text Region	28. Southwest		5	5	31	31	The authors should delete "of precipitation" to make the sentence more concise.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Change made as suggested.
Sean	Fleming	Figure	28. Southwest		6	6	8	18	Figure 28.2(c) doesn‚Äôt actually show ‚Äústreamflow,‚Äù as it purports to do. Streamflow only happens in streams. It‚Äôs instead a raster image showing the net water balances of grid cells in a land surface model containing no routing. There‚Äôs no acknowledgement in this figure of the (seemingly obvious) fact that streamflow only occurs in stream channels, and that the flow at one point in a river comes from the entire upstream watershed, so describing the value at a given pixel as the ‚Äústreamflow,‚Äù at that point is in simple factual error. In fact, calling the quantity shown here ‚Äústreamflow,‚Äù implies that the entire land surface of California is under water because there‚Äôs a value for every location in California, not just in river channels! The map content is potentially useful but needs to be named more appropriately, something like ‚Äòlocal water balance,‚Äô or ‚Äòrunoff production potential,‚Äô or ‚Äòlocal runoff generation,‚Äô with an explanation in the caption that this is output of a LSM depicting cell-by-cell ability of the landscape to generate excess water potentially available for river runoff. The figure also needs to state which scenario(s) and GCM(s) were used. The literature citation is also a little unclear; is Vano et al (2020), the only real reference given here, the source for all the information in this figure? If not, give proper citations, not just ‚ÄúNew Mexico State University,‚Äù or ‚ÄúArizona State University,‚Äù which are useless to the reader.	We thank the reviewer for the detailed comments. (1) Streamflow - we substituted "runoff" for "streamflow" (2) SCenarios, GCMs: scenrio has been added to the caption. A reference to LOCA website has been added. The LOCA website includes the models used. (3) Land surface model: we are in the porcess of adding brief information to explain this (4) Vano et al., is the recommended citation from the original modeling team. At the time of writing the fourth order draft, there are no additional references that are recommended by the dataset authors. The references to institutions are the university affiliations of the chapter authors involved with producing this figure.
Thomas	Knutson	Figure	28. Southwest		6	6	8	18	Suggest to expand these figures to show the entire Southwest region.	We thank the reviewer for the helpful suggestion, which has been incorporated into the figure. The revised figure will include the entire SW region.
Liza	Leynes	Text Region	28. Southwest		6		9		This line seems out of place with its indentation. Suggest it be left-justified. it may also be centered to distinguish it as something other than a paragraph.	We thank the reviewer for the comment. The figure caption style is maintained for consistency throughout the chapter and report.
Gregg	Garfin	Text Region	28. Southwest		6	6	11	13	‚ÄúCAPTION: This panel shows projected mean mid-21st-century (2036‚Äì2065) percent difference in annual soil moisture, snow water equivalent, and streamflow over the Sierra Nevada compared to the period 1991‚Äì2020.‚Äù The differences that you mention in this caption are important, and your point can be amplified by reminding readers that the climatology of 1991-2020 (the baseline for the figure) is already substantially warmer than the climatology of many preceding 30-year periods. Thus, the depleted soil moisture, snow water equivalent, and streamflow depicted in Figure 28.2 is, a ‚Äúdepletion on top of depletion,‚Äù if we consider that 1991-2020 presents an already substantial depletion in these parameters in comparison to, let‚Äôs say, 1921-1950 or 1951-1980. In the text, or in the caption, I recommend that you give the reader further context.	We thank the reviewer for this suggested revision, which we have adopted.
Ariela	Zycherman	Figure	28. Southwest		6				For this audience, SWE should be defined.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. This has been dded to the caption.
Jessica	Evans	Figure	28. Southwest		6				The authors should indicate in the caption or on the figure what CMIP and/or scenario are shown.	We thank the reviewer for the comment. In the final figure, which is under revision, we will include full description of the methods and scenarios used.
Liza	Leynes	Text Region	28. Southwest		7		2		Recommend replacing the comma after the word moisture with a period and split the sentence into two. The word which can then be replaced with the word This to make that a separate statement. This increases readability.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. wE divided these sentences with a semicolon to indicate that the citations apply to both parts (vs. using a period). we think this still increases readability, as is the intent of the comment.
Thomas	Knutson	Text Region	28. Southwest		7		4		You could mention here that: "The Southwest region has stronger inferred evidence for a drying trend over the past century in column soil moisture (increasing dry area coverage) than other major U.S.regions (Su et al. 2021, Fig. 4). Ref.: Su, L., Cao, Q., Xiao, M., Mocko, D. M., Barlage, M., Li, D., Peters-Lidard, C. D., & Lettenmaier, D. P. (2021). Drought Variability over the Conterminous United States for the Past Century, Journal of Hydrometeorology, 22(5), 1153-1168. https://journals.ametsoc.org/view/journals/hydr/22/5/JHM-D-20-0158.1.xml	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. The authors included mention of reduced soil moisture and included the recommended citation.
Ariela	Zycherman	Text Region	28. Southwest		7	7	6	7	Here it says streamflow will be reduced, but Figure 28.2 makes it look like streamflow will increase?	We thank the reviewer for the comment. We note to the reviewer that figure 28.2 uses an ensemble of climate model projects that characterizes the full range of potential futures. Figure 28.2 is being revised for clarity.
Liza	Leynes	Text Region	28. Southwest		8		6		The comma after the word deeper seems unnecessary. Suggest removing that comma to increase readability.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Liza	Leynes	Text Region	28. Southwest		8		12		Suggest inserting a hyphen between the words water and use to make it and adjective for the word efficiency. water use efficiency vs water-use effeciency	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Jessica	Evans	Text Region	28. Southwest		8	8	13	17	AMWA and WUCA recommend you change, "Urban and industrial water conservation, recycling, and reuse improvements could support economically productive industries such as microchip manufacturing in the Southwest." to "Urban and industrial water conservation, recycling, and reuse improvements could support watersmart and economically productive industries in the Southwest." Microchip manufacturing has historically been a large water consumer. It's only through implementation of more recent reuse technology that newer plants are using less water.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Reid	Sherman	Text Region	28. Southwest		8	8	14	14	To improve usefulnesss, add information about efforts the Navajo Nation, EPA, and UofA are mounting to improve access to water.	We appreciate this suggestion, but space is limited. The author team has deliberated and prioritized the information and illustrations to include. Based on these agreed priorities, the chapter has not been revised.
Gregg	Garfin	Text Region	28. Southwest		8	8	15	17	‚ÄúThrough a partnership with Mexico on coastal water desalination, the region could free up Colorado River water for the United States while providing Mexico with a secure new supply.‚Äù This statement is true. However, I recommend that you provide a source for this idea, since it is not the original idea of the authors. Also, the statement ignores that there will undoubtedly be trade-offs for Mexico, not the least of which is disposal of the desalination brine, but also long-term maintenance of a desalination plant and its technology, while U.S. water users merely need to maintain existing Colorado River water conveyance infrastructure. You have demonstrated exceptional sensitivity to notions of Indigenous culture and the effects of colonization on Indigenous peoples. To be consistent, please acknowledge that the proposition that a partnership with Mexico on water desalination will have some negative consequences (i.e., maladaptation).	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Specifically, we have revised the text to include mention of some of the potential trade-offs for this adaptation measure including energy intensity, cost, and brine management. We specifically note that the implication of these potential tradeoffs on Mexico. We have also included reference to the proposed desalination plans.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jessica	Evans	Figure	28. Southwest		8				This image would be more impactful if the left image (a) was from the year 2000 or the start of the Colorado River basin drought.	We thank the reviewer for the comment. The chapter text has been revised to address the suggestion. The figure caption was corrected to note the left image is from the year 2000.
Reid	Sherman	Figure	28. Southwest		8				Satellite is misspelled, 2020 should be 2000	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Reid	Sherman	Figure	28. Southwest		8				" declined to just 27% of its capacity" sounds as if it went from 100% capacity down to 27% in the stated period. Either state its capacity in 2000, or say "declined to just 27% of its total capacity" to help clarify.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Specifically, we included the reservoir capacity in 2000 for reference.
Reid	Sherman	Text Region	28. Southwest		9	9	5	5	Consistency issue: Covid versus COVID	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Changed to all caps to match the rest of the chapter mentions.
Jessica	Evans	Text Region	28. Southwest		9	14	15	31	The California coast is certainly an important topic. To make this section more applicable to southwest states beyond California, the authors could frame this section regarding CA as "adaptation lessons learned to non-coastal southwest communities." If the authors cannot make that change, this section could be reduced by word count to this section to allow more coverage of the topics relevant to the southwest region as a whole.	We appreciate this suggestion, but the author team has deliberated and prioritized the information to include and determined that the Coast is an integral topic to the Southwest chapter. We added a sentence to the intro paragraph, citing a figure in the Adaptation Chapter demonstrating CA leads the nation in adaptation actions and practices provide examples and lessons learned for the entire region. The author team has further concluded that the word count for this section is appropriate and balanced with the ohter key message areas . Based on these agreed priorities, the chapter has not been revised.
Gregg	Garfin	Text Region	28. Southwest		9	9	27	27	Here you state ‚ÄúThe coastal region of the Southwest encompasses approximately 840 miles of California coast,Ã¶‚Äù whereas Chapter 28, page 4, line 9 states ‚ÄúThe California coast stretches 3,400 miles.‚Äù This seems confusing. Please rectify this by either citing a single statistic for the length of the California coast. If both measures are important to mention, then put the page 9 measurement (840 miles) in the context of the page 4 measurement (3,400 miles).	We thank the reviewer for catching this discrepancy. We corrected the text to use one method for the length, using NOAA measurements for tidal coastline.
Thomas	Knutson	Text Region	28. Southwest		9	9	31	32	This needs a reference, and probably more careful wording, as it is very specific about precise quantitative contributions of humans to regional SST warming over a small region of the planet, which seems overly precise, given uncertainties in such estimates. An alternative wording, which is supported by a published study/figure, is the following: "Sea surface temperatures near the California coast have generally warmed by more than 1 deg F since 1901, a warming that is highly unusual compared to estimated natural variability and partly attributable to human caused climate warming (Vose et al. 2017, their Fig. 6.6). A further rise of 3.6 ..." Reference: Vose, R.S., D.R. Easterling, K.E. Kunkel, A.N. LeGrande, and M.F. Wehner, 2017: Temperature changes in the United States. In: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 185-206, doi: 10.7930/J0N29V45.	Thank you for this suggestion. We have updated the text for CA specific SST changes that have occurred and cite the updated trends from EPA. The citation provided by the reviewer unfortunately does not appear to provide CA specific information. We have now linked broadly to the NCA5 Ch 2, IPCC 2022 and a CA specific downscaled CMPI6 projections paper.
Ariela	Zycherman	Text Region	28. Southwest		9	9	37	37	Not sure what Figure 36.11 is referencing. Do the authors mean Figure 28.4?	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Text has been corrected for Indicators Appendix figure.
Gregg	Garfin	Text Region	28. Southwest		10	10	9	9	The figure caption states ‚ÄúFigure 28.4. Pacific Marine Heatwaves Impact the Coast.‚Äù This differs from the title that is embedded in the figure ‚ÄúNortheast Pacific Marine Heat Waves 2013-2016.‚Äù Please rectify this difference. Also, the figure only shows the California coast; thus, you could make the figure caption more explicit by stating ‚ÄúImpact the California Coast.‚Äù	Change to "California Marine Heatwave"
Gregg	Garfin	Figure	28. Southwest		10	10	9	10	Chapter 28, page 10, Figure 28.4. The color coding in the figure is somewhat problematic, in the following ways: first, there is no description of the correspondence between the color coding in the icons and the color coding in the timeline; second, the choice of colors will be a problem for people with red-green color blindness. To rectify at least part of this issue, a small subtitle to the left of each timeline element will make the correspondences crystal clear. For example, to the left of ‚Äúsevere drought‚Äù mention ‚ÄúEnvironmental‚Äù; below that, and off to the left of ‚Äúspecies shift north to cooler waters‚Äù mention ‚ÄúEcological‚Äù; below that, and off to the left of the first marine creature icon mention ‚ÄúFishery disasters‚Äù.	We thank the reviewer for the helpful suggestions, which have been incorporated into the figure. A revised figure has been submitted and is in development with TSU.
Ariela	Zycherman	Figure	28. Southwest		10				Figure caption says adapted from Figure 10. 2 -- from where?	The Figure has been adapted from NCA5 Figure 10.2 in the Oceans chapter.
Ariela	Zycherman	Text Region	28. Southwest		12	12	3	10	Would be good here to reference the Coasts chapter.	We thank the reviewer for the comment. A reference has been added to the chapter text.
Jim	Titus	Text Region	28. Southwest		12	12	3	10	It might be worth mentioning that California has more people living below sea level than any state other than Louisiana. This is commonly known, though if you want a numerical estimate see Titus (2023) Environmental Research Letters at table S3-C (33,000 people in CA below 0m). Also the population below 1m has increased 29% in the last 30 years (Table S2-A).	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Gregg	Garfin	Text Region	28. Southwest		12	12	4	6	‚ÄúSLR is also expected to exacerbate inequities in communities and result in compounding impacts, such as saltwater intrusion changing groundwater tables,Ã¶‚Äù. The phrase ‚Äúsaltwater intrusion changing groundwater tables‚Äù is unclear. You could improve the ability of non-specialist readers to interpret the text by adding a clarifying remark, such as changing the levels of groundwater tables, or polluting groundwater with saline ocean water.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Reid	Sherman	Figure	28. Southwest		12				Highways in figure 28.5 are very close to the same color for At risk airports.	We thank the reviewer for the comment. Revisions of the figure are underway with TSU.
Ariela	Zycherman	Text Region	28. Southwest		13	13	16	16	I don't know if SSPs and RCPs are going to be described in the overall report frontmatter, but I think that it would be worth explaining the differences between them, and why for example this text mentions RCP but the preceding figure is based on SSPs.	We thank the reviewer for the comment. Information on SSPs and RCPs is included in Chapter 0 and Chapter 1; furthermore, the use of RCPs here is given the source article's use of RCPs, pre-dating the latest SSPs.
Jim	Titus	Text Region	28. Southwest		13	13	23	39	Somewhere around here or perhaps elsewhere, it might be worth mentioning that in California the population of even the mapped 100- and 500-year coastal floodplains increased 10% in the last decade. Titus (2003) Table S4-A. And the number of people living behind levees increased from around 750,000 to 1 million during the last 30 years. Table S4-C. The population of inland 500-year floodplain also increased about 10% during the last decade, while the 100-year floodplain increased about 3%. Table S4-E.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion within the Coastal and Demographics & Human Health KMs.
Reid	Sherman	Text Region	28. Southwest		13	13	25	25	Seems like the time when this would occur should be mentioned.	We thank the reviewer for the comment and have added detail to the text.
Kelly	Van Baalen	Text Region	28. Southwest		13	13	30	32	Buchanan et al. do not comment on the percentage of affordable housing versus general housing exposed for the entire country. They only state that the percentage of affordable housing exposed to SLR is greater than the percentage of the general housing stock exposed to SLR for certain areas like Massachusetts, Maine, and the District of Columbia.	We thank the reviewer for this comment and flagging this. We have corrected the text.
Kelly	Van Baalen	Text Region	28. Southwest		13	13	32	34	The numbers given in these lines do not agree with the numbers reported by the paper cited. According to SI Table 3 in Buchanan et al. 2020, only 2 cities in California are in the top 20 nationwide for number of affordable housing units exposed at least four times per year to recent threat of coastal flooding; Foster City and Corte Madera. However, 4 cities in California are in the top 20 nationwide for number of affordable housing units exposed at least four times per year to coastal flooding in 2050 under a medium carbon emissions scenario (RCP 4.5); Foster City, Suisun City, Redwood City, and Corte Madera.	We thank the reviewer for this comment and flagging this. We have corrected the text to better reflect the findings of Buchanan et al. 2020
Ariela	Zycherman	Text Region	28. Southwest		13	13	34	34	Was guidance given to NCA authors about which scenarios to focus on? This chapter seems to have a lot of RCP8.5 in it.	We thank the reviewer for the comment. NCA5 provide guidance to authors to evaluate the full breadth of relevant, available literature, focusing primarily on results since the publication of NCA4. Authors are strongly encouraged to address the full range of scenario information and the full range of uncertainty available for each chapter. Authors may use and report any scenarios that are in the literature and are encouraged to consider multiple ways to frame model projections in graphics and text when deciding on approaches to best present specific information. Authors were guided to use descriptive terms for CMIP5 Marker Scenarios and CMIP6 Tier 1 Scenarios in NCA5 text that included Very High, High, Intermediate, and Low, whcih are keyed to the CMIP5 RCPs and CMIP6 SSPs. Where possible, we have drawn upon the literature to include a full breadth of scenarios and range of uncertainty, but we recognize the prominence of published literature relying on RCP8.5.
Ariela	Zycherman	Figure	28. Southwest		13				I don't know if SSPs and RCPs are going to be described in the overall report frontmatter, but I think it would be helpful here to explain generally what the range of SSPs here might be and how they may be influencing the spread that we see here.	We thank the reviewer for the comment. The chapter text has been revised to cite Chapter 0 and Chapter 1, where more information on SSPs and RCPs can be found.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Ariela	Zycherman	Text Region	28. Southwest		14	14	6	6	Plus impervious surfaces of urban areas as well.	We thank the reviewer for this comment. Given limited space, the author team has deliberated and prioritized the information to include. Based on these agreed priorities, the chapter has not been revised.
Reid	Sherman	Text Region	28. Southwest		15	15	2	2	For usefulness, add information about why 86DegreesF matters	The text has been revised to incorporate this suggestion and now clarifies that the number of days above 86°F is used to define heat zones.
Thomas	Knutson	Text Region	28. Southwest		15		10		Could add here that: "Summertime heat stress, as indicated by wet bulb globe temperature, is projected to increase substantially across western North America during the coming century (Li et al. 2017). Ref: Li, C., Zhang, X., Zwiers, F., Fang, Y. and Michalak, A.M. (2017), Recent Very Hot Summers in Northern Hemispheric Land Areas Measured by Wet Bulb Globe Temperature Will Be the Norm Within 20 Years. Earth's Future, 5: 1203-1216. https://doi.org/10.1002/2017EF000639	Thank you for the suggestion. We use studies that have been published since 2018. Also, the study cited does not calculate WBGT, rather it calculates an index that does not include radiation, causing errors in the true estimation of a WBGT value that would be measured for human health during work. Literature in this area has worked to overcome the issue of using Tg=Tair in the WBGT for outdoor estimates; thus, we do not want to include and cause confusion between more advanced methods of determining heat stress and strain on humans (which are more valuable to decision making).
Ariela	Zycherman	Text Region	28. Southwest		15	15	32	32	I don't know where the "Focus on Risks to Supply Chains" is	This was a note to authors that was inadvertently left unaddressed. New content has been added.
Ariela	Zycherman	Text Region	28. Southwest		16	16	17	17	Why is agriculutre less vulnerable, if droughts are predicted?	The text has been revised for clarity. Irrigated agriculture generally has been thought to be less vulnerable to drought when supplemental water is available in times of rainfall scarcity, however given water supply uncertainties in the Colorado River and Great Salt Lake basins, this assumption is no longer supported.
Ariela	Zycherman	Figure	28. Southwest		16				Should there be an indicators bar at the bottom, similar to Fig. 28.1?	Thank you for this observation. An indicators bar was discussed by the authors. We felt the climate impacts illustrated in the figure map out to so few categories that trying to add an indicators bar might add complexity to the figure.
Jessica	Evans	Figure	28. Southwest		16				Is it possible to enlarge the subtext in the figure? It is difficult to read. Same for Figure 28.1.	We thank the reviewer for the helpful suggestion. We have requested revisions to Figure 28.6 and Figure 28.1 to improve the clarity and legibility of the figure.
Ariela	Zycherman	Text Region	28. Southwest		18	18	38	38	Which conventional system? What does this mean here?	We thank the reviewer for the comment. The chapter text has been revised to remove "conventional system". Instead the text now reads as "some farmers" and gives the example of small-acreage farmers (and ranchers) who may find it hard to change to conservation agriculture practices due to a lack of resources or because of the perception of risk.
Ariela	Zycherman	Text Region	28. Southwest		21	21	9	9	This is a little confusing because the 100% here is not referring to the figure but to the overall calculation of PWC.	Thank you for this comment and we see the confusion. We have adapted the caption to make it what PWC refers to as connected to the figure. and aded an example in the caption.
Ariela	Zycherman	Text Region	28. Southwest		22	22	1	1	Why change to a different SSP for the last 2?	We used a range of potential futures (a "bookend" approach) from the lowest to highest, acknowledging that the future will likely be somewhere in between. If we do not use SSP5, then we don't have a full range. We have added "To provide a range of potential impacts,...." We are also limited in the number of maps that can be shown.
Thomas	Knutson	Text Region	28. Southwest		22		2		Could add here that "Studies indicate that summertime WBGT over parts of the Southwest and over western North America as a whole have increased over 1973-2012 beyond natural variability, with a contribution from human influence (Knutson and Ploshay 2016, Li et al. 2017). Refs: Knutson, T.R., Ploshay, J.J. Detection of anthropogenic influence on a summertime heat stress index. Climatic Change 138, 25-39 (2016). https://doi.org/10.1007/s10584-016-1708-z Li, C., Zhang, X., Zwiers, F., Fang, Y. and Michalak, A.M. (2017), Recent Very Hot Summers in Northern Hemispheric Land Areas Measured by Wet Bulb Globe Temperature Will Be the Norm Within 20 Years. Earth's Future, 5: 1203-1216. https://doi.org/10.1002/2017EF000639	Thank you for the suggestion. We use studies that have been published since 2018. Also these two studies do not calculate WBGT; they calculate an index that does not include radiation, causing errors, which the newest literature in this space has worked to overcome, and thus we do not want to include and cause confusion between more advanced methods of determining heat stress and strain on humans (which are more valuable to decision making).
Reid	Sherman	Text Region	28. Southwest		22	22	8	8	"PM2.5 exceedances" could be restated to be more meaningful. Identifying PM2.5 with a	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. We have clarified that we are referring to exceedences of the federal air quality standards.
Emma	Conrad-Rooney	Text Region	28. Southwest		24	24	22	30	Key Message 28.5 should reference the Key Message 7.1 in the Forests chapter, which discusses wildfires, particularly in the Southwest. One place where KM 7.1 could be referenced is at the end of the sentence "In the US...in the Southwest."	We thank the reviewer for the comment. We have added the suggested reference.
Reid	Sherman	Text Region	28. Southwest		25	25	12	12	Consistency issue: Covid versus COVID	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Changed to all caps to match the rest of the chapter mentions.
Reid	Sherman	Text Region	28. Southwest		26	26	4	4	"less" should be "fewer"	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Don	Falk	Text Region	28. Southwest		26	26	16	17	Add literature reference: "...stream water quality and availability (Sidman et al. 2015; Rhoades et al. 2019)." Sidman G, DP Guertin, DC Goodrich, D Thoma, DA Falk, and IS Burns. 2015. A coupled modeling approach to assess the impact of fuel treatments on post-wildfire runoff and erosion. International Journal of Wildland Fire. http://dx.doi.org/10.1071/WF14058	We appreciate the suggestion and have reviewed the source of information. However, we have followed guidance to emphasize references published since publication of the 4th National Climate Assessment, and believe those are appropriate and adequate.
Don	Falk	Text Region	28. Southwest		26	26	33	33	Add literature: "...highly variable with elevation and across geographies (Swetnam et al. 2015;Kitzberger et al. 2017; Margolis et al. 2022)." Swetnam TL, AM Lynch, DA Falk, SR Yool, and DP Guertin. 2015. Discriminating natural variation from legacies of disturbance in semi-arid forests, Southwestern USA. EcoSphere 6(6):97. http://dx.doi.org/10.1890/ES14-00384.1 Kitzberger T, DA Falk, AL Westerling, and TW Swetnam. 2017. Direct and indirect climate controls predict heterogeneous early-mid 21st century wildfire burned area across western and boreal North America. PLoS One 12(12): e0188486. https://doi.org/10.1371/journal.pone.0188486 . Margolis EQ, CH Guiterman, RD Chavardv®s, JD Coop, K Copes-Gerbitz, DA Dawe, DA Falk, et al. 2022. The North American tree-ring fire-scar network. Ecosphere 13(7), p.e4159. https://doi.org/10.1002/ecs2.4159	We have added the most recent of these references, however due to space limitations we have referenced only those sources that have appeared since publication of the 4th National Climate Assessment.
Don	Falk	Text Region	28. Southwest		27	27	13	13	Add literature reference: "...increased invasions by non-native species (Webb et al. 2019)." Webb AD, DA Falk, and DM Finch. 2019. Fire Ecology and Management in Lowland Riparian Ecosystems of the Southwestern United States and Northern Mexico. US Forest Service, General Technical Report RMRS-GTR-401. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 132 p. https://www.fs.usda.gov/treesearch/pubs/59156	We thank the commenter for this suggestion and have added the suggested citation to the chapter.
Don	Falk	Text Region	28. Southwest		27	27	21	21	Add region-specific references: "...future shifts in species composition or vegetation type (Falk 2013; O'Connor et al. 2017, 2020; Halofsky 2020)." Falk DA. 2013. Are Madrean ecosystems approaching tipping points? Anticipating interactions of landscape disturbance and climate change. In Gottfried GJ, Ffolliott PF, Gebow BS, Eskew LG, and Collins LC, Merging science and management in a rapidly changing world: Biodiversity and management of the Madrean Archipelago III. RMRS P-67. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Fort Collins, CO. https://www.fs.usda.gov/treesearch/pubs/44410 O,ÃöConnor CD, DA Falk, AM Lynch, TW Swetnam, and C Wilcox. 2017. Disturbance and productivity interactions mediate stability of forest composition and structure. Ecological Applications 27(3): 900,Äi915. http://doi:10.1002/eap.1492 O,ÃöConnor CD, DA Falk, and GM Garfin. 2020. Projected climate-fire interactions drive forest to shrubland transition on an Arizona Sky Island. Frontiers in Earth Science 8: Article 137. https://doi.org/10.3389/fenvs.2020.00137	We have added the most recent of these references, however due to space limitations we have referenced only those sources that have appeared since publication of the 4th National Climate Assessment.
Emma	Conrad-Rooney	Text Region	28. Southwest		27	27	25	27	Chapter 7, the forest chapter, highlights the destruction from western pine beetle in the West, particularly in California in Box 7.1 due to warming and drought. I would recommend referencing Box 7.1 at the end of the sentence "Consequently, many Southwest...and devastating wildfire" where pests and climate change are mentioned.	We thank the reviewer for the comment. We have added the suggested reference.
Don	Falk	Text Region	28. Southwest		27	27	34	34	Add regional reference: "...burning and other traditional practices of ecosystem restoration (Guiterman et al. 2019)..." Guiterman CH, EQ Margolis, CH Baisan, DA Falk, CD Allen, and TW Swetnam. 2019. Spatio-temporal variability of human-fire interactions on the Navajo Nation. EcoSphere 10(11): e02932. https://doi.org/10.1002/ecs2.2932	We thank the commenter for this suggestion. However, the 3 references that we cite suffice, especially as they include Indigenous authors who are leaders in the application of traditional practices.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Thomas	Knutson	Traceable Account	28. Southwest		29		29		Modify to: " ...Uzun et al 2021b), and increased dry area coverage based on inferred column soil moisture (Su et al. 2021)." Ref.: Su, L., Cao, Q., Xiao, M., Mocko, D. M., Barlage, M., Li, D., Peters-Lidard, C. D., & Lettenmaier, D. P. (2021). Drought Variability over the Conterminous United States for the Past Century, Journal of Hydrometeorology, 22(5), 1153-1168. https://journals.ametsoc.org/view/journals/hydr/22/5/JHM-D-20-0158.1.xml	We thank the reviewer for the comment. While the comment highlights a good example of increased dry area coverage based on column soil moistere, the authors feel the existing examples are appropriate and adequate. We have revised the text to include the suggested reference.
Thomas	Knutson	Text Region	28. Southwest		31	31	30	31	Change to: "Marine heatwaves and century-scale sea surface temperature warming trends near the coast of California have been attributed in part to human influence on climate." A reference for the SST attribution, if needed, would be Vose et al. (2017)--their Fig.6.6. Reference: Vose, R.S., D.R. Easterling, K.E. Kunkel, A.N. LeGrande, and M.F. Wehner, 2017: Temperature changes in the United States. In: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 185-206, doi: 10.7930/J0N29V45.	We thank the reviewer for this suggested revision, which we have adopted. However, we are including more CA specific citations.
Thomas	Knutson	Traceable Account	28. Southwest		33	33	18	19	You could add the following, as it relates to agricultural drought (soil moisture): "Dry area coverage trends based on column soil moisture reconstructions over the past century show a drying trend in the Southwest (Su et al. 2021). Ref: Su, L., Cao, Q., Xiao, M., Mocko, D. M., Barlage, M., Li, D., Peters-Lidard, C. D., & Lettenmaier, D. P. (2021). Drought Variability over the Conterminous United States for the Past Century, Journal of Hydrometeorology, 22(5), 1153-1168. https://journals.ametsoc.org/view/journals/hydr/22/5/JHM-D-20-0158.1.xml	We thank the reviewer for the comment. We have added the suggested reference.
Thomas	Knutson	Traceable Account	28. Southwest		35		2		Add: "Regional-scale warming in the Southwest since 1901 has been assessed as detectable compared to natural variability and at least partly attributable to human influence (Vose et al. 2017, their Fig. 6.6)." Reference: Vose, R.S., D.R. Easterling, K.E. Kunkel, A.N. LeGrande, and M.F. Wehner, 2017: Temperature changes in the United States. In: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 185-206, doi: 10.7930/J0N29V45.	This has been added.
Thomas	Knutson	Traceable Account	28. Southwest		36	36	14	16	Change to: Analyses of observations and climate models agree that the Southwest is experiencing higher temperatures, more intense, longer, and frequent heat events due to human-caused climate change (Martin et al. 2020; Gabbe and Pierce 2020; Habeeb et al. 2015; Vose et al. 2017). Additional ref: Vose, R.S., D.R. Easterling, K.E. Kunkel, A.N. LeGrande, and M.F. Wehner, 2017: Temperature changes in the United States. In: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 185-206, doi: 10.7930/J0N29V45.	Thank you for this suggestion. The sentence has been rewritten and Vose et al. 2017 has been added as a citation.
Thomas	Knutson	Traceable Account	28. Southwest		38	38	7	19	The statements in the report (such as p. 28-37, line 5) that "climate change is linked to increases in extreme wildfire activity" are rather vague and don't quantify how much of the increase in fire activity in recent years/decades is due to specific anthropogenic climate forcing agents like increasing greenhouse gases or aerosol changes, and how much is due to other factors like historical forestry management practices or natural climate variability (e.g., ENSO, PDO, or IPO). It seems that the inability to be more quantitative about these relative influences (with confidence intervals) is a major uncertainty and research gap in this topic area. Improved knowledge there could help increase confidence in future quantitative projections of wildfire activity and help prioritize adaptive measures.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. We have revised the major uncertainties and research gaps for KM 28.5 to identify the major uncertainty and research gap related to the attribution of multiple causal factors on increases in extreme wildfire activity including anthropogenic climate change forcing agnets and other factors such as historical forestry practices or natural climate variability. We note the need to improve scientific understanding of these multiple factors and our ability.
Ariela	Zycherman	Text Region	28. Southwest		50	50	24	25	This citation is incorrect. Should be Ebi, KL, not Kristie, E. Also missing article title.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. We have updated the reference to: Ebi, K. L., Åström, C., Boyer, C. J., Harrington, L. J., Hess, J. J., Honda, Y., ... & Otto, F. E. (2020). Using Detection And Attribution To Quantify How Climate Change Is Affecting Health: Study explores detection and attribution to examine how climate change is affecting health. Health Affairs, 39(12), 2168-2174.
Glenn	Branch	Whole Chapter	28. Southwest						A discussion of climate change education and outreach efforts in this region is needed. (Note that the chapter on the Southern Great Plains includes a brief discussion of climate change education on ch. 26, pp. 31-32.) Education and outreach efforts are foundational to topics discussed in this chapter, including: * livelihoods and economies, since a goal of education is to prepare the workers and consumers of the future, which will be transformed by the effects of climate change; * human health and well-being, since educators play a role in ensuring the intellectual, psychological, and social health of their students in the face of climate change; and * planning and adaptation, which require policymakers and voters to grasp the scientific and social issues involved in meeting the challenges posed by climate change. While it would be best for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change, it would help for this chapter to discuss the situation specifically in its region.	We thank the reviewer for the comment. The decision to add chapters, appendices, or Focus Boxes is made by the Federal Steering Committee based on comments received on the draft NCA5 prospectus (2020). At this stage of development, the Federal Steering Committee is not considering the addition of additional chapters, especially because such chapters would not have undergone the same rigor of agency, technical, and peer review as the existing chapters. This comment has been conveyed to the developers of the sixth National Climate Assessment and the US Global Change Research Program for consideration in future assessments. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5.
Charles	Keeling	Whole Chapter	28. Southwest						A discussion of climate change education should be included similar to the one in chapter 26, pp. 31-32.	We appreciate the suggestion, but space is limited. The author team has deliberated and agreed on the most relevant information/illustrations to include. The chapter has not been revised to address this comment.The authors agree that climate education, literacy, and workforce training are important elements of addressing climate change (see Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within) and that public education systems that support scientific literacy and social cohesion enable public engagement solutions (see KM26.5). See also examples of Vulnerability and Assessment plan and an Adaptation Plan that incorporate climate education in Chapter 21.
Gregg	Garfin	Whole Chapter	28. Southwest						Thanks for researching and writing a useful and mostly easy-to-read chapter. The chapter does a fine job of connecting biophysical science with impacts and adaptations.	We greatly appreciate the reviewer's comment about the report/chapter and hope that the content is useful.
Brittany	Gutermuth	Whole Chapter	28. Southwest						Climate change education is explicitly discussed in ch. 26, pp. 31 (line 18-27)- 32 (line 1-2), it should be addressed here as well.	The authors, Federal Steering Committee, and the US Global Change Research Program agrees that educators and students are an important audience of NCA. NCA5 has been developed with these important audiences and their needs in mind. Development of the NCA is designed to result in a report that is authoritative, timely, relevant, and policy neutral; valued by authors and users; accessible to the widest possible audience; and fully compliant with the GCRA and other applicable laws and policies (see About NCA5 at https://www.globalchange.gov/nca5). To make the findings of the NCA useful and usable to educators and students, we have worked to make the NCA accessible to a broad range of audiences, both in the development of the content and the delivery of the final report materials on the website (see Appendix A1.3). Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside the development of NCA5.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Salil	Mahajan	Whole Chapter	28. Southwest						While the effect of ENSO is discussed in the report, the diversity and changing nature of ENSO and thus the challenges it poses for quantifying its teleconnections in the present and the future has attracted little attention here. Future climate projections suggest that with warming of the Eastern Pacific, the frequency of Eastern Pacific flavor of ENSO is likely to increase (e.g. Williams and Patricola 2018). The plausible impacts of these changes, particularly over Southwest US and Southeast US (e.g. Patricola et al. 2020) have not been reported here. Also, the capability of state-of-the-art models in capturing ENSO teleconnections are not included. For example, a recent study shows that the global high-resolution version of E3SM can capture the observed ENSO teleconnection to precipitation mean and extremes over the Southeast-US better than its low-resolution counterpart (Mahajan et al. 2022). Although model resolution sensitivity is not always clear (Molteni et al. 2021). References: Mahajan, S., Tang, Q., Keen, N. D., Golaz, J., & van Roekel, L. P. (2022). Simulation of ENSO Teleconnections to Precipitation Extremes over the United States in the High-Resolution Version of E3SM, Journal of Climate, 35(11), 3371-3393 Molteni, F., and Coauthors, 2020: Boreal-winter teleconnections with tropical Indo-Pacific rainfall in HighResMIP historical simulations from the PRIMAVERA project. Climate Dyn., 55, 1843,Äì1873, https://doi.org/10.1007/s00382-020-05358-4. Patricola, C. M., J. P. O,ÄôBrien, M. D. Risser, A. M. Rhoades, T. A. O,ÄôBrien, P. A. Ullrich, D. A. Stone, and W. D. Collins, 2020: Maximizing ENSO as a source of western US hydroclimate predictability. Climate Dyn., 54, 351,Äì372, https://doi.org/10.1007/s00382-019-05004-8. Williams IN, Patricola CM (2018) Diversity of ENSO events unified by convective threshold sea surface temperature: A nonlinear ENSO index. Geophys Res Lett 45:9236,Äì9244	We greatly appreciate the reviewer's comment and the recommended references. We have revised the chapter to address the issue in the Traceable Accounts, noting the new tools modeling tools aand research directions and need for additional research into this topic.
Jim	Titus	Whole Chapter	28. Southwest						It would be helpful for this chapter to provide more specific facts at the state level for every state, including tables or maps that quantify impacts and location-specific expectations. It is important to do so because some federal agencies will create state-specific fact sheets about the impacts of climate change. To avoid the accusation of cherry picking, these agencies are often limited to using the facts presented by IPCC, NAS, and the National Assessment, which as a practical matter, usually means that NCA is the main source.	We appreciate this suggestion, but space is limited. The author team has deliberated and prioritized the information and illustrations to include. Based on these agreed priorities, the chapter has not been revised.
Carl	Markon	Text Region	29. Alaska		3	3	4	4	Figure 29.1 is written as 'Winter sea ice'; sea ice is mentioned 15 times, sometimes in general, and sometimes specifically to winter sea ice. It may be helpful to stay consistent throughout the document and indicate if winter sea ice or other sesonal sea ice.	We have revised the figure and also checked other uses of sea ice throughout the chapter to make sure we are consistent.
Emily	Johnson	Text Region	29. Alaska		3	3	5	5	Where it says fish, birds, wildlife and insects, note that birds and insects are also wildlife, so it should read fish and wildlife or fish, mammals, birds and insects.	Thank you for this point. We have made the change you suggest.
Carl	Markon	Figure	29. Alaska		3				Winter sea ice is only mentioned in figure 1, and winter mean sea ice is not mentioned at all. I would recommend both be removed, as in this circumstance, it does not really lend much to the report; one could however, add a sentence or two in the introduction that ties it into other reports or the last Alaska chapter.	The recent decades' mean trend and the 2018 very low area winter extent serve to indicate that recent sea ice declines are important, even compared to the already lower 1981-2010 mean. We have re-worded the figure and caption to explain this more clearly.
Carl	Markon	Figure	29. Alaska		3				Atmospheric river is not defined nor mentioned in the caption or the main text. I recommend it be deleted or mentioned in the text.	We have added a definition of "atmospheric river" in the main text.
Carl	Markon	Figure	29. Alaska		3				Is heat wave one word or two (see page4, line 2).	Thank you for pointing this out. We will confirm NCA usage and make the two consistent.
Carl	Markon	Figure	29. Alaska		3				The 'Blob' is only mentioned in this figure. If it is significant enough to be mentioned here perhaps add to text with explaination of what and why it is important.	The "Blob" is explained in the caption, with references to other places in the chapter and report where its importance is discussed further.
Carl	Markon	Figure	29. Alaska		3				This figure caption is extremely long and would be better presented in main text with a much shorter caption.	We have rewritten the caption.
Carl	Markon	Text Region	29. Alaska		4	4	11	11	Atmospheric river is not defined nor mentioned in the caption or the main text. I recommend it be deleted or mentioned in the text.	We now include this in text below: "For example, an atmospheric river (an atmospheric flow that causes extreme precipitation) in December 2020 broke all-time extreme 24-hour precipitation records in 11 southeast Alaska communities and caused two fatalities and over $30M US2020 in public property damage due to rain-on-snow and storm runoff as well as wind and landslides."
Carl	Markon	Text Region	29. Alaska		4	4	13	13	Perhaps 13 Alaska Native corporations to separate from tribal governments	Good point. We've rephrased this sentence to separate the tribal governments and the corporations and to mention both regional and village corporations.
George	Kling	Text Region	29. Alaska		4	4	13	14	The use of the word ?ship? here implies a level of community infrastructure that was likely not intended by the authors. Docks, harbors, and ports are not typically found in these communities. The key message here is that these communities are isolated and not accessible by a traditional system of roads as is typical in the Lower 48. Many of these communities aren?t located on the coast at all, but on river systems too shallow or narrow to be accessible by ?ship?. At a minimum, most communities have a small airstrip, but aren?t serviced by regularly scheduled flights or commercial carriers. Most of the communities located on the coast or river systems don?t have dock, harbor, or port infrastructure. Instead, they may only have a barge landing or gravel boat haul-out. Additionally, during much of the year, the winter presence of ocean and river ice may restrict all water access to those communities. It may help to change the sentence to better reflect these realities; perhaps something like ?More than 200 communities are isolated from any road system, with access only by small aircraft, cargo barge, or river-going vessel. During the winter months, aircraft may be the only viable option.?	Good point. We've rephrased the sentence in a similar way to what you suggested.
George	Kling	Text Region	29. Alaska		4	4	14	16	The use of the phrase ?natural resource use? in this sentence seems inappropriate. Alaska?s economy is not dominated by the state?s domestic use of natural resources, but instead by the oversized presence of natural resource industries in the state. It is more accurate to state that Alaska?s economy is dominated by the public sector and ?natural resource industries?.	Good point. We've changed the text as you suggested.
Albert	Hermann	Text Region	29. Alaska		4	4	31	33	Thank you for including the Cheng et al. 2021a study in this assessment. As one of the coauthors of that study, I would suggest also citing Hermann et al. 2021 (reference below). The Cheng et al. paper summarizes dynamical downscaling results for the Bering Sea using three of the CMIP6 models (GFDL, CESM, MIROC) under two different emission scenarios (ssp126, ssp585). In the companion work (Hermann et al. 2021), these results were statistically extended to include a much larger suite of ~30 of the CMIP6 models - lending further statistical support to the statement that "there is no indication that these trends will slow or reverse in the near future". Reference: Hermann, Albert J., Kelly Kearney, Wei Cheng, Darren Pilcher, Kerim Aydin, Kirstin K. Holsman, and Anne B. Hollowed. "Coupled modes of projected regional change in the Bering Sea from a dynamically downscaling model under CMIP6 forcing." Deep Sea Research Part II: Topical Studies in Oceanography 194 (2021): 104974, https://doi.org/10.1016/j.dsr2.2021.104974	Thank you. We have added the suggested reference.
Holly	Prendeville	Text Region	29. Alaska		4	4	37	37	I thought papers had to be 'In press' to be eligible to cite in NCA5.	The paper was published online on March 10, 2023, within the publication cutoff date established by the USGCRP.
Emily	Johnson	Text Region	29. Alaska		5	5	4	6	Typically projections use a middle-of-the-road emissions scenario. Why have the authors chosen to use a very high emissions scenario here?	Projections typically state which scenarios were used to develop them, which/how many models the ensemble is, and what the reference period is, and what the expected change is. There is evidence that the average of many skilled GCMs provide a superior estimate of mean climate change in the historical and thus, presumably, for the future (e.g. Hausfather et al, 2019). But a "middle of the road" emissions scenario is not considered more likely than higher or lower ones just because it is in the "middle". The current "middle of the road" scenario is SSP2-4.5, for which there is less current evidence than something higher, such as SSP4-6.0 or SSP3-7.0. Moreover, for risk framing purposes (e.g., Terando et al. 2020), stating a higher end scenario can be useful. Finally, more modeling groups submitted results for SSP5-8.5, and so there are more models from which to make an ensemble estimate. However, we have added SSP2-4.5 end of century statewide projections for changes in both mean temperature and total precipitation.
George	Kling	Text Region	29. Alaska		5	5	4	9	Reword this sentence, it is hard to follow.	Thank you for pointing this out. We have broken it into two sentences.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Melissa	Shapiro	Text Region	29. Alaska		5	5	10	14	Thawing permafrost should be associated not only with ‚Äúinfrastructure damage,‚Äù but also with food security, livelihoods, access to schools and medical and health facilities, and travel/mobility, generally; permafrost is also linked to flooding, ground collapse, carbon and water cycling, and vegetation.	Good point. We have re-worded this sentence to make it simpler and still make the same overall points.
Holly	Prendeville	Text Region	29. Alaska		5	5	16	19	Are these better or additional papers to cite: https://www.mdpi.com/2073-445X/10/1/82 https://repository.library.noaa.gov/view/noaa/29705	The first reference concludes that 2019 was indeed extreme, but not yet detectably anthropogenically forced. We now cite it in addition to Jandt and York. The second reference uses an earth system model (GFDL) to conclude that increased fire activity in July 2019 was due to increased human ignitions and increased fuel availability from CO2 fertilization, but the simulations are not compared to observed weather and fire dynaics. It reports results only from a single model run of a single ESM that uses a fire model not paramaterized for Alaska. The paper is related to the topic sentence, but does nothing to substantiate the statements in the text. We therefore decline to cite it.
Thomas	Knutson	Text Region	29. Alaska		5		19		Could mention here that "A regional climate change detection and attribution study indicates that human-caused warming since 1900 has been detected at least for parts of Alaska (Vose et al. 2017). Additionally, summertime wet bulb globe temperatures (WBGTs) over parts of Alaska and over western North America as a whole have increased over 1973-2012 by an unusual amount compared to estimated natural variability, with a contribution from human influence on climate (Knutson and Ploshay 2016, Li et al. 2017). Refs: Vose, R.S., D.R. Easterling, K.E. Kunkel, A.N. LeGrande, and M.F. Wehner, 2017: Temperature changes in the United States. In: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 185-206, doi: 10.7930/J0N29V45. (see Fig. 6.6) Knutson, T.R., Ploshay, J.J. Detection of anthropogenic influence on a summertime heat stress index. Climatic Change 138, 25-39 (2016). https://doi.org/10.1007/s10584-016-1708-z (See Fig. 5) Li, C., Zhang, X., Zwiers, F., Fang, Y. and Michalak, A.M. (2017), Recent Very Hot Summers in Northern Hemispheric Land Areas Measured by Wet Bulb Globe Temperature Will Be the Norm Within 20 Years. Earth's Future, 5: 1203-1216. https://doi.org/10.1002/2017EF000639	RESPONSE: Vose et al. 2017 is an NCA4 chapter, not a regional study, and guidance was to focus on what is new SINCE NCA4. Moreover, Vose et al. 2017 presents relatively limited information on Alaska compared to the CONUS. The comment suggests Vose et al. 2017 show that Alaska has detectable anthropogenic forcing since 1900,, but the evidence (presumably Figure 6.6) is from Knutson et al. 2013 and Alaska data analyzed in Vose et al. 2017 is nClimGrid, which only goes back to 1925. Morevoer, Markon et al. 2017 (NCA4 Alaska chapter) showed clearly that the trend in Alaska-wide temperatures is emergent only since the 1970s - prior to that variability dominates the record. Ballinger et al. show similar results for the various climate divisions in Alaska and compare nClimGrid and ERA5 trends. This work is new since NCA4 and cited elsewhere in this chapter. The Li et al and Knutson et al papers are global studies with regional infromation, and while the maps include Alaska, this is not compellingly Alaska centric - it belongs more in overarching NCA chapters.
George	Kling	Text Region	29. Alaska		5	5	23	24	Over what period is this 20% - 90% increase?	RESPONSE: We agree this was too general. It now reads, "...between 20% - 60% by the 2050s (2040-2069, moderate emissions) and 40% - 90% by the 2080s (2070-2099, higher emissions)"
George	Kling	Text Region	29. Alaska		5	5	32	34	Although ?management policies and practices? are one set of factors to be considered, Alaska?s Indigenous People place a much higher value on their bond to ancestral lands, traditions, culture, and subsistence lifestyle when considering climate solutions that contemplate community relocation. Incorporating a broader IP perspective, a more accurate and impactful statement might be ?As coastlines erode and fish and animal distributions shift, the relocation of impacted people and communities could be part of the solution. However, the bond Alaska?s Indigenous People have to their ancestral lands, traditions, culture, and subsistence lifestyles are a significantly limiting factor, as are complex land and resource management policies and practices.?	Good point. We do not, however, want to imply that Alaska Native ties to lands and waters are a limitation on response. We have added a sentence to underscore the importance of taking those ties into account in any response efforts.
Emily	Johnson	Text Region	29. Alaska		5	5	34	34	Fish and animals should read fish and wildlife or fish and terrestrial animals.	Good point. We've changed "animals" to "wildlife" as suggested.
Carl	Markon	Figure	29. Alaska		6				Technically, there is no problem with the two parts of the figure, I howeve, find it visusally distracting and unpleasing to look at when mixing a simple line drawing with a more complex picture/figure composition.	The figure will be re-drawn, with the Denali panel in the form of a map.
Emily	Johnson	Figure	29. Alaska		6				In regards to the Denali graphic, the landslide is caused by permafrost thaw which has significantly, from inches per year to inches per day, sped up the movement of a rock glacier that the park road traverses. The increase in movement of this rock glacier landslide has blocked road access to the western portion or about 50 percent of the park road. The park will be building a bridge at the cost of up to 102 million in 2023 dollars to maintain access to the western half of the park road including lodges in Kantishna. Construction budgets and management barriers have not hindered progress on the building of a bridge to span the rock glacier landslide. Additionally, there are no alternative routes as there is just the one road into the park.	Thank you for these details. We have adjusted the text in the figure accordingly.
George	Kling	Figure	29. Alaska		6				Figure 29.2, p. 6. Placing ?Denali tourism? together with ?salmon fishing? in this early figure of the chapter is troubling (and tourism is the top panel of the figure). First, it sets the tone for the entire chapter that tourism is the most critical aspect of climate change for Alaska and Alaskans. Second, it invites comparison between tourism and salmon fisheries, putting them on at least equal footing, but the two are nowhere near comparable. Salmon, and their subsistence and commercial fishing, define the essence of Alaska in terms of its culture, traditions, and the relationship people have with the land, ice, and water. There is also the overwhelming commercial and subsistence value of salmon and the massive economic threat to Alaska by climate degradation of salmon populations. Yes, tourism generates income for the state, and people from around the world see Alaska as a tourism destination, but Alaskans would be very troubled by the idea that tourism defines their identity, their values, and is representative of the majority of Alaskan perspectives, especially those of Indigenous People. Third, this Figure on Denali tourism is out of place in the report, coming some 16 pages before tourism is mentioned or described on p. 24 (where, by the way, you need to cite Figure 29.10 because otherwise it isn?t cited in the report). We recommend that you consider moving the Denali box from the first Figure of the report into Figure 29.10 where it fits logically with the topic of tourism. Finally, it is clear that Figure 29.2 was meant to provide ?examples? of climate change effects and responses and that the authors likely did not intend to prioritize tourism as a defining climate-change challenge for Alaskans, but unfortunately this is how it is being seen by reviewers.	Thank you for making this point. We agree that the two are not directly comparable, and we have added a line to the caption to specify that these are simply examples. We have also switched the order so that fishing now comes first. We believe, however, that this figures makes a general point about the interplay of environmental and societal factors that should come at the beginning of the chapter, so we have chosen to leave it where it is.
Ariela	Zycherman	Figure	29. Alaska		6				Top figure ¬ñ the word ¬ëaccess¬í is spelled wrong and requires another ¬ëc¬í. Top figure - Perhaps ¬isocietal inputs" would be more accurate than ¬ëexisting societal condition¬í which would include much more than just the revenue generated (but also the governance structure for example). Top figure ¬ñ suggest including Park staff as a ¬ësocietal input¬í	Thank you for pointing out the typo. We will correct it. We believe the description of "Existing societal conditions" is appropriate, especially since it is parallel with "Existing environmental condition." We are not sure what adding Park Staff to the Denali figure would add (we could also, for instance, add the staff of lodges and guide services, etc.) so decline to do so.
kottie	christie-blick	Text Region	29. Alaska		7	7	3	7	In addition, increased education for all stakeholders is imperative, including the youth. Alaska education standards are influenced by the Framework for K-12 Science Education. These standards, and those of the Next Generation Science Standards, which go a step further, are designed to create scientifically literate Americans. As such, they help learners understand ways in which humans impact Earth's resources and environment. There is a great need for schools to fully adopt and implement these standards, and for educators to be trained to teach the core ideas, concepts, and practices to their learners at an age-appropriate level. https://ngss.nsta.org/about.aspx https://www.nextgenscience.org/search/node/Earth%20and%20Human%20Activity	To address this and similar comments, we have added a paragraph and references to discuss climate change education efforts in Alaska, written by a prominent expert on the topic.
Carl	Markon	Text Region	29. Alaska		7	7	3	4	I guess I just don't like how this sentence starts out. Potential rewrite: Alaskans can choose how to respond to cliamte change by effective planning and adaptation...	We appreciate the comment. We think it's important to point out that Alaska cannot solve the problem alone. We also think it's important to emphasize the need for action regarding planning and adaptation. We have rewritten the sentence to make this clearer.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
George	Kling	Text Region	29. Alaska		7	7	3	11	This paragraph starts by saying ?Alaska by itself cannot stop global warming, but Alaska can choose how to respond?. That opening phrase sets the tone as defeatist, and the remainder of the paragraph text, while ?positive in intent? by asking people to rally together, reads like simple platitudes. Second, the paragraph clearly places Alaskans in the back seat, out of control, and only able to ?respond? to change. If this paragraph is to be kept in the report, the narrative must be shifted to one where Alaskans and their culture have a leading role in how the state and the nation respond to climate change. For example, you mention the ?earthquake response? of 2018, but most readers will not know what that is unless details and a clear message are provided. More examples of positive actions of Alaskans could be included, such as the use of Traditional Knowledge to provide hope for sustainable responses to changes in climate. If a more positive dialogue with specific examples cannot be included, the paragraph would be best to omit.	We disagree that the tone is negative. We have changed the first sentence to start with "Although" to show that a contrast is coming, and made other changes to the text, which we believe also helps emphasize the alternatives that we can choose.
Carl	Markon	Text Region	29. Alaska		7	7	7	7	I don't see where in Table 1 how the responses create a just society; healthy may be a bit more appropriate.	We believe that increased community capacity (for Our Communities) and priority setting by communities themselves (Our Built Environment) are examples of a more just society.
Carl	Markon	Text Region	29. Alaska		7	7	8	11	I don't think the earthquake has anything to do with this report, and the last three sentences of this paragraph could be changed to be less poetic and more factual, such as: Alaskans have shown to be very resiliant, goal oriented, and when working together, can create long lasting benefits for current and future generations.	The 2018 earthquake remains a powerful memory for many people in Southcentral Alaska, and we thus prefer it to more generic statement about resilience. The paragraph is intended to be aspirational in tone. In response to other comments, the paragraph has been rewritten.
George	Kling	Text Region	29. Alaska		7	7	8	8	Is there a reference for ?as seen in the rapid and effective response??	We have added a reference.
Ariela	Zycherman	Text Region	29. Alaska		7	7	9	11	The sentences appear to be place holder and filler ¬ñ what does ¬ëpulling together' look like? Perhaps instead their might be discussion that, e.g. "Funding is available to adapt to climate change that is particularly useful for Indigenous and local peoples in Alaska who are at the frontlines of climate change. Such funding opportunities include	More details are provided in KM 29.7 Our Future. Here, we are intentionally writing an aspirational end to the introduction. In response to other comments, the paragraph has been rewritten.
Melissa	Shapiro	Table	29. Alaska		8		5		‚ÁúOur health‚Äù should also include a specific reference to nutrition (in addition to basic health); and ‚ÁúOur security‚Äù should include physical safety and security associated with clean water and adequate, available and accessible food.	We have added "nutrition" to Our Health. Adding detail under Our Security would make the entry too long for the purposes of this table. As stated in the caption, these are intended to be examples, not a comprehensive list.
George	Kling	Text Region	29. Alaska		8	8	8	8	Is the framework for the confidence statement (?high confidence?) defined elsewhere in NCA5 and then used consistently across the chapters, or is this something the AK chapter authors implemented? If the former, perhaps this could be stated and cross references to that section of the report that defines the framework. If the latter then these need to be defined prior to these sections.	The confidence statements are found throughout the whole assessment. The explanation will be provided in the introductory materials rather than repeated in every chapter.
Ariela	Zycherman	Text Region	29. Alaska		8	8	9	10	Suggest rephrase ¬ëchallenged by climate driven hazards and emerging diseases' to be ¬ëchallenged by climate-driven threats¬Ö" which is more inclusive. Harmful algal blooms are becoming more common and making seafood more toxic, yet do not fall into the category of hazards or diseases	Good point. We have changed "hazards" to "threats".
George	Kling	Table	29. Alaska		8				?Our Built Environment?. It is unclear what ?barriers to innovation? refers to, because there is a lot of innovation in the built environment to deal with climate change adaptation and future resilience. The problem is the implementation. Yes the community sharing and priority setting (third column) are needed, but also needed are partnerships, people across government, industry and communities working together to design and implement the best solutions, many of which we already have. In addition, in this Table under Our Natural Environment for examples you have ?Ecosystem-based management? and you could add ??and equitable participation of all those affected?.	Good points. We have changed "innovation" to "implementation" in Our Built Environment and added "and equitable participation" to Our Natural Environment.
George	Kling	Text Region	29. Alaska		9	9	1	5	A close relationship with the land (and natural environment) isn?t what makes this population vulnerable to the health impacts of climate change. It?s a combination of factors that include food insecurity caused by declining subsistence resources, lack of access to medical care, inadequate sanitation and drinking water infrastructure, and the geographical isolation of individual communities (not the isolation of the state itself) from healthcare and medical resources. While these other factors are mentioned later in the text, the sentence as phrased implies that ?a connection to the land? is the primary factor driving the population?s health vulnerabilities. It might be more accurate to remove that introductory phrase and restate the sentence something like ?A heavy subsistence diet, when combined with limited access to healthcare and geographical isolation, make the population particularly vulnerable to the health impacts of a changing climate.?	We have reworded the sentence to address these points, but also being careful not to imply that a subsistence-intensive diet is the source of health impacts.
Melissa	Shapiro	Text Region	29. Alaska		9	9	1	1	Recommend amending to text to read ‚ÁúMany Alaskans, especially Alaska Native people, have a distinct connection to and understanding of the natural environment.‚Äù	Good point. We have made the suggested change.
Holly	Prendeville	Figure	29. Alaska		9	9	6	10	Sea-level decline will also have impacts, so change wording to 'sea-level change'. https://meridian.allenpress.com/jcr/article-abstract/35/4/765/428127/Impacts-of-Submerging-and-Emerging-Shorelines-on	We appreciate the point, but sea level decline is not a result of current climate change. Providing a longer explanation would be out of place here.
Carl	Markon	Text Region	29. Alaska		9	9	11	14	This introductory sentence places to much emphasis on COVID-19 and makes me think it is the subject of the paragraph. Perhaps something like: Climate change in Alaska highlights many exisiting...,(delete ; these inequaities include) including discrimination,....	We have adopted your suggested start to the sentence and the deletion of "these inequities", and revised the paragraph so that it only mentions COVID at the end as an illustration of what a disruption does to health and health-related systems.
George	Kling	Figure	29. Alaska		9				In the caption the first sentence ends ??which in turn are affected by climate change.? We really need to add ?? are affected by climate change and occur simultaneously?. If we don?t stress this in our language throughout the chapter and the report, people are still allowed to think of these issues, and their solutions, as separate from one another rather than as interconnected, compounding, and cascading.	Good point. "and occur simultaneously" has been added as suggested.
George	Kling	Figure	29. Alaska		9				In this figure there is no mention of who is responsible for the actions. For example, in the Social and Behavioral Context and the Environmental and Institutional Context, there is no mention of governance, which of course sets the policies we have in place. It would be helpful to tie specific actions (e.g., any ?management?) to the actors responsible.	"Subsistence resource management" is listed, and is one examples of governance. We have added a mention of governance in the caption, too, in addition to re-wording the caption further to address this point.
George	Kling	Figure	29. Alaska		9				In this figure it would be good to have ?spiritual values? mentioned in the social context of the graphic itself and not just in the caption below.	Thank you for the suggestion. There are many different components of health and well-being that are shaped by climate change. We have listed a few examples in this figure and included spiritual health in the caption to encompass and even wider definition of health.
Carl	Markon	Text Region	29. Alaska		10	10	2	3	change end of sentence to 'exacerbated by unforseen circumstances such as the COVID-19 global pandemic'.	Good point. We have made the suggested change.
George	Kling	Text Region	29. Alaska		10	10	5	6	While the reference to Hahn et al. 2021 about wildfire smoke exposure is good, it is presented as a single-factor issue when really it is linked with heat waves and living in homes with inadequate ventilation or cooling needed in the current climate. People are thus forced to make some tough choices in terms of suffering with the heat or opening windows and increasing exposure to poor air quality. Throughout the chapter the authors could use examples that illustrate the interconnectivity of these issues that people are experiencing, rather than presenting the situation as single-factor problems.	We have added additional information to provide this context.
Carl	Markon	Text Region	29. Alaska		10	10	9	11	I wonder if the last part of this paragraph is more appropriate in KM29.7. The other paragraphs in this section do not mention adaptation strategies and it seems out of place.	We appreciate the suggestion, but also think that adaptation is appropriately woven throughout the chapter, rather than relegated entirely to the end. We have added a mention of this in the Introduction.
Carl	Markon	Text Region	29. Alaska		10	10	12	31	My main problem with these two paragraph is that the issues listed are presented as a POTENTIAL future climate reated issue, and MAY be related to climate change. They are a bit out of place compared to the other paragraphs in this section. If they are to be included, I would recommend placing them at the end of the section and reduce to four or five sentences for both subject areas.	Whether current or potential issues, these paragraphs are intended to discuss climate related concerns that have been raised by Alaskans. These paragraphs have been moved towards the end of the section to better connect with the topic of surveillance systems.
George	Kling	Text Region	29. Alaska		10	10	25	25	How large? Can ?unusually large? be put in context of historic outbreaks of rabies?	We have added the number of confirmed animal cases and the comparison to historical averages.
Ariela	Zycherman	Text Region	29. Alaska		10	10	26	26	Page 10 -- line 26. Is it accurate to say that rabies vaccine clinics were canceled -- or is it more accurate to say that clinic appointments were canceled?	The clinics were cancelled, because travel was restricted for the veterinarians and technicians who would have done the vaccinations and other treatments. The blame is not on rural residents for failing to show up.
Ariela	Zycherman	Text Region	29. Alaska		10	10	28	29	Page 10 Line 28-29 I'm not understanding why sea ice would affect red/Arctic foxes, and then why overlap of red and Arctic foxes would affect rabies transmission to people? Potentially, the claim is that it is just increasing the cases of rabies in animals, in which case ignore the second part of my question.	We have added an explanation of the connection.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Carl	Markon	Text Region	29. Alaska		10	10	32	36	As with the previous paragraph, this is a potential issue, although my guess is that it is a current issue (second sentence). Also, the introductory sentence gives the idea that there are lots of emerging issues with diseases and parasites, but only one is listed. If there are no others, I would recommend the following change: Climate change is also affecting the potential for exposure to diseases and parasites such as toxic harmful algal blooms (HABs) (KM 10.1; Hendrix et al. 2021; Lefebvre et al. 2016; Van Hemert et al. 2020, 2021). Warming ocean temperatures and loss of sea ice mean these cysts will be more likely to hatch into massive and recurring toxic blooms (Anderson et al. 2021), affecting human, marine mammal and seabird health and survival.	Additional examples were not added to this paragraph due to space, but the paragraph has been revised.
Ariela	Zycherman	Text Region	29. Alaska		10	10	32	39	Page 10 Lines 32-39. Most of the paragraph is on HABs but for some reason there is a clause on "the ability to dry and store food in traditional ways". Suggest omit since it¬ís not the topic of the paragraph.	Thank you for pointing out the ambiguity. We have added a sentence specifying that HABs are one example of the kinds of problems mentioned in the first sentence, and a sentence at the end about food storage.
Ariela	Zycherman	Text Region	29. Alaska		10	10	32	39	Page 10 Lines 32-39. What¬ís missing is why HABs threaten health for those that don¬ít know. After "Human, marine mammal, and seabird health and survival are increasingly threatened by toxic harmful algal blooms (HABs) in Alaska, which can be ingested when accidentally or intentionally drinking contaminated water or wildlife (e.g. shellfish) that were exposed (KM 10.1; 35 Hendrix et al. 2021; Lefebvre et al. 2016; Van Hemert et al. 2020, 2021)."	Good point. We have rephrased the sentence to make this point.
Carl	Markon	Text Region	29. Alaska		11	11	1	11	As written, this paragraph is not about climate change, but COVID-19. I would recommend deleting it or state the climate change impacts.	Good point. We have spelled out the connection and connected this paragraph to the next so that the climate change impacts on water and sanitation infrastructure are clear.
George	Kling	Text Region	29. Alaska		11	11	7	9	In the communities where households are using buckets in lieu of toilets (i.e., ?honey? buckets), the community also typically lacks any type of centralized water and sewer utility infrastructure. Consequently, those buckets are hauled to a designated tundra pond or wastewater lagoon for disposal. These stabilization ponds only provide a minimum level of secondary treatment and often have little or no control over the quality of effluent going back into the surrounding environment. Adding this additional detail may help contextualize the magnitude of the challenge for those unfamiliar with these communities. Potential rewording ?Many of these households must haul water from untreated sources such as nearby rivers. They use buckets in lieu of toilets and haul that waste to tundra pond or wastewater lagoon the community has designated for sewage disposal.?	This additional context has been incorporated into this paragraph.
Ariela	Zycherman	Text Region	29. Alaska		11	11	9	11	Page 11 Line 9-11 More obviously, lack of a safe water source also contribute to digestive issues (in addition to respiratory and ear infections).	This sentence has been edited to reflect that there are a number of potential health risks related to lack of water and serer services
Carl	Markon	Text Region	29. Alaska		11	11	12	12	End of line - this? In relation to what?	We have clarified that we are referring to health-related infrastructure.
Carl	Markon	Text Region	29. Alaska		11	11	12	18	This paragraph seems more appropriate for KM29.7 as it seems to be more of a response; or perhaps a text box under that section.	We appreciate the suggestion, but do not want to relegate all responses or adaptation to the end of the chapter.
Melissa	Shapiro	Text Region	29. Alaska		11	11	12	14	The chapter authors could also note that permafrost thaw (along with other environmental factors) have caused the collapse of existing public water sources ("washeterias") and sanitation systems, and not only creating barriers to the construction of new facilities.	Good point. We have rephrased to specify inequitable health-related infrastructure.
Ariela	Zycherman	Text Region	29. Alaska		11	11	14	15	Page 11 line 14-15 Suggest including the number of communities the PASS system services (i.e. 5), the way it is written it seems like many communities have this option.	Additional information about PASS has been added to this paragraph to provide additional context
Ariela	Zycherman	Text Region	29. Alaska		11	11	14	15	Page 11 line 14-15 Suggest including a brief description of what PASS is, since most might not be aware of how it works. For example, "PASS are portable, providing households with treated water for drinking and a handwashing sink, in addition to a waterless toilet system that separates urine from feces which are disposed of separately on nearby ground or dried for burning."	Additional information about PASS has been added to this paragraph to provide additional context
Carl	Markon	Text Region	29. Alaska		11	11	19	19	The introductory sentence could be for a number of environmental factors, not all related to climate change. I would recommend the following: Climate change in Alaska have been shown to be directly related to increased instanses of flooding, which can directly…	Thank you for the suggestion. We have revised the sentence accordingly.
George	Kling	Text Region	29. Alaska		11	11	19	27	It is understood that there is little data on health impacts, but the authors should explicitly state that fact and then say they do have data for pregnant women. Otherwise it reads like only pregnant women are affected.	Revisions have been made to clarify that this is just one example of a specific population in Alaska and how certain climate factors can impact their health.
Carl	Markon	Text Region	29. Alaska		11	11	20	21	Suggested change to end of sentence: as illustrated in KM15.1.	We have made the change as suggested, subject to style guidance for the entire assessment.
Ariela	Zycherman	Text Region	29. Alaska		11	11	21	22	Page 11 line 21-22 I would argue flood can impact physical and mental wellbeing for all (not just pregnant women), suggest revise. "¬Öflooding negatively impacts physical and mental well-being for all, with special implications for pregnant women, who have babies of low birth weight, premature births, and fetal death (Mallett and Etzel 2018)."	Thank you for the suggestion. We have revised the sentence accordingly.
George	Kling	Text Region	29. Alaska		11	11	28	39	This would be a good place to include spiritual impacts as well. Perhaps the authors could reference the Oscarville Adaption Plan and the reference Donkersloot et al. (2020) as two of the many examples would be helpful (both are already cited in this chapter).	Good point. We have added this to the following sentence, with the references you kindly suggested.
Melissa	Shapiro	Text Region	29. Alaska		11	11	28	28	Suggest amending the text to read: ‚ÁúEnvironmental disruption to traditional livelihoods and practices due to climate change can cause ecological grief‚Ä¶Ä¶Áù	We appreciate the suggestion, but do not want to limit the causes of grief solely to disruptions affecting traditional livelihoods and practices.
George	Kling	Text Region	29. Alaska		11	11	37	37	Using the phrase ?Forced migrations? implies that people can return, but they cannot. Perhaps a more accurate phrase would be ?Forced displacement?.	Good point. We have changed the word as suggested.
Melissa	Shapiro	Text Region	29. Alaska		11	11	37	39	The text should be amended to account for forced migrations due to erosion and permafrost thaw, as follows: ‚ÁúForced migrations inland due to rising sea levels, coastal erosion, flooding, and permafrost thaw, which disrupts social networks,Ä¶Áù	We have changed the sentence as suggested.
Carl	Markon	Text Region	29. Alaska		12	12	1	11	This paragraph is more related to COVID-19 and response, and not climate change. I recommend deleting it. The subject matter (response) is more appropriate in section KM29.7.	We have reorganized the paragraph to make a clearer connection to climate change. We have chosen to keep this paragraph here so as not to move all adaptation and response ideas to the end of the chapter.
George	Kling	Text Region	29. Alaska		12	12	1	2	While it is true that Alaska has limited health surveillance systems, it would still be useful to highlight what does exist and recommend to expand the services. This is especially important when it is a good example of multiple agencies or organizations and people working together (e.g., the Local Environmental Observer, https://www.leonetwork.org/).	We have added a new paragraph to include additional information about surveillance systems.
Carl	Markon	Text Region	29. Alaska		12	12	13	13	I would recommend the following: Tragedies related to climate change, in particular changing ice conditions, impact…. There isn't a clear relationdhip between falling through ice and climate change	Good point. We have added the example of changing ice conditions, as suggested.
George	Kling	Text Region	29. Alaska		12	12	13	26	Box 29.1, p. 12. ?I?ve been called to pray? makes a powerful statement about the loss of life due to climate effects on ice safety. However, it also makes an equally powerful but potentially damaging statement about religion in Alaska, especially for Indigenous People. Many see churches and religion for Alaska?s Indigenous People as carrying the burden of a colonial imposition where missionaries were paid to ?cleanse? the tribes and replace their culture, traditions, and even language with western thought and Christianity. Because it is impossible to separate religion and praying, no matter what the context or intended message, from this colonial overprint, this Box will be harmful to many readers and will give mixed messages to many others. At a minimum, this box needs more recognition of the history and context of forced religion in Alaska, coupled perhaps with a shift in perspective from religion to ?respect for elders? as the context for this quote. We recognize that there is a Figure 29.4 that appears intended to be in the same Box 29.1, but the figure is not yet in the report and so its placement or content can?t be evaluated. Even without that Figure 29.4 inside the Box, the placement of this Box is strange because it comes right after a paragraph on COVID and it ends the section on Our Health, and it is never cited in the text. In addition, the very real problem of climate-altered ice conditions for inland hunting and fishing, which we believe the box is intended to address, is only mentioned sporadically in the report (briefly in Box 29.2 and on p. 20, lines 34-35) and when talking about sea ice and marine mammal hunting (pages 30-31). Hopefully the authors will reconsider the placement, message, and use of this Box in the chapter, to instead consolidate and highlight the topic of shifting safety of inland ice for hunting and fishing, and to focus the perceived message on the direct loss of life from shifting climate and the respect for elders, rather than on religion.	We appreciate this point about the colonizing impacts of churches and religion on Alaska Native communities and culture. However, this is a direct quote from an Iñupiaq Elder expressing her personal experiences responding to community needs in light of fears and tragedies related to changing ice conditions due to climate change. To change her quote or to add an explanatory comment adding context about the harms of the church and religion would both diminish her lived experiences and spiritual beliefs, and therefore act in conflict with the Iñupiaq Values "Respect for Elders" and "Spirituality."

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
George	Kling	Text Region	29. Alaska		12	12	13	16	It probably wasn?t the authors? intent, but the use of ?social media? and ?networks? in this sentence implies a level of connectivity and access to communications infrastructure that simply doesn?t exist in many communities in Alaska. According to the Alaska State Broadband Office, 118 communities in Alaska (47%) are considered ?unserved? by broadband as defined by the National Telecommunications Information Agency (i.e., 25/3 Mbps). Similarly, cellular phone service may also be unavailable in these communities. Please consider omitting ?social media? and rewording the sentence to something like: ?Alaska Native communities, although often geographically spread out, remain intimately connected through family, cultural ties, social networks, tribal affiliations, and community activities, such as church.?	We appreciate the point, but Facebook in particular is widely used in rural Alaska, and is indeed the way that Gladys Pungowiyi often receives requests to pray. It would be inaccurate to remove "social media."
Carl	Markon	Text Region	29. Alaska		13	13	19	25	I recommend this paragraph be deleted. It is not directly related to climate change, and would be an issue even if climate change were not occurring.	As stated in the last sentence, broadband and cell service are important to emergency response, demands that are expected to increase with climate change.
George	Kling	Text Region	29. Alaska		13	13	19	21	These numbers should be verified with the last NTIA and Alaska State Broadband Office. According to the data I have seen, only 50.5% of communities in Alaska are considered ?served? as defined by NTIA (minimum of 25/3 Mbps).	Thank you for pointing this out. We have revised changed from households to communities and updated the numbers based on updated figures from the Alaska Broadband Office.
George	Kling	Text Region	29. Alaska		13	13	23	24	While this is believable, are there citable data to back up the assertion?	In addition to publicly available regional and statewide reports, there are numerous privately commissioned reports by Tribal organizations such as the Tanana Chiefs Conference Tribal Broadband Plan. We have added the following citation: Hudson, H. E., Hanna, V., Hill, A., Parker, K., Sharp, S., Spiers, K., & Wark, K. (2012). Toward Universal Broadband in Rural Alaska.
Melissa	Shapiro	Text Region	29. Alaska		13	13	23	23	The text should be amended to read: ‚ÄúLack of broadband and cell reception diminishes access to healthcare (telemedicine), educational opportunities, emergency response capability,Ä¶Äù	Good point. We have made the suggested additions to the sentence.
Carl	Markon	Text Region	29. Alaska		14	14	7	12	The entire discussion about Fairbanks should be deleted as has nothing directly related to climate change and would be a factor in the absence of cliamate change as written. There are actual infrastructure and access challenges in rural Alaska that should be listed.	We have elsewhere discussed rural Alaska, and it's important not to neglect urban areas. Exposure to permafrost thaw is a serious climate-related issue, in Fairbanks as elsewhere, as these sentences explain.
Carl	Markon	Text Region	29. Alaska		14	14	13	22	I would recommend deleting this entire paragraph as it does not add anything to the report about climate change and how it affects the minority population.	The paragraph describes the increasingly prominent non-White population in Alaska. Non-White communities in urban Alaska are understudied and, in the absence of information characterizing vulnerable populations and the inequities they experience, the state is not equipped to address them. We have added an explanation to the paragraph.
George	Kling	Text Region	29. Alaska		14	14	13	13	The authors? likely didn?t want to imply that Alaska?s overall population is growing, but simply that the existing population is becoming more diverse. Alaska?s net migration has been negative for the last nine years (2012 to 2021), https://live.laborstats.alaska.gov/pop/projections/pub/popproj.pdf . Suggest simply deleting the words ?growing and? so that it reads: ?Alaska?s population is gradually becoming more diverse?.	Good point. We have deleted "and growing," as suggested.
Carl	Markon	Text Region	29. Alaska		15	16	8	20	I would recommend deleting these two paragraphs Food security is important, but I don't think COVID-19 should be listed here as an analog to 'potential' climate related issues. Also, most of the text is actually just supportive information about food access and abundance, and not really related to climate change in Alaska. I would recommend just putting in subject matter in which climate change is, or has directly impacted food security.	As we have explained in the Introduction, the context in which climate affects society is important. We have added to the discussion of climate-related effects in the second paragraph, to make the connection clearer.
Ariela	Zycherman	Text Region	29. Alaska		15	16	8	12	Pages 15-16, lines 8-11 and 1-12 For this paragraph on food security, it seems important to focus both on the high price of externally sourced market-based food as well as the changes to subsistence food systems which is affected in numerous ways. For example, thawing permafrost is affecting underground food refrigeration, while more frequent storms are affecting the food sharing systems of communities. I would suggest adding something to this effect to the paragraph.	Thank you for these ideas. Climate-related effects on subsistence are discussed in the following paragraph, and elsewhere we added mention of the problem of thawing ice cellars.
Carl	Markon	Figure	29. Alaska		15				I would recommend deleting this figure as it does not add anything to the report about climate change and how it affects the minority population.	In the caption, we have added an explanation of the connection to climate change.
Emma	Conrad-Rooney	Figure	29. Alaska		15				As a reader, I was confused by the size of the pie charts. The key seems to give examples of four circles that differ in size based on population. It would be helpful if the caption could more clearly describe the sizes of the pie charts as well as the four circles indicating population size.	"Circle size indicates population" is stated right above the four example circles in the figure, and we have added this to the caption as well.
Ariela	Zycherman	Figure	29. Alaska		15				Fig 29.5 and 29.7 Is it possible to get this figure as higher resolution so that it doesn't look so granular?	The figures in the final report will be higher resolution.
Melissa	Shapiro	Text Region	29. Alaska		16	16	3	3	The chapter authors could cite the percentage of food grown outside of Alaska (95%), as this is a compelling statistic to further illustrate that the ‚Äúvast majority‚Äù of food consumed in the state is imported.	We consulted with experts in Alaska food systems, and the 95% figure is of uncertain origin and at least a decade old. We will stick with "vast majority" rather than use a precise-sounding but unsubstantiated figure.
Melissa	Shapiro	Text Region	29. Alaska		16	16	13	15	The chapter authors could amend the text to read ‚ÄúGiven the high cost of food and the vulnerability of rural transportation networks, subsistence activities (including hunting, fishing, and sharing) are critical in rural Alaska, especially for Indigenous communities that are best suited to overcome commercial food shortages through the continuation of traditional practices. Such subsistence activities are critical for urban residents too.‚Äù	Good point. We have reworded the sentence to include these ideas, and to avoid having a very long sentence.
George	Kling	Text Region	29. Alaska		16	16	17	20	In the sentence ?Yet the success of subsistence harvests??, please elaborate on the ways in which subsistence harvests are impacted ? rising fuel costs makes traveling to hunting sites impractical, shifts in location and timing of ice extent makes hunting on the ice dangerous, shifting migration patterns can affect and diminish hunting success, and so forth.	Good point. We have changed the sentence accordingly.
Emily	Johnson	Text Region	29. Alaska		16	16	19	19	Fish and animals should read fish and wildlife or fish and terrestrial animals.	Good point. We have changed the wording to "fish, birds, and mammals" as suggested in another comment.
George	Kling	Text Region	29. Alaska		16	16	19	19	Do you mean ?fish and mammals? instead of what is written, ?fish and animals?? If you want to be very general then at least say ?fish and other animals? because fish are animals, or you could say ?fish, birds, and mammals? to be inclusive of subsistence activities.	Good point. We have revised the phrase to read fish, birds, and mammals", as suggested.
Melissa	Shapiro	Text Region	29. Alaska		16	16	21	25	Agricultural production may also be negatively impacted by climate change as permafrost thaw has the potential to cause flooding and ground collapse in cultivated areas.	We have added this point.
George	Kling	Text Region	29. Alaska		16	16	26	37	This paragraph is good but it might be better placed at beginning of the entire Alaska Chapter, as part of the Introduction. The complexities of governance in Alaska, large federal land ownership, 220+ tribes, Alaska Native Corporation structure, overlapping responsibilities and jurisdictions, etc., is fundamental to evaluating any potential solutions and responses to climate change in the region. In addition, many of these complexities are appropriately highlighted in the chapter, and the reader would benefit from the structure and organization of having this brief introduction at the beginning of the report.	Thank you for the suggestion. We have moved this paragraph to the introduction.
Carl	Markon	Text Region	29. Alaska		16	16	27	37	Recommended change: Climate change in Alaska affects society in many ways, especially when multiple governances are not set up for coordinated responses, and potentially inhibit the ability of communities to respond. Governance in Alaska is divided among federal, state, local, and tribal agencies, with various and often overlapping responsibilities. Tribal governments, with few exceptions, do not have geographical jurisdiction but are responsible for many programs affecting tribal members (Figure 29.15). Delete section on Denali Commission.	Thank you for the suggestion. We believe it's important to include examples of what can be done better, such as the Denali Commission's approach. We appreciate the suggested re-wording, but prefer our original version.
Melissa	Shapiro	Text Region	29. Alaska		16		32	37	The chapter authors could acknowledge that despite the potential for the Denali Commission to serve as a coordination hub for holistic and cohesive government support, the success of this positioning depends on the adequacy of funding, resources and support, and a clear directive.	We have added a qualifying phrase to include this idea.
Emily	Johnson	Text Region	29. Alaska		16	16	34	34	There is a parenthetical reference to Figure 29.15 that should be Figure 29.16.	Thank you. We have corrected this.
Melissa	Shapiro	Text Region	29. Alaska		17	17	4	4	The chapter authors should cite to data or verify the impacts (e.g. lives lost) of the 2021 holiday storms in Fairbanks.	We have added citations and a mention of the ensuing disaster declarations.
Carl	Markon	Figure	29. Alaska		17				This figure caption could use a bit more information: where?, what are the red lines?, and how is it related to the text, other than a lot of snow.	We have added a caption with the requested information.
George	Kling	Figure	29. Alaska		17				In the caption please indicate the approximate height of this snowpack and say what the red lines in the image represent (is it a height scale?).	We have added a caption with the requested information.
Ariela	Zycherman	Figure	29. Alaska		17				Fig 29.6 The figure obviously has red lines that are trying to indicate something ¬ñ maybe areas of ice layers where it rained? The figure description needs to say what we are looking at beyond the 'cross section'	We have added a caption with the requested information.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
George	Kling	Text Region	29. Alaska		18	18	1	16	Key Message 29.3, Our Livelihoods, p. 18. The statement that climate change is ?likely? to create opportunities related to adaptation and response may be correct, but the placement of this next to the loss of jobs from the collapse of major fisheries is a problem because the two are not equivalent in numbers. That is, the number of steady-income jobs lost by collapsing fisheries could hardly be made up for by climate change response opportunities. Please clarify that the ?confidence? associated with these statements does not include the magnitude of the problem for livelihoods.	Good point. We have reworded the sentence to remove likelihood and to refer to "some" opportunities.
George	Kling	Text Region	29. Alaska		18	18	5	7	This sentence doesn?t seem to fit in a Key Message (29.3) related to livelihoods, and it doesn?t seem to be supported by the text in the remaining section. Livelihood is this section is primarily referring to economic (wage and salary) security, which has little bearing on the food insecurities experienced by Alaska?s indigenous and subsistence cultures due to climate change. There is a reference on page 19 in lines 9-10 to ?creating new employment opportunities in mariculture?. While the southcentral or southeastern portions of Alaska could experience a slight increase in food security due to investments and economic advances in local agriculture and mariculture, those aren?t a substitute for subsistence activities, particularly in the northern, interior, and western regions of the state. Recommend removing the phrase ?that increase food security? so that the sentence reads: ?Economic diversification, especially expansion of local value-added industries, can help increase overall livelihood options.?	Good point. We have removed the reference to food security as suggested.
George	Kling	Text Region	29. Alaska		18	18	8	8	As mentioned in comments to the same sentence on page 4, the phrase ?natural resource use? in this sentence is inappropriate. Alaska?s economy is not dominated by the state?s domestic use of natural resources, but instead by the oversized presence of natural resource industries in the state. A more accurate statement might be ?Alaska?s economy depends largely on the public sector and natural resource industries.?	We have made the change as suggested.
George	Kling	Text Region	29. Alaska		18	18	12	14	?Livelihood?, as it is being used in this section, primarily refers to economic (wage and salary) livelihood ? employment and jobs. Indigenous cultures in Alaska, and many communities in the state today, have no cash economy per se. In these communities, sustaining healthy livelihoods depends on their ability to maintain cultural traditions and subsistence lifestyles. Therefore, these two sentences might be reworded to better reflect this subsistence economy: ?Sustaining healthy livelihoods in Alaska involves more than wages and salaries. Traditional cultures operate outside the cash economy, and many communities in the state maintain subsistence lifestyles, harvesting and sharing fish, wildlife, and other natural sources of food.?	Good point. We have reworded the sentence in a similar way to the suggestion.
George	Kling	Text Region	29. Alaska		18	18	13	14	It would be good to give estimates of the size and value of subsistence harvests.	These are provided in Figure 29.7.
George	Kling	Text Region	29. Alaska		18	18	14	16	The last sentence of this paragraph is vague. What changes to land and water? What other societal trends? How do these changes affect harvests?	We have rephrased the sentence to be more specific.
Holly	Prendeville	Figure	29. Alaska		19	19	1	7	The statistics need to have appropriate citations in this figure. USDA NASS 2019 doesn't say anything about climate, so need to include a citation for agriculture and climate impacts. One option: https://www.climatehubs.usda.gov/sites/default/files/pnw-gtr1002.pdf Also, I don't know that this NASS fact sheet provides $ for wages and number of jobs so a different citation is needed for this information related to ag.	Cheng et al. 2021b; Fresco et al. 2021; Lader et al. 2018 are cited in the main text for climate change impacts to agriculture. The number of jobs and wages was derived from the cited NAAS report. Jobs = number of producers + number of hired farm laborers. Wages = producer net cash farm income + hired farm labor payroll.
Emily	Johnson	Figure	29. Alaska		19				Winter tourism is increasing not decreasing in Fairbanks and Denali National Park and Preserve.	The statement concerns opportunities for winter activities, not numbers of tourists. We have requested a change in the bullet to "opportunities for winter tourism activities will be reduced."
Emily	Johnson	Figure	29. Alaska		19				Consider adding a bullet point in the subsistence box specifying climate change driven declines to subsistence resources (fish, wildlife, plants, and berries).	Thank you for the suggestion. We don't have room for an additional bullet point, so we will replace zoonotic diseases with declining resources.
Ariela	Zycherman	Figure	29. Alaska		19				Fig 29.5 and 29.7 Is it possible to get this figure as higher resolution so that it doesn't look so granular?	Figure quality will be improved for the final version.
Ariela	Zycherman	Figure	29. Alaska		19				Fig 29.7 Agriculture will likely also be affected by flooding not just drought and pests. In tourism section, human-bear interactions may increase. Fishing, is it accurate to say ¬ëadditional fish stocks WILL collapse¬í, or "MAY" collapse? Subsistence, ¬ënew opportunities¬í seems overly vague	We agree that there are many more effects that could be listed. We have chosen a few, in the interests of space and clarity. We have changed "will collapse" to "are expected to collapse," as you are correct that the outcome is not certain, though it is more than simply possible.
Carl	Markon	Text Region	29. Alaska		20	20	1	16	Recommended change since you only talk about fisheries: Climate impacts have resulted in several severe socioeconomic consequences (Barbeaux et al. 2020; Conrad and Gray 2018; Garber-Yonts and Lee 2020; Oke et al. 2020), and in particular, Alaskan fisheries, a $5.7 billion industry (2021 dollars). Climate change has negatively impacted the condition, growth, survival, reproduction, population biomass, and harvest of marine fishes, salmon, and crab. In addition, groundfish and crab distributions have shifted northward or offshore, following colder water, and the timing of groundfish spawning and salmon spawning migration have been altered (KM 8.1). Salmon are in double jeopardy because climate affects both their freshwater and marine habitats (Box 29.3). This has resulted in a number of fisheries being closed or dramatically reduced due to fewer fish (KM 10.2; Barbeaux et al. 2019; Dorn et al. 2018; Szuwalski 2021).	We have revised the paragraph to specify commercial fisheries are the main topic.
George	Kling	Text Region	29. Alaska		20	20	1	3	Climate change impacts all Indigenous Peoples of Alaska, not just those on the coast. It would be better to remove the word ?coastal? and restate the sentence as: ?Climate impacts have severe socioeconomic consequences for Indigenous Peoples, small rural communities, and industries throughout Alaska.?	Good point. We have removed "coastal."
Melissa	Shapiro	Text Region	29. Alaska		20		6		This sentence is ambiguous as to who declared fishery disasters in January 2022; the chapter authors should clarify that this is not a federal government disaster declaration (as such declarations do not extend to subsistence loss), but rather is a process led by commercial entities.	Good point. We have specified that the declaration was done by the U.S. Department of Commerce.
Ariela	Zycherman	Text Region	29. Alaska		20	20	8	9	Page 20, lines 8-9 The numbers on jobs here are different for Fig 29.7, make sure they are harmonized	Thank you for pointing this out. We have updated the numbers in the table and removed the employment figures from this sentence, since they are redundant to those in the table.
Carl	Markon	Text Region	29. Alaska		20	20	17	30	I would recommend deleting this paragraph as it is, as the first word in the first sentence states, an adaptation, and more appropriate for KM29.7	As noted in other responses, we have chosen to include adaptation throughout the chapter, rather than relegating all mention to KM 29.7, which would then become a very long key message text.
Carl	Markon	Text Region	29. Alaska		20	20	25	26	Delete this sentence as it has nothing to do with fisheries.	We have moved the sentence to the following paragraph, where it fits better.
George	Kling	Text Region	29. Alaska		20	20	25	26	In the sentence ?Shifts in spring marine mammal subsistence hunting opportunities??, it feels like this could be elaborated on ? what kind of shifts? What species? Why the shifts?	We have specified shorter duration of suitable spring hunting conditions.
Carl	Markon	Text Region	29. Alaska		20	20	31	31	Reading this, I don't know if this is a general statement or has to do with recent warmer temperatures and changes in precipitation (which according to page 5, are small or slightly increasing). If this is in the future tense, I would delete the paragraph.	The changes in average temperature and precipitation may be statistically small, but the consequences are substantial and occurring today.
Emily	Johnson	Text Region	29. Alaska		20	20	36	37	The report could benefit from a few sentences in between the last two paragraphs to identify rain on snow events and other climate driven impacts to subsistence resources. Rain on snow events have been identified as a cause to stress, starvation, or direct mortality of caribou, Dall sheep, moose, and other important subsistence resources.¬†Also, potential climate driven changes to caribou migration patterns and timing of the migration affects their availability to subsistence communities. NPS authors Kyle Joly has many caribou reports and scientific articles, and Will Deacy and Matt Cameron have reports that can be referenced for sheep.	We have added two sentences to make these points. Thank you for the suggestion.
Carl	Markon	Text Region	29. Alaska		20	21	37	2	Again, most of this paragraph is a future scenario; perhaps take this and the previous paragraph and combine and rewrite using specific cause and effects that have occurred. I wonder if you should have a future scenario section (but I don't think that is in your general guidance).	Effects are being seen already, and more are anticipated. We have reorganized the paragraph to make this clearer.
Carl	Markon	Text Region	29. Alaska		21	21	3	12	I would delete this paragraph and it has to do more with local economics, and local crisis response to those economics, than climate change; i.e., they could happen without climate change.	That is true, but climate change does not exist on its own. It intersects with other changes and stressors, which can exacerbate problems or create opportunities for synergy.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
George	Kling	Text Region	29. Alaska		22	22	6	12	Key Message 29.4, Our Built Environment, p. 22. It is unclear why the last sentence on planning for future change is only medium confidence. As a society we are very certain that if you do this planning and climate risk analysis, which we do in other places all the time, then the newly designed built environment will be more resilient to the current and future environment-climate envelope. The problem is the cost of building the infrastructure resilience, not a lack of confidence that it would work. In addition, this section on the built environment ignores Indigenous infrastructure such as fish racks, fish camps, and so forth, many of which were completely destroyed during the most recent typhoon Merbok.	Good point. We have changed "medium" to "high".
Carl	Markon	Text Region	29. Alaska		22	23	13	8	This is rather lengthly, and although factual, not all of the items listed in this introductory paragraph are mentioned in the remainder of the section. I would delete or significantly reduce those unmentioned items.	We do not have space to discuss all aspects of infrastructure, but we do think it important to mention major issues, even if they are not developed in detail in this section.
Carl	Markon	Text Region	29. Alaska		23	23	9	23	Introductory sentence states flooding, erosion and permafrost degadation, but only erosion is specifically mentioned as a climate change result (but no effects due to that erosion). I recommend combining the next paragraph with this one,	We have combined the paragraphs as suggested and added an explanation of what communities are vulnerable to.
Carl	Markon	Text Region	29. Alaska		23	23	12	16	Delete two sentences as they are more appropriate to KM29.7, and parts are not applicable since 'reports are not available'.	As noted in other responses to comments, we do not wish to put all adaptation and response ideas into KM 29.7. The fact that community-level reports are not available for all communities does not diminish the importance they have for communities where they do exist, and it's important not to imply that all communities have them at this point.
George	Kling	Text Region	29. Alaska		23	23	19	23	In the sentence ?An additional infrastructure challenge is that 80% of Alaska is underlain with permafrost, ??, can you make reference to the use of or need for permafrost for food storage for Indigenous People?	Good idea. We have added this to the first sentence.
Melissa	Shapiro	Text Region	29. Alaska		23		19	23	The authors could also address the compounding impact of permafrost thaw and more severe weather conditions on winter travel.	We believe introducing the topic of winter weather would require more space than is available in a section focused on infrastructure.
Carl	Markon	Text Region	29. Alaska		24	24	1	9	Delete paragraph as it is more of an adaption. The cost to Alaska Native communities could be added to the next paragraph.	As noted elsewhere, adaptation is a theme we have intentionally woven throughout the chapter.
George	Kling	Text Region	29. Alaska		24	24	1	12	There is a disconnect between the two cost estimates included in this section on lines 1-2 versus lines 10-12. If the impact of climate change on Alaska Native communities is estimated at $4.3 billion, then the lower bound of the statewide estimate can?t be less than that - $4.2 billion. These values may be from different sources, but it would be best if only one range is included in the report, and if necessary, just include a subset of that estimate for Alaska Native communities. It appears that the Key Message here should be that Alaska?s infrastructure is being disproportionately impacted by climate change ? both because of the pace of warming (2-3x anywhere else) and the fact that 80% of the state is underlain by permafrost.	Thank you for pointing out the disconnect. We have removed the reference here to Melvin et al. 2017's estimate of costs.
Melissa	Shapiro	Text Region	29. Alaska		24		1	11	The authors should also discuss the costs to infrastructure that may not be part of large-scale infrastructure assessments, including damage to subsistence resources (including fish camps and boats) and the resulting noneconomic losses, such as loss of cultural heritage, traditional livelihoods, and those that are less quantifiable, such as food insecurity, and compromised nutrition and health.	Good point. We have added this idea to the sentence about underestimating the cost of infrastructure damage. We have also re-organized both paragraphs that discuss costs.
George	Kling	Text Region	29. Alaska		24	24	2	9	In the two sentences starting ?Communities dealing with flood, erosion, and permafrost degradation??, can you make reference to the fact that ?community relocation? necessitates finding land that is suitable economically, culturally, and environmentally and poses its own challenges?	Good idea. We have included a sentence mentioning this and referring to the Introduction where we also raise this point.
Carl	Markon	Text Region	29. Alaska		24	24	12	14	Suggested change: ….(Melvin et al. 2017), but these costs could be significantly underestimated (Schneider von Deimling et al. 2021).	Thank you for the suggestion. In response to another comment, we removed the sentence referring to Melvin et al.'s cost estimate.
Melissa	Shapiro	Text Region	29. Alaska		24		19		The content of this callout box is far narrower than the title would suggest, focusing not on local business and livelihoods but on large-scale industries of tourism and oil. The title could be updated to state ‚ÄúThe Cost of Thawing Ground to Alaska Industry.‚Äù	Good point. We have made the suggested change.
Emily	Johnson	Text Region	29. Alaska		24	24	20	26	The Denali Park Road was closed at mile 43 of 92 miles due to permafrost thaw creating a rock glacier landslide. NPS road maintenance could no longer keep up with the slumping. The road will remain closed through at least the 2024 season. A bridge over the damaged section of the road is estimated to cost up to 102 million 2023 dollars.	Thank you for the details. We have specified a section of the road and updated the cost estimate.
George	Kling	Text Region	29. Alaska		24	24	20	32	Permafrost degradation is having a devastating impact on infrastructure throughout the interior and northern parts of the state. While the damage to the Denali National Park access road has received widespread national attention, it is hardly the most significant or even the best example of negative infrastructure impacts and accompanying economic consequences caused by climate change in Alaska. Given that this is a National Climate Assessment, mentioning the climate-induced risk to installed national defense assets (DOD bases, US Coast Guard infrastructure, etc.) and to assets critical to Alaska?s domestic economy (Trans-Alaska Pipeline, Dalton Highway, other oil and gas infrastructure) would seem to be better examples to highlight. This point seems to be made later in Section 29.6 on Security. At a minimum, it would be important to move the paragraph on oil and gas infrastructure (lines 27-32) to the beginning of Section 29.4 before any discussion of the Denali National Park.	The Denali road problem is indeed highly visible and will resonate with many readers. We have switched the order of the paragraphs as suggested.
Carl	Markon	Text Region	29. Alaska		24	24	30	30	This sentence should have two references, one for operation costs and one for viability of industires, either the industry itself, its infrustructure, or both.	We have repeated the reference to the 2020 BLM report.
George	Kling	Text Region	29. Alaska		25	25	6	8	In the two sentences starting ?Alaska?s ecosystems are changing rapidly??, it is increasingly common for people to misunderstand or disagree with the very generic term ?ecosystem services?. Would you consider changing this to something like ?the benefits from a healthy ecosystem that Alaskans expect and enjoy?.??	Ecosystem services is a term with a long history and a strong current scientific context and literature. Whether readers disagree with that framing or not is the issue here. In contrast, ecosystem services may be preferable to "subsistence resources", which some argue inappropriately judges one kind of relationship with the natural world. While it is an imperfect word, it means what we intend here and we elect to retain this language.
Carl	Markon	Text Region	29. Alaska		25	25	9	9	Perhaps replace stresses with stressors; I believe a stressor causes the stress.	We want to reduce the actual stresses, not just the stressors.
Carl	Markon	Text Region	29. Alaska		25	26	11	3	Suggested change: Alaska enjoys large, unfragmented marine and terrestrial ecosystems, and makes possible hunting and fishing for livelihoods, cultural well-being, recreation, and commercial activities. Climate change is expected to exacerbate existing challenges to all of these activities by shifting the timing, distribution and abundance of fish and wildlife across the State, and by re-distributing and expanding existing and new activities on lands and waters through various personal and commercial activities already present (Figure 29.11; KMs 8.1 and 8.2).	Thank you for the suggestions. We have revised the paragraph to take this into account.
Melissa	Shapiro	Text Region	29. Alaska		25		11	12	The authors should consider amending the text to read as follows: ‚ÄúThis abundance makes possible hunting and fishing for livelihoods, culture, traditional practices, well-being, and recreation.‚Äù	Thank you for the suggestion. We have revised this sentence to include subsistence use.
George	Kling	Text Region	29. Alaska		25	25	12	14	The tourism industry is only one of the industry sectors potentially impacted by climate change effects on Alaska?s ecosystems. Land use and natural resource allocation issues in the state are complex, but no other industry is called out in this introductory paragraph even though several, such as oil and gas, fisheries, mining, are equally impacted, and potentially more important to the economic, social, and cultural ecosystems of the state. Please consider removing this entire sentence from the paragraph or modifying it to be more inclusive.	We have removed the sentence.
Carl	Markon	Text Region	29. Alaska		26	26	3	5	I don't think this sentence is needed as it is a recommendation and not a cause and effect attributed to climate change.	We are not making a recommendation but simply an observation, that management decisions can help adapt to climate change, but these policies cannot by themselves alter the trajectory of the global climate.
Holly	Prendeville	Figure	29. Alaska		26	26	6	19	The accurate common name is "WESTERN BLACKHEADED BUDWORM" not just blackheaded budworm (as there is an eastern species). Please correct the image and line 18 text. https://www.fs.usda.gov/detailfull/r10/forest-grasslandhealth/?cid=FSEPRD646066&width=full Is the an accurate representation of a pacific cod? It looks upside down.	Black-headed and black headed were changed to western blackheaded in three instances.
Carl	Markon	Figure	29. Alaska		26				As in the very first figure, this caption would be more applicable as main text with a much shorter caption; its actually written quite well - short and succinct.	We are working on the both figures and captions, noting that our instructions are in favor of longer captions where appropriate.
Emily	Johnson	Figure	29. Alaska		26				Note the misspelling of Arctic in the figure. Currently reads Artic chum.	Suggested change in figure; pending
George	Kling	Figure	29. Alaska		26				Walrus impacts should be added to this figure.	Suggested change in figure; pending

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Ariela	Zycherman	Figure	29. Alaska		26				Fig 29.11 Caption. The caption starts by describing a number of wildlife changes that do not exist on the figure, e.g. beaver and trumpeter swans. Suggest either including them in the figure, or omitting them from the caption so that they are harmonious.	We have added trumpeter swans to the figure and noted that beaver are not shown.
Carl	Markon	Text Region	29. Alaska		27	27	7	12	Suggested rewrite: Climate change has negatively impacted nearly all aspects of the life history of Pacific cod, Arctic seabirds, and marine mammals, in terms of reproductive failure, unprecedented mortality, and changes in migratory behavior. The causes are thought to include extreme ocean warming and record low sea ice in the Chukchi Sea, which in turn, are affecting these animals' entire food web (Gitta et al. 2015; Quakenbush and Citta 2019; Romano et al. 2020) and possibly transforming the ecosystem not previously seen (Huntington et al. 2020).	Thank you for the suggestion. We prefer our wording, in which the sentences are a bit shorter and convey the same basic information.
George	Kling	Text Region	29. Alaska		27	27	7	24	Why are there no mentions of changes to whale migrations for subsistence populations?	This paragraph focuses on changes to the natural environment without reference to implications for human populations, which is covered in other sections. Whales are included in the information about marine mammals.
Carl	Markon	Text Region	29. Alaska		27	27	23	24	This sentence seems like an afterthought. I would recommend deleteing it.	We believe it adds useful information.
George	Kling	Text Region	29. Alaska		27	27	30	33	These concerns about ocean acidification on crab species have been expressed for many years, but as far as we know there is no evidence from the wild, only from the laboratory. If there is evidence from the wild then it should be cited, and if not then it would be prudent to mention that evidence from wild populations does not yet exist, or that wild populations have not yet been studied.	No studies in the wild in Alaska have been conducted. We have added this point, and we cite one study from California of the effects of OA on crabs in the wild.
Carl	Markon	Text Region	29. Alaska		27	27	34	35	This sentence seems like an afterthought. I would recommend deleteing it.	We believe it adds useful information. We have added a topic sentence to the start of the paragraph to better tie it together.
Carl	Markon	Text Region	29. Alaska		27	28	36	9	This is an odd paragraph. The first sentence is OK, but the rest seems like a mix and miss-match of items, and it does not include human access; I guess resource availability is implied (moving animals and not as many trees). I see lots of effects but no associated causes. Why are moose and beaver moving into Arctic areas; why are salmon moving to new areas; why is tundra greening; why is browning occurring in southwestern Alaska; why are the spruce bark beetle expanding?	The first sentence clearly implicates warming temperatures as a driver for all of these. All these responses have, either in the cited literature or previous NCAs, been attributed to temperature and/or drought. Nevertheless, we added causal relationships for each one in the text, sentence by sentence.
George	Kling	Text Region	29. Alaska		27	28	36	9	There is no mention here of berry growth and changings in timing or location, and what that means for subsistence food sources.	We added a sentence, "Decreases in berry production have been noted by communities in Alaska, and the changes related to multiple climatic drivers (e.g., Herman-Mercer et al. 2021)." and the included citation.
Carl	Markon	Text Region	29. Alaska		28	28	10	23	I guess I have a real problem with this paragraph, and I do not have the information at my finger tips to try and change it; and in part, because I do not see a lot of continuity within it. What will cause the boreal forest transition (first two words), wildfires? If so, it is not apparent, at least not to me; and what about heat and drought stress to the trees? Wildfire is important, and can be related to a warming climate, but it is not stated as such, and what about 'zombie' fires, which are different from forest fires, but can also occur in the subarctic, although I am not sure over-wintering fires have occurred in Alaska; permafrost thaw, thermokarst, and lake drainage have more to do with warming soils/permafrost than just wildfires, or did I read it wrong. Finally, how does carbon emissions and sequestration (carbon captured) fit into the fire component, as most of the paragraph is about; it fits into the permafrost component of the paragraph, but isn't really explained as to why, and what about methane emissions from lakes and ponds; if you are going to mention carbon, I strongly recommend you have a separate paragraph just on that. I believe there are publications out as to Alaska's carbon footprint, with USGS Professional Paper 1826 as a starting point.	The reviewer's chief complaint appears to be continuity, and possibly a lack of direct mechanisms. We have added a unifying topical sentence to clarify, described more specifically the causal climatic drivers, and clarified where possible to ease the reviewer's concerns. We disagree that carbon requires its own paragraph and have declined to cite the suggested paper - this is an overarching issue that belongs elsewhere in the NCA. Instead, we note that these impacts, especially if they continue, have implications for planetary scale impacts via emissions.
Melissa	Shapiro	Text Region	29. Alaska		28		11	23	This is critically important content that is improperly buried within a discussion on fishing. The chapter authors have aptly recognized the complex and concerning interaction between wildfires, permafrost thaw, and the resulting contribution to global greenhouse gas emissions. However, the importance of this issue is not sufficiently conveyed as written. We strongly urge the authors to elevate this discussion by dedicating a separate section in this chapter to permafrost (with a subsection in wildfires), which underlies roughly 38% of the land in Alaska and is associated with a myriad of environmental impacts,Âîas has been documented by a plethora of peer-reviewed and recently published studies.	Thank you for the suggestion. There is no perfect way to organize a chapter such as this. We have added a transition before the terrestrial impacts section so that it is clear that "Our Natural Environment" is broken into marine/terrestrial sections. The Alaska chapter in previous NCAs had sections on permafrost, sea ice, etc. We have chosen a different way of organizing the material, emphasizing societal effects (per instructions for NCA5) while trying to include important ideas such as permafrost. We have reorganized the cryosphere section in the introduction to put permafrost on equal footing with sea ice and snow as agents of change in Alaska. However, prior NCAs (3 and 4) dealt with permafrost, and the new "plethora" of information contains far more detailed research and not very much in the way of accessible, regional summaries that put that research in context. To split the difference, we added some of the new research that changes what we previously thought about permafrost (in addition to the specific impacts in this section on drivers of landscape change). The introductory text on permafrost now reads, "Permafrost degradation and thaw described in previous NCAs (e.g., Markon et al. 2018) continues and may be accelerating due to recent warm winters and increased snow cover (e.g., Douglas et al. 2021). Previously reported future projections of permafrost degradation based solely on ground temperature modeling may underestimate permafrost thaw rates due to the prevalence of sub-surface thaw lakes, lateral thaw and other hydrology-permafrost interactions (Farquharson et al. 2022)."
George	Kling	Text Region	29. Alaska		28	28	16	17	Where it mentions lake drainage, there should be an extra clause such as ?reducing habitat for overwintering birds? or something similar. In addition, it could be mentioned that animal migration and range extensions, such as for beavers, exasperates degrading permafrost and lake drainage in the Arctic.	Most of the lakes in Alaska in the continuous and discontinuous permafrost region, whether permafrost controlled or not, are not overwintering habitat for birds because such lakes freeze over for months. There may be some effects, but we found no comprehensive studies of effects on either migratory or resident birds. Moreover, the available literature on beaver influence on permafrost (Tape et al. 2020, Jones et al. 2022), while compelling, is for a very small fraction of the Alaskan arctic - specifically the Baldwin Peninsula near Kotzebue. The reviewer's comment is interesting, but the science has yet to determine that this is anything like a regional-scale event that rises to the level of synthesis and assessment mention. We therefore decline to address these specifically. However, there is an existing review of ecosystem relationships, among other things, that are outcomes of thes changes. We now cite this in an additional sentence: "These changes are projected to affect Arctic ecosystems and hydrology in important ways (Jones et al. 2022), altering habitat and function in the region."
George	Kling	Text Region	29. Alaska		28	28	25	25	It seems odd that a specific person is called-out here, but nowhere else in the text. There must be many other personal stories or people associated with ?ideas? such as ?warmer is better? for salmon. And, was this idea first stated by the person specifically (or by the research they published), or is their name just added because they work on salmon migration? It seems inconsistent in tone and approach for the chapter and the rest of the report.	We disagree. The boxes are intended to be personal, and others include descriptions of or quotes from individuals, as this one does. Dr. von Biela's experience as a researcher includes more than her publications, which we draw attention to here. We have added additional mentions of her role in salmon research so that the opening sentence is not left hanging.
George	Kling	Text Region	29. Alaska		28	28	25	38	Box 29.5, p. 28, lines 25-38. It is unclear why this box on salmon research is separated from the discussion of fisheries on page 20 and from Box 29.3 ?What it means to lose salmon?. At a minimum these sections of text on the same topic should be co-referenced, and it would be better to have them co-located.	Thank you for this suggestion. The final location of the boxes has not been determined. In the manuscript, we included them all at the end of each KM to avoid interrupting the flow of the main text.
Melissa	Shapiro	Text Region	29. Alaska		28		35		The text should be amended to delete the phrase ‚ÄúSalmon have always reshuffled on landscapes,Äù and instead read ‚ÄúSalmon have always adapted to their environments.‚Äù	We have re-written this sentence.
Holly	Prendeville	Figure	29. Alaska		29	29	9	18	Is 1982-2010 "Winter mean sea ice"? If similar to the 2004-2020 should the wording be the same? Should the second one time period stop at 2004 and the other start there? It's not clear why there is an overlap between these lines in the dates they represent. Also as 2022, is completed will 2022 data such as Anchorage's wettest year be added to the map? Or the massive wildfires in SW be added? It would be helpful if text boxes didn't overlap map to improve readability. Maybe something like the NOAA map: https://www.ncei.noaa.gov/access/billions/	The winter sea ice lines are based on studies for the time periods specified. We did not have the resources to do our own analysis, so we are left with the overlapping time periods. We are working on the figure to improve readability and appreciate the suggestions on that score.
Carl	Markon	Text Region	29. Alaska		29	29	18	20	This sentence is out of place and should be moved to the local level discussion below.	The paragraph is about security at all levels, introducing the concept for the whole Key Message.
George	Kling	Text Region	29. Alaska		29	29	20	22	It is not clear what is being said here.	We have provided an example of a national policy response.
Holly	Prendeville	Figure	29. Alaska		30	30	1	9	Hard to read text within each panel. Unclear why sections are not making a circle, rather jittered in left panel.	Suggested change in figure; pending
George	Kling	Text Region	29. Alaska		30	30	10	10	Omit the phrase ?Regarding national security?.	The previous paragraph is about security at all levels, so a transition to national security is necessary here.
George	Kling	Text Region	29. Alaska		30	30	12	12	How exactly does this have the ?potential to affect operations??	We have changed "thus have the potential to" to "can" and added "in a variety of ways" at the end of the sentence. Readers who would like more detail can look at the DOD report that is cited, but we do not have room to provide those details here.
Carl	Markon	Text Region	29. Alaska		30	30	13	15	This is a response and could be deleted. A better option would be a direct example of climate change damages.	We would like to highlight specific adaptation strategies to climate-mediated issues throughout the chapter so will opt to leave this in.
Melissa	Shapiro	Text Region	29. Alaska		30		16	21	The chapter authors should also acknowledge that due to less (predictable) ice formation in riverine systems, traveling those routes has become unpredictable and dangerous for local communities that otherwise use these routes for trapping, collecting firewood, and accessing clean drinking water.	Thank you for the suggestion. We have added a sentence at the end to make this point.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Carl	Markon	Text Region	29. Alaska		30	31	22	10	Much of this is unnessary. Recommend change: Rising concern about climate change and increased competition in the Arctic are reflected in recent Arctic-specific military strategy documents (DOD Defense 2019) and the U.S. Coast Guard Arctic strategies (DHS 2019)). Increasing maritime traffic (CMTS 2019) intersects with the broader geopolitical context of operations in and near the US exclusive economic zone; concerns about expanded illegal, unreported, and unregulated fishing in the Bering Sea; and increased concerns about marine debris (NOAA 2021).	This section has been revised and streamlined to clarify and make language more concise per comments.
Tom	Ellison	Text Region	29. Alaska		30	31	22	7	This is a much more specific discussion of Arctic competition with Russia than in the national security section; suggest incorporating this dynamic more explicitly there and synthesizing the two sections.	This section has been revised and clarified per comments.
George	Kling	Figure	29. Alaska		30				Figure 29.13, p. 30. The caption on figure 29.13 is extremely hard to decipher.	We have tried to improve the clarity of the caption.
Carl	Markon	Text Region	29. Alaska		31	31	13	13	What type of security challenges?	Added "such" to connect to the concerns mentioned earlier in the sentence.
Carl	Markon	Text Region	29. Alaska		31	31	14	14	Perhaps use infrastructure instead of road construction	We have made the suggested change and added a reference to KM 29.4 (Our Built Environment).
Carl	Markon	Text Region	29. Alaska		31	31	16	24	This is sort of an odd paragraph. The introductory sentence mentions food, environmental security, and marine safety. Do cultural practices include food and environmental security, and if so, how? Is fisheries management and climate change research in this case directly related to each other, and if so, how?	Paragraph has been revised per comments on organization and flow.
Carl	Markon	Text Region	29. Alaska		31	31	20	24	Suggested change to tighten up paragraph (may have to check references): Changing sea ice conditions are also increasing the physical risks for hunters pursuing marine mammals by intensification of human offshore activity in the local area, such as increased commercial shipping, that may generate additional risks such collision with hunters, disturbance of prey, or spills (Bennett et al. 2020).	Thank you for the suggestion, but the wording implies that the risks are solely due to intensification of human use, rather than also to changes in the ice itself.
Carl	Markon	Text Region	29. Alaska		31	31	25	26	Shouldn't this sentence be at the front of the section ni the KM?	We think it also works here as a wrap-up to the section and have edited slightly to remove likelihood language.
Melissa	Shapiro	Text Region	29. Alaska		31		31		The text should reference not just ‚Áúleadership‚Äù but also ‚Äúsovereignty.‚Äù	Good point. We have added sovereignty.
George	Kling	Text Region	29. Alaska		32	32	10	17	Key Message 29.7, Our Future, p. 32, lines 10-17. This is another instance where the ?confidence? assignments are confusing. For example, in the first sentence is the ?high confidence? associated with a changing climate, or with local and regional efforts underway to prepare an adaptation (it could be read as either one). And why is the final statement, the effectiveness of adaptation planning and activities, only medium confidence?	The first sentence is about preparation and adaptation, so we're not sure how the confidence statement could be read to apply only to the final two words. The confidence statements are intended to apply to the whole sentences. The final statement concerns addressing intersecting stressors, for the effectiveness of which there is less evidence. Confidence statements reflect the strength of the underlying evidence, not our expectations.
George	Kling	Text Region	29. Alaska		32	32	11	13	It is clear from estimates included in this report (Section 29.4) and others, that the investment of financial resources for resiliency, mitigation, and adaption are substantial. Using the generic term ?additional resources? doesn?t emphasize that key message as strongly as it should. One way to highlight this emphasis would be to reword the sentence something along the lines of: ?The breadth of adaptation needed to meet the magnitude of climate impacts experienced around the state will require a significant investment of financial resources, as well as close coordination across state, federal and local agencies, as well as tribal governments and Alaska Native interests.?	Good point. We have added "substantial investment of" before "additional resources" and "including Tribal governments" at the end.
George	Kling	Text Region	29. Alaska		33	33	13	14	This statement that many of Alaska?s 229 federally recognized Tribes have completed or are currently engaged in climate adaptation efforts needs to be verified. As far as I know, most Alaskan tribes have not engaged in coordinated adaption efforts. It implies a level of sophisticated engagement and coordinated action with regard to climate impact issues that isn?t clearly apparent with many of the most impacted tribes.	We say "many," not "most." We stand by the statement and the citations in the sentences that follow.
George	Kling	Text Region	29. Alaska		33	33	18	20	The historical adaptive ability of Alaska?s Indigenous People should in no way be used to minimize the transformative impact of the ecological and environmental changes that are now being experienced. Yes it is appropriate to highlight Traditional Knowledge and its role today, but this paragraph edges too close to a message of ?it?s OK, they will adapt as they?ve done in the past?, and this is unlikely the message that the authors are trying to convey.	Excellent point. We have added a sentence at the end of the paragraph to make this point clear.
George	Kling	Text Region	29. Alaska		33	34	21	2	In this section, especially after lines 23-25, it would be great to add that we should all learn from the people who have been here for millennia, and we should help in their efforts because it would benefit all involved. This is also a prime spot to elevate the need for focus on co-production efforts in response to the challenges of climate change.	Good points. We have added both ideas (one in each paragraph).
Melissa	Shapiro	Text Region	29. Alaska		33		27	39	The chapter authors importantly raise the challenges that Alaskan communities face when trying to navigate a complex and confusing governance landscape. When noting the advantages of collaboration between communities and governing entities, it would be helpful to clarify the distinct nature of coordination that exists between communities, tribal governments, tribal corporations, and local non-tribal governments. In addition, the suggestion that ‚ÄúComplex governance and resource management systems,‚Äùcreate challenges to adaptation,‚Äù should be further elaborated and qualified to refer to ‚Äútimely, equitable, and community-led adaptation.‚Äù	Good point. We have added the qualifier as suggested.
Emily	Johnson	Text Region	29. Alaska		33	33	28		Figure 29.15 is referenced for text that actually refers to Figure 29.16.	There is some problem with the way Microsoft Teams is auto-filling the numbers (sections, boxes, figures, etc.). This will be fixed in final production.
Carl	Markon	Text Region	29. Alaska		33	33	31	35	Suggested less political rewrite: Complex governance, resource management systems, ongoing impacts of tribal colonization, barriers to social networks, and the lack of Indigenous knowledge, all create challenges to adaption at the community level.	We think it appropriate to avoid euphemisms and indirect statements.
Carl	Markon	Text Region	29. Alaska		33	33	39	39	recommended' - I have seen recommendations in this report. Please make sure that is one of the goals of the report. If not, a possible rewrite: ...tribal entities may help build resilience....	Good point. We have changed "recommended" to "necessary," as we are indeed not supposed to make recommendations.
Melissa	Shapiro	Figure	29. Alaska		34		3	4	Figure 29.15. This is a critical figure and its inclusion is welcomed. For additional context, a spatial scale and location names would be useful.	We will see if a spatial scale can be added. Location names would become cluttered and illegible if all were included, and including only some would be unfair to those who were not named. We have also asked for certain geologic features (rivers) to be added.
Emily	Johnson	Figure	29. Alaska		34				There are no instances in the text where this figure is directly referenced. The figure is not very informative as the difference between either or a combination of the factors listed seems arbitrary. The figure could be simplified to a single symbol indicating Communities Highly Threatened by Flooding, Erosion, or Thawing Permafrost, or could perhaps be deleted as it is not referenced in the text.	We have added a reference to the figure in the text and a sentence in the caption explaining why facing more than one challenge is worth noting.
Melissa	Shapiro	Figure	29. Alaska		35		2		Figure 29.16. Recognizing that the chapter authors have sourced this figure from the University of Fairbanks, with agencies selected from GAO, there are nevertheless opportunities to improve upon the content, as follows: The figure title refers only to ‚Áúlocal‚Äù and ‚Äúregional‚Äù priorities, but the inclusion of federal agencies and a federal initiative suggests that there are also national priorities reflected in this visual. Other federal agencies/executive branch entities relevant to mention include NSF, DOD, DOI, US EPA, IARPC, and AESC. The named ‚Äúlustice40 initiative‚Äù is only one of many federal initiatives that have been strengthened or launched during the Biden Administration that address climate equity, justice and adaptation; Indigenous Knowledge; disaster response and recovery; and Tribal rights and other efforts (including those announced at the 2022 White House Tribal Nations Summit),Âîall of which are intended to be cross-cutting and holistic, but which may nevertheless exist in siloes.	We acknowledge that other agencies and entities have been involved in climate adaptation in Alaska. For the sake of traceable accounts we chose to limit those entities listed in the figure to the ones also in the GAO 2022 report. Some of the federal initiatives mentioned by the reviewer have come on board since the cut-off date for inclusion in this NCA 5.
George	Kling	Text Region	29. Alaska		35	35	11	14	If this refers to the FEMA BRIC funding then it should be stated as such, and if not then the BRIC funding should be mentioned.	This sentence refers to the FEMA Risk MAP program, which is different from the Building Resilient Infrastructure and Communities (BRIC) Program. The Risk MAP program is provided as an example of collaboration. A discussion of all relevant federal programs (including BRIC) is beyond the scope of this section
Carl	Markon	Text Region	29. Alaska		35	35	19	19	What level of leadership? Local, State, Federal? All?	We have added "local" to this sentence to clarify which level of leadership we are referring to.
George	Kling	Figure	29. Alaska		35				This figure is showing institutions at different levels of government, but that doesn?t mean they are automatically ?siloed?. This figure could be much more effective if it focused on particular issues or an example of an issue, and then within the issue the figure showed how many disconnected institutions one must deal with to make progress. In addition, this figure is missing a key player in the Alaska Native Tribal Health Consortium (ANTHC).	We have changed the figure title to reflect the fact that institutions are not always siloed, and revised the figure caption to include a discussion of the complexity of accessing state and federal support for adaptation efforts that meet local priorities. We have requested to change "Tribal governments" to "Tribal entities" to include ANTHC, regional Tribal nonprofits, and other Tribal organizations.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
George	Kling	Figure	29. Alaska		35				This figure would be made better if it also mentioned bringing together not only different levels of government but all Native organizations such as ANTHC, academic institutions and researchers, etc.	We have requested to change "Tribal governments" to "Tribal entities" to include ANTHC, regional Tribal nonprofits, and other Tribal organizations. This institutions listed in this figure come from GAO 2022, which focuses on agencies and other institutions that provide funding and technical assistance. GAO 2022 does not include agencies or agency components that have scientific research as a primary purpose.
George	Kling	Text Region	29. Alaska		36	36	7	15	This paragraph suggests that there are policy goals being developed relative to climate that don?t employ sound ?regulatory and ecosystem-based approaches?. But there is nothing in the text to support those conclusions. Please provide referenced support for those conclusions.	We have revised the text to clarify.
Carl	Markon	Text Region	29. Alaska		36	36	27	27	This section seems to center on Native communities and their ability to cope with climate change. I don't have a problem with that as they are the ones most impacted, but I wonder if there are other actions being performed in the more populus parts of the State that might warrent mentioning, if available. There are bits and pieces throughout the document about minorities, recreation, tourism, industry (big and small), and DOD, which is fine, but they seem to be wholly left out of here. Maybe the information, or actions, just aren't there.	Section 29.7 ("Our Future") and the Alaska chapter describe climate impacts and adaptation efforts at various levels and locations around the state.
Melissa	Shapiro	Text Region	29. Alaska		36		27		The sentence should be amended to read ‚ÃúThe need to center adaptation actions around and support Indigenous and local values, knowledge and priorities‚Ä¶Ù	Thank you for the suggestion, which we have added.
Ariela	Zycherman	Text Region	29. Alaska		36	36	27	34	Page 36 Line 27-34 It is worthwhile citing new White House Guidance to Federal Agencies recognizing the important and use of Indigenous Knowledge. Press release available here: https://www.whitehouse.gov/ceq/news-updates/2022/12/01/white-house-releases-first-of-a-kind-indigenous-knowledge-guidance-for-federal-agencies/	We have added a sentence and the reference.
Melissa	Shapiro	Text Region	29. Alaska		36		30	34	The chapter authors could feature an example to illustrate the diverse and community-led partnerships in the climate and adaptation monitoring space, as follows: The Alaska Institute for Justice and Alaska Native Science Commission are currently engaged in an effort with Woodwell Climate Research Center and the Arctic Initiative at Harvard Kennedy School called ‚ÃúPermafrost Pathways‚Äù which is intended to foster collaboration between expert scientists, local communities (including ten Alaska Native Tribes), and policymakers at the state, national, and international levels on strategies to monitor, predict, mitigate, and adapt to permafrost thaw in Alaska (and across the Arctic) (please see https://permafrost.woodwellclimate.org/about/).	We applaud the Permafrost Pathways effort, but prefer to include examples that have results to show already. This will be very timely for NCA6!
George	Kling	Text Region	29. Alaska		37	37	2	14	The quote talks about the need to learn how to spell food sovereignty. That?s already a bit strange, but then the language underneath, starting on line 5 says ?to meet this need??. The focus likely is not intended to be the need to learn how to spell a word, but that is currently how it reads. Perhaps change language to ?to meet the need of addressing food sovereignty? or something similar. In fact, it would be even more helpful for readers if the authors could distinguish between food security and food sovereignty.	Thank you. We have reworded the sentence as suggested and added a brief description of food sovereignty.
George	Kling	Text Region	29. Alaska		40	40	29	30	This statement that research linking climate drivers and biological effects is unavailable (unknown) is a surprise, because there are dozens of papers that already document these relationships (see the review paper by Wiese and Nelson, 2022, https://www.mdpi.com/2077-1312/10/3/338).	We have reworded this paragraph to reflect this comment.
Melissa	Shapiro	Text Region	29. Alaska		41		14		As previously commented, there are gaps in current assessments of costs associated with infrastructure collapse and degradation due to permafrost thaw (which can also compound the studied risks of coastal and riverbank erosion).	We have added a sentence on this point.
George	Kling	Text Region	29. Alaska		41	41	26	28	This is another surprising statement of the lack of knowledge about how infrastructure can withstand climate change. Architecture and engineering design firms have been advising business and governments on this for many years, and there is a great amount of knowledge about what works and what does not work. Perhaps this statement is made from an academic standpoint, and if so it would be important to include other expertise before statements like this are made.	Good point. As with the Key Message, we have amended this to specify that the uncertainty is in what is required to implement the ideas and designs you mention.
George	Kling	Text Region	29. Alaska		42	42	24	27	Yes there are gaps in data availability for downscaling, but several of the issues in this section on research gaps could be addressed by better coordination and working together of scientists, community members and knowledge holders, and private businesses especially engineering consulting firms that are already implementing practical solutions. A real gap here is the fact that there are few incentives to bring these knowledge holders together rather than simply punting this yet again to ?more research is needed?.	Good point. We have added this idea to the traceable account for the previous key message (Our Built Environment), as that seems a better place for the reference to engineering firms.
Melissa	Shapiro	Text Region	29. Alaska		42		24	27	There is also a need to allocate resources to coordinate and improve the accessibility of existing data due to bottlenecks. A process for ensuring coordination, the assurance and control of quality, and accessibility of data would also allow for strategic assessment of data needs and enable more targeted data collection.	Good point. We have added this idea.
Melissa	Shapiro	Text Region	29. Alaska		42		27		The sentiment alluded to in the final sentence of this paragraph warrants far more nuance and explanation. It matters ‚Äúwho‚Äù is documenting the Indigenous knowledge, ‚Äúhow‚Äù and ‚Äúwhere‚Äù this knowledge is documented and for what purpose, and what this means within the broader objectives of co-production, climate justice, and recognition of Indigenous rights. The chapter authors should address these considerations.	Good point. We have added these ideas.
George	Kling	Text Region	29. Alaska		43	43	1	3	Similar to lines 24-27 on p. 42, the confidence assignments are somewhat arbitrary and based on only one criterion, that of scientific literature. For example, here the confidence is high that if we implemented management strategies they would work, but the confidence that people will do the right thing and push for such solutions is likely lower.	Following revision to the Key Message statement (changing "medium confidence" to "high confidence"), we have revised the wording here.
George	Kling	Text Region	29. Alaska		44	44	4	11	In terms of the uncertainties and research gaps it is good to use more of the white and gray literature as well as lived experience (e.g., Traditional Knowledge). However, it is somewhat shallow to simply say that academic research is driving the solution, or in this case holding it back. In many parts of the world joint projects are designing and implementing solutions with plenty of evidence of what works and what does not.	Good point. We have added a sentence stating the need to assess what is and is not working in practice.
Carl	Markon	Whole Chapter	29. Alaska						There are a number of sections that appear to be more about COVID-19 and not climate change. I understand that COVID-19 brought up some issues that may have exacerbated the response to climate change, but COVID-19 in and of itself, is not the subject matter for this report and I would recommend that its mention be kept at a minimum.	Thank you for this comment. It's not simply that COVID exacerbated the effects of climate change, but that COVID showed some of the deficits in the system that will also affect our response to climate change. We have tried to explain this connect a bit better to make it clear that we are not writing about COVID just for the sake of writing about COVID.
Carl	Markon	Whole Chapter	29. Alaska						Please check the use of 'state' vrs 'State'	Thank you. We checked and have removed a mention of "state of Alaska" that was not specifically about the State of Alaska (i.e., state government). Otherwise, we use lower case except when referring to the government entity the State of Alaska.
Glenn	Branch	Whole Chapter	29. Alaska						A discussion of climate change education and outreach efforts in this region is needed. (Note that the chapter on the Southern Great Plains includes a brief discussion of climate change education on ch. 26, pp. 31-32.) Education and outreach efforts are foundational to topics discussed in this chapter, including: * livelihoods and economies, since a goal of education is to prepare the workers and consumers of the future, which will be transformed by the effects of climate change; * human health and well-being, since educators play a role in ensuring the intellectual, psychological, and social health of their students in the face of climate change; and * planning and adaptation, which require policymakers and voters to grasp the scientific and social issues involved in meeting the challenges posed by climate change. While it would be best for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change, it would help for this chapter to discuss the situation specifically in its region.	To address this and similar comments, we have added a paragraph and references to discuss climate change education efforts in Alaska, written by a prominent expert on the topic.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Sean	Fleming	Whole Chapter	29. Alaska						The Alaska chapter looks good overall, but an important element that seems to be missing from chapter 29 is how rivers, through their freshwater and biogeochemical fluxes, link the ecological effects of climate change across the landscape, from icefields to forests to the ocean environment. This may be especially crucial in southeastern Alaska but it's also strongly relevant to the Yukon basin, for example, and elsewhere. For two recent syntheses in this region, see (1) O,ÄôNeel et al., 2015, Icefield-to-ocean linkages across the Northern Pacific coastal temperate rainforest ecosystem, BioScience, 65, 499-512 and (2) Bidlack et al., 2021, Climate-mediated changes to linked terrestrial and marine ecosystems across the Northeast Pacific coastal temperate rainforest margin, BioScience, 71, 581-595.	Both suggested papers are conceptual reviews of properties of coupled terrestrial-coastal systems in SE Alaska that present research in the context of knowledge frameworks developed at workshops. They demonstrate very little that is citeable about observed or projected climate impacts on the region other than the fact stated by the reviewer, that rivers link climate change impacts across terrestrial, glacial, and costal environments. While compelling and interesting, we decline to add and explain this conceptual framework in a chapter that is already quite long and detailed.
Charles	Keeling	Whole Chapter	29. Alaska						A discussion of climate change education should be included similar to the one in chapter 26, pp. 31-32.	To address this and similar comments, we have added a paragraph and references to discuss climate change education efforts in Alaska, written by a prominent expert on the topic.
George	Kling	Whole Chapter	29. Alaska						This chapter reflects the extensive knowledge of a particularly strong author team comprising scientists and Indigenous scholars. The authors followed the guidance of the National Climate Assessment leadership to make the assessment ?people-centered.? The result is a well-researched, well-written account that, for the most part, effectively blends hard data with human accounts of the personal and community impacts of climate change in Alaska. That integration puts the data in a compelling context for policy audiences. The chapter covers a broad range of people-centered topics recognizing diverse interests in the state and beyond. The authors also are to be commended for successfully following NCA leadership guidance (see p. 37).	Thank you for the kind words!
George	Kling	Whole Chapter	29. Alaska						A general comment is that many of the stories in this chapter succeed in humanizing the messages.	Thank you for the kind words!
George	Kling	Whole Chapter	29. Alaska						What is meant by ?Our? in the titles to the chapter sections? Who is ?our?, and at what level of organization is the term being used? For example, it could be that the authors live in Alaska, it could refer to the entire state, or it could refer to the entire nation, and each use might be appropriate. As it is, however, there is both a sense of confusion as to what the term means, and a vague sense of ownership that is likely not what the authors intended. The chapter on Hawaii and Pacific islands does not follow this format. It would be better to replace the word ?Our? with either ?The? (The Built Environment) or with "Alaskan" (Alaskan Health, Alaskan Communities), or simply remove ?Our? altogether.	While we appreciate the grammatical point raised in this comment, we believe the rhetorical power of "Our" outweighs any ambiguity. "Our" can indeed be interpreted in various ways, but we believe the context should make clear that we are referring to the people of Alaska. We also note that the Southern Great Plains chapter uses "We" in their key message headings, so we are not alone in doing so.
George	Kling	Whole Chapter	29. Alaska						This is the only report chapter that is defined by a single, specific state, instead of representing broader geographic regions. Because of this, it would be helpful to have a bit more of ?Alaska 101? in the Introduction to help place the rest of the chapter into context. The Introduction now is climate specific, which is consistent with the theme of the entire report, but it jumps around and needs more organization and structure (even topic and concluding sentences within paragraphs). For example, from a first paragraph about climate it moves to a topic sentence in the second paragraph about climate but then the rest of the paragraph characterizes other aspects of Alaska, and then it jumps back to two paragraphs about climate specifics although it is difficult to tell what separates those two paragraphs in content or intent. Then there is an ending paragraph on the effects of climate change on Alaskan society. The entire Introduction could be more clearly organized, potentially with some substructure of headings helping readers to understand what the paragraph or section is about. Finally, because much of the rest of the chapter is very ?people centric?, which we applaud, it would help for your final paragraph in the Introduction to provide a better outline of the structure and themes of the sections to come in the rest of the chapter.	Thank you for the comments on the organization of the Introduction. By NCA style, we do not include a precis of the rest of the chapter. We have added an explanation of the Introduction structure to the first paragraph in hopes of making the intent of this section clearer.
Holly	Prendeville	Whole Chapter	29. Alaska						Overall the authors did a nice job making an informative cohesive chapter that is accessible to the public.	Thank you for your kind words!
Brittany	Gutermuth	Whole Chapter	29. Alaska						Climate change education is explicitly discussed in ch. 26, pp. 31 (line 18-27)- 32 (line 1-2), it should be addressed here as well.	To address this and similar comments, we have added a paragraph and references to discuss climate change education efforts in Alaska, written by a prominent expert on the topic.
F Stuart	Chapin III	Whole Chapter	29. Alaska						The chapter is clearly written and addresses the main issues of climate change in the U.S. Arctic. To the best of my knowledge, the chapter reflects the best scientific knowledge currently available and conveys it in a way that can be understood by most audiences.	Thank you for your kind words!
F Stuart	Chapin III	Whole Chapter	29. Alaska						Page 29-6, Fig. 29.2, top: It is unclear whether tourism dollar amount is for Denali Park or Alaska. Page 29-8, line 2: Delete ‚Áúadditional;‚Äù it reads as though social tensions are considered a benefit of climate change. Page 29-17. Figure 29.6 needs more explanation. The picture doesn‚Äôt make obvious what the problem is. For example, point out that the red lines correspond to ice layers. Page 29-21, line 14: Many readers may not know what the ‚Áúwarm phase,‚Äù is. Page 29-23, line 1: Change ‚Áúheavier goods and fuel,‚Äù to ‚Áúfuel and other heavy goods.,‚Äù Page 29-26, line 9: Change ‚Áú29.1,‚Äù to 29.11,‚Äù	Thank you for these comments. We have specified that the dollar figure refers to Denali tourism. We have changed "additional" to "societal." We have added more details about the photo of the Fairbanks snowpack. We have re-written "warm phase" to avoid the jargon. We have changed the wording about fuel and heavy goods as suggested. The cross-reference to Figure 29.1 in the caption to Figure 29.11 is correct, so we did not change it.
Ariela	Zycherman	Whole Chapter	29. Alaska						The "key messages" are not really messages, instead they are themes. Suggest rephrasing them to be a real message. For example, ¬ëour health¬í could be: Improving health and well-being. Alternatively consider rephrasing to just be 'key themes'	The titles of the Key Message sections (Our Health, Our Communities, etc.) are not the Key Messages themselves. The Key Messages are the three-sentence statements that begin each section. Our use of titles for each section is consistent with the rest of the NCA and with past NCAs.
Jasmine	Koster	Whole Chapter	29. Alaska						Yaghali du? My name is Jasmine Koster, I prefer to go by Fern. I am a Kenaitze tribal citizen, CIRI shareholder and I speak as an individual not representing an organization. However I know my comments reflect on my people and I hope to improve conditions for all my relatives and fellow Alaska citizens present and future. Chiqinik, thank you. COMMENTS ON CHAPTER 29, Alaska Pg 10,Âîrabies (23) For the issue with rabies, free rabies clinics for pet/livestock owners could be furnished. This would help on a few facets: 1) improving people with disability,Âôs care for their ESA and service animals 2) alleviating the financial pressure on animal shelters that provide rabies vaccines 3) improving food security for Alaska stewards of livestock and culturally important animal breeds that are susceptible to rabies (including their herd dogs, sled dogs, mousing cats, rabbits as livestock, etc). Also, if wildlife caretakers of fox populations in Alaska were given funding to catch, vaccinate and release foxes from wild-urban interfaces, this would alleviate the problem twofold. It is irresponsible and inhumane to let wild or tame foxes suffer from climate-driven rabies increases while only providing for our own pets/livestock. Particularly, concerning Alaska Native cultural relationship with our relatives, fur bearing foxes, we should be supporting their flourishing. Maybe volunteers could be trained to help with vaccinating the foxes Pg 11; 19- erosion and flooding. Banks should be protected by planting willow, alder, and native sedges/grasses. Additionally, native medicines like nettles, pushki, and berry species should be protected and encouraged. Why not involve youth in schools and cultural groups? This would not only improve santitation outcomes but also provide salmon habitat as demonstrated by groups already planting trees along riverbanks. Also, it would provide better protection for cultural sites such as old villages, graves and current fishcamps. Pg 11; 28: ecological grief and risk of displacement; dislocation from refugeeship: Mental health clinics may face increased burden of care. Providing clinicians with free or even paid training on the specifics of ecological grief could help. Also, the potential for healing from said grief by participating in hands on restoration ecologically could help some patients if the option was accessible and provided free of cost	We are very grateful to you for reading the chapter carefully and offering great ideas for how to respond to some of the challenges we describe. Unfortunately, recommendations are outside the scope this report. Thank you for taking the time and effort to read the draft chapter so carefully and thoughtfully.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Thomas	Knutson	Traceable Account	30. Hawai'i & US-Affiliated Pacific Islands		6	6	4	7	Concerning tropical cyclone frequency near Hawaii, some climate modeling studies suggest that human influence on climate will increase cyclone occurrence in that region of the central North Pacific in particular, even with reduced cyclone frequency over the northwestern Pacific and globally (Knutson et al. 2015, their Fig. 8; Murakami et al. 2015). However, there is not yet a clear trend in past observed TC frequency near Hawaii (1949-2014) (Murakami et al, 2015 Fig. 23.1(b)). Thus while it is possible that tropical cyclone frequency near Hawaii will increase (in contrast to global and northwest Pacific trends) confidence in this projection is not high due to lack of an observed increasing trend to date. References: Murakami et al. (2015) INVESTIGATING THE INFLUENCE OF ANTHROPOGENIC FORCING AND NATURAL VARIABILITY ON THE 2014 HAWAIIAN HURRICANE SEASON [in: Explaining Extremes of 2014 from a Climate Perspective]. Bull. Amer. Meteor. Soc., 96 (12), S115-S119. https://journals.ametsoc.org/downloadpdf/journals/bams/96/12/bams-d-15-00119.1.pdf Knutson, T. R., J. J. Sirutis, M. Zhao, R. E. Tuleya, M. A. Bender, G. A. Vecchi, G. Villarini, and D. Chavas, 2015: Global Projections of Intense Tropical Cyclone Activity for the Late Twenty-First Century from Dynamical Downscaling of CMIP5/RCP4.5 Scenarios. Journal of Climate, 28(18), DOI:10.1175/JCLI-D-15-0129.1.	The comment is referring to Hawaii, but this sentence is addressing trends for the entire region, and the references we provided (and the suggested Knutson et al 2015 reference) show a general decrease across the entire chapter's region. Authors added text to clarify this statement refers to the entire Pacific Island region, not just Hawaii, and notes the geographical diversity.
Thomas	Knutson	Text Region	30. Hawai'i & US-Affiliated Pacific Islands		6		10		Could add here that: "Regional gridbox-based climate change detection and attribution studies indicate that human-caused warming since 1900 can be detected for theregion of the Pacific Ocean that includes Hawaii (Vose et al. 2017)and also for much of the northwest tropical Pacific region that includes the USAPIs (Knutson et al. 2013)." References: Vose, R.S., D.R. Easterling, K.E. Kunkel, A.N. LeGrande, and M.F. Wehner, 2017: Temperature changes in the United States. In: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 185-206, doi: 10.7930/J0N29V45. (See Fig. 6.6) Knutson, T. R., F. Zeng, and A. T. Wittenberg, 2013: Multimodel assessment of regional surface temperature trends: CMIP3 and CMIP5 twentieth-century simulations. Journal of Climate, 26, 8709-8743, doi:10.1175/JCLI-D-12-00567.1. (See Fig. 10 e,f)	Thank you for this comment. Authors feel that this is a valid point but too specific in the context of the rest of the paragraph. Thus we do not feel it is suitable information to add.
Frederick	Reppun	Text Region	30. Hawai'i & US-Affiliated Pacific Islands		14	14	5	7	There may be a more specific source that Winter et al. 2020 cites with regard to the ability of Hawaiian lo'i agroecosystems absorbing flood pulses. See, for example: Bremer, Leah, Kim Falinski, Casey Ching, Christopher Wada, Kimberly Burnett, Kanekoa Kukea-Shultz, Nicholas Reppun, et al. 2018. ‚ÁúBiocultural Restoration of Traditional Agriculture: Cultural, Environmental, and Economic Outcomes of Lo‚Äôi Kalo Restoration in He‚Äôeia, O‚Äôahu.‚Äù Sustainability 10 (12): 4502‚Äì4502. https://doi.org/10.3390/su10124502.	Thank you for the comment. The Bremer et al., 2020 citation was added to this line to incorporate the suggestion.
kottie	christie-blick	Text Region	30. Hawai'i & US-Affiliated Pacific Islands		18	18	10	13	In addition, increased education for all stakeholders is imperative, including the youth. Hawaii has adopted the Next Generation Science Standards, as have many other states in the US. These standards are designed to create scientifically literate Americans. As such, they help learners understand ways in which humans impact Earth's resources and environment. There is a great need for schools to fully adopt and implement these standards, and for educators to be trained to teach the core ideas, concepts, and practices to their learners at an age-appropriate level. Just as important as educating the youth, is the need to empower them to take climate action, creating opportunities for them to influence their communities to mitigate and adapt to climate change. Moving forward creates a sense of hope. https://ngss.nsta.org/about.aspx https://www.nextgenscience.org/search/node/Earth%20and%20Human%20Activity	We addressed this comment in chapter text below where we thought it was more topically appropriate, in 'Social Adaptive Capacity and Community Resilience' by referencing the national health chapter findings: "The ability of individuals, communities, and institutions to endure stress and adapt to change determines health impacts of climate change. Recent examples demonstrating the importance of social capital (such as community networks, equitable access to education [KM 15.3], sharing, and relationships) in disaster response include community initiatives..."
Emma	Conrad-Rooney	Figure	30. Hawai'i & US-Affiliated Pacific Islands		22				As a reader, it is challenging to see the different colors for ¥c¬Ä¬úpeople per mile" and ¥c¬Ä¬úmillions of dollars per mile" of coastline. It would help to have the outlines representing the coastline be thicker to make the different colors more visible.	Thank you for this comment. The figure is being modified to try to make the color bands wider and thus stand out more/be more visible.
Juanita	Constible	Text Region	30. Hawai'i & US-Affiliated Pacific Islands		24	24	16	19	It is not clear what the word MINORITY means in this sentence, or from the cited study. Does it mean non-white people, the racial and ethnic minorities within the context of each island (e.g., whites and Hispanics on Guam and American Samoa), or something else?	These results are based on US Census data (and we have clarified this in the text). In this case, the US Census Bureau defines "minorities" as being composed of several different race categories—Black, American Indian, Asian, Pacific Islander, Other, and Two or More races. Hispanics are also considered a minority, though Hispanic, or Latino, is defined by the US Census Bureau as an ethnicity rather than a race. We also added some text in the 2nd paragraph of the introduction to describe the diverse population in the region.
Thomas	Knutson	Traceable Account	30. Hawai'i & US-Affiliated Pacific Islands		36		29		Recommend to delete "frequency" here, or reduce confidence from high confidence for storm frequency and perhaps intensity. Concerning the general topic of TC frequency near Hawaii, below are two additional references. Murakami et al. (2015) show a time series of past tropical cyclone frequency changes near Hawaii in observations and model simulations. There is no obvious trend in past observed TC frequency (1949-2014) (their Fig. 23.1(b)), although their climate model runs suggest that historical anthropogenic forcing has increased the risk of TCs near Hawaii. Some other studies project increased future TC frequency near Hawaii (e.g., Knutson et al. 2015, their Fig. 8b). However, given the lack of a clear trend in historical observations I'm not sure you want to imply here that there is high confidence in increasing storm frequency (at least near Hawaii). See also p. 30-39, line 13-14 (Widlansky et al. 2019). References: Murakami et al. (2015) INVESTIGATING THE INFLUENCE OF ANTHROPOGENIC FORCING AND NATURAL VARIABILITY ON THE 2014 HAWAIIAN HURRICANE SEASON [in: Explaining Extremes of 2014 from a Climate Perspective]. Bull. Amer. Meteor. Soc., 96 (12), S115-S119. https://journals.ametsoc.org/downloadpdf/journals/bams/96/12/bams-d-15-00119.1.pdf Knutson, T. R., J. J. Sirutis, M. Zhao, R. E. Tuleya, M. A. Bender, G. A. Vecchi, G. Villarini, and D. Chavas, 2015: Global Projections of Intense Tropical Cyclone Activity for the Late Twenty-First Century from Dynamical Downscaling of CMIP5/RCP4.5 Scenarios. Journal of Climate, 28(18), DOI:10.1175/JCLI-D-15-0129.1.	We deleted "frequency", but also added text to note that the region is not just Hawaii but the entire US Pacific Island region.
Glenn	Branch	Whole Chapter	30. Hawai'i & US-Affiliated Pacific Islands						A discussion of climate change education and outreach efforts in this region is needed. (Note that the chapter on the Southern Great Plains includes a brief discussion of climate change education on ch. 26, pp. 31-32.) Education and outreach efforts are foundational to topics discussed in this chapter, including: * livelihoods and economies, since a goal of education is to prepare the workers and consumers of the future, which will be transformed by the effects of climate change; * human health and well-being, since educators play a role in ensuring the intellectual, psychological, and social health of their students in the face of climate change; and * planning and adaptation, which require policymakers and voters to grasp the scientific and social issues involved in meeting the challenges posed by climate change. While it would be best for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change, it would help for this chapter to discuss the situation specifically in its region.	We thank the reviewer for the comment. The chapter text has been revised to reference several education and outreach efforts in the region (see introduction and KM 30.2 (health) and 30.4 (ecosystems)). Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside the development of NCA5.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Charles	Keeling	Whole Chapter	30. Hawai'i & US-Affiliated Pacific Islands						A discussion of climate change education should be included similar to the one in chapter 26, pp. 31-32.	Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside the development of NCA5.
Brittany	Gutermuth	Whole Chapter	30. Hawai'i & US-Affiliated Pacific Islands						Climate change education is explicitly discussed in ch. 26, pp. 31 (line 18-27)- 32 (line 1-2), it should be addressed here as well.	Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside the development of NCA5.
Charles	Keeling	Text Region	31. Adaptation		3	8	1	30	One or more references to climate change education could be appropriately added to chapter 31, pp. 3-8: "Introduction".	Thank you for your comment. We have added "interdisciplinary climate change and adaptation education at all age levels" to the Capacity Building section of Table 31.1 to address this comment.
Ariela	Zycherman	Text Region	31. Adaptation		3	3	7	7	"changing access to cultural and heritage resources" seems like it was tacked on as an afterthought to include changes to human spheres. More poignant, relatable, and urgent needs could be of focus including, changing access and availability to ancestral foods (see Alaska chapter).	Thank you for your comment. We added "and availability of cultural, heritage, and ancestral resources and foods" with a reference to the Alaska chapter to this sentence.
Reid	Sherman	Text Region	31. Adaptation		3	3	9	9	Citation needed for sentence "In some instances..."	Thank you for your comment. We have included a citation here.
Ariela	Zycherman	Text Region	31. Adaptation		3	3	13	13	Page 3 Line 13 ¬ñ "adaptation at all levels¬Ö" it is ambiguous what levels are referring to? Are you refering to governance levels ¬ñ local, national and international? Suggest including to be more clear.	Thank you for your comment. We have added "of governance" to this referring to all levels of organization and type.
Reid	Sherman	Text Region	31. Adaptation		3	3	17	35	I agree that small scale adaptation isn't going to work as the only approach, but I suggest we soften this language so that we don't underestimate the value of doing something over nothing. There is value in taking action, even if it is small. Separately, for lines 34-35, we should say "studies on the impact and effectiveness of specific practices are ongoing and increasing with time." or something like that.	Thank you for your comment. We have adjusted the first paragraph to be a bit more positive. We have added text to include your recommendation related to lines 34-35 to indicate that the effectiveness and impact of adaptation measures is still being studied.
Juanita	Constible	Text Region	31. Adaptation		3	3	32	32	Copy editing comment: It seems like a word is missing after GRADUAL in the parenthetical statement. Consider amending to GRADUAL CHANGES or similar.	Thank you for your comment. We have added "changes" next to "gradual" in the parenthetical statement to address this comment.
Reid	Sherman	Text Region	31. Adaptation		3	3	33	33	I've made this comment previously re: adaptation - infrastructure "hardening" is not adaptation. Building or retrofitting infrastructure to withstand climate change impacts is. There's a difference that needs to be communicated out in an intentional way.	Thank you for your comment. We have removed the term "hardening" and replaced it with your suggested text.
Ariela	Zycherman	Text Region	31. Adaptation		3	3	34	36	Page 3 34-36 ¬ñ The sentence alludes to different bodies that require adaptation, from the governance level ("new governance mechanisms¬í) to the individual level ("civic engagements"), yet it ends with "processes for valuing, developing, or sustaining a wider range of societal benefits", and it¬ís unclear who the agent in the sentence is (government?) and what level it is to occur.	Thank you for your comment. This last section of the sentence is not specific to any one governing body or entity hence why we did not specify who should own this or lead this. We believe keeping the sentence as is will allow for the reader to see that any entity can value, develop, or sustain a wider range of societal benefits.
Angelica	Greco	Whole Page	31. Adaptation		3				The introductory phrase for the sentence pasted below could be strengthened and clarified. What does in some instances mean? Perhaps no equivocation is needed here. In some instances, humanity may have passed the point where reactive and incremental measures such as energy efficiency, cooling centers, and elevating homes will sufficiently prepare communities for the scale of physical climate change underway.	Thank you for your comment. We have edited this section to clarify that "some areas of high climate vulnerability may have passed the point..."
Angelica	Greco	Whole Page	31. Adaptation		3				In paragraph 3, beginning at line 25, consider mentioning the pressing need to align financing with adaptation goals. In many contexts, transformation is impossible without the funding needed to implement it.	Thank you for your comment. We have added "and creative financing aligned with adaptation goals," to this 1st sentence to address this comment.
Melissa	Shapiro	Whole Page	31. Adaptation		3				The introductory text nicely frames the issues raised in this chapter, effectively defining adaptation as a multi-faceted systems concept that implicates matters of equity, governance, and physical and social drivers. The chapter authors also successfully draw a connection between mitigation and adaptation, which is often lacking in adaptation-focused reporting.	Thank you for your comment. We appreciate the feedback.
Elizabeth	Wilkening	Whole Page	31. Adaptation		3				Under Capacity Building - Lay out specifics about formal education and youth programs. Climate change education is a critical component of any plan for responding to climate change, since future generations will face, and thus need to be equipped with the requisite knowledge and know how to cope with, the challenges of climate change. Climate Change education should also be interdisciplinary and not just in science classes.	Thank you for your comment. We have added "interdisciplinary climate change and adaptation education at all age levels" to the Capacity Building section of Table 31.1 to address this comment.
Ariela	Zycherman	Whole Page	31. Adaptation		3				Page 3. It seems as though there is a need to define commonly used terms throughout the document, e.g. coping, adaptation, adaptive capacity, vulnerability, resilience. I see that many of the terminology are defined much later (page 13 lines 8-16), I suggest bringing that terminology up since many of the terms are used far before they are defined.	Thank you for your comment. We are hopeful that there will be a final master glossary of all terms that need to be defined for our adaptation chapter in the final draft of the NCA5 report. This will address this comment and will allow for the reader to understand the terms as they read through the document.
Reid	Sherman	Whole Page	31. Adaptation		3				After reading this Introduction, I am entirely dissuaded from performing climate adaptation. As in there is nothing in here that is positive information I can act on. There are a lot of comments made about what is not possible and what is not currently working. If I am the intended audience, we are not meeting our goal with the NCA.	Thank you for your comment. We have adjusted the introduction to provide a bit more hope around adaptation and what's happening in the US.
Stephen	Yaeger	Table	31. Adaptation		4		1		The following are comments on Table 31.1, found on page 31-4, which lists climate adaptation measures across a variety of different categories. This list is a helpful introduction to the section, although many items included in the list are not discussed in detail in the main body of the report. Greater explanation of why these measures were included and others were excluded would aid the usefulness of the report. For example, the ‚ÄúPractice and Behavior‚Äù section includes individual behavioral changes like changes to diet and how food waste is handled. However, it does not include other important changes to individual behavior, like changes in transportation habits. In the ‚ÄúPhysical Infrastructure,‚Äù section, solar infrastructure for electrification is mentioned as a measure that should be taken. Other important infrastructure solutions for creating a clean and resilient electricity grid, like wind power and energy storage, are not included, and this decision is not explained. Additionally, ‚ÄúPhysical Infrastructure,‚Äù and ‚ÄúGreen Infrastructure,‚Äù are included separately. Instead, these two approaches should be thought of in conjunction with one another. Physical/gray infrastructure and green infrastructure are often applied to address the same adaptation challenges. These approaches should be thought of together to determine which aspects of physical infrastructure could be improved or replaced with green infrastructure as a part of a holistic approach to infrastructure resilience.	Thank you for your comment. We have added "changes in transportation habits" to the "Practice and Behavior" section of the table. We may not be able to include specific examples in addition to this - pending word count. We have also combined the physical and green infrastructure examples so the reader understands that these are similar and should be thought of in conjunction with each other. We will cite examples throughout our chapter in this table to conect those.
Juanita	Constible	Table	31. Adaptation		4				The information in this table is important but the table is not very effective in its current format. Some of the items (e.g., institutional change) are so broad as to be meaningless and others are technical terms or jargon that would require definitions to be understandable. Consider paring down the table so that it provides a smaller number of clear, well-defined examples demonstrating that adaptation includes a wide variety of actions, including both tangible and intangible activities.	Thank you for your comment. Given the nature of this report being national, we wanted to include broad examples of adaptation measures so readers can understand what's possible. Since adaptation is very place-based and hazard-specific, well-defined examples in this summary table would not be as useful as they are how we currently have them embeded throughout the rest of the chapter.
Ariela	Zycherman	Table	31. Adaptation		4				Table 31.1 How is this table organized? If it is ranked in some way then say so, otherwise put it in alphabetical order. It makes it seem as though Capacity Building is the most important (or ubiquitous), while Early Warning or Observing Systems are the least important (or ubiquitous).	Thank you for your coment. We have reorganized this table alphabetically so no one category is conisdered more important than another.
Ariela	Zycherman	Table	31. Adaptation		4				Table 31.1 Are there resources or tools for each of these that could be provided as a final column? If I were a city planner or someone looking for resources I would be overwhelmed by the lengthy list of options without much description.	Thank you for your comment. Given the nature of this report being national, we wanted to include broad examples of adaptation measures so readers can understand what's possible. That said, specific resources or tools for each of these are not currently available to link to at this time.
Stephen	Yaeger	Figure	31. Adaptation		5		1		On page, 31-5, figure 31.1 shows the ‚ÄúProgression of Adaptation Activity Across the US.‚Äù This map uses colors and a pattern to show the approximate number of adaptation activities which have been implemented in each state, as well as which states have state-level adaptation plans. This metric is a relatively vague way to quantify progress on climate change adaptation. Some activities may be much more significant than others but are counted equally. In addition, some states may be much more at-risk than others. 50 adaptation activities in one state may cover a much higher percentage of climate risk than 50 adaptation activities in another state. Overall, this figure lacks nuance. This is further reinforced in page 31-6 where, referencing this figure, the report refers to ‚Äúmany jurisdictions and organizations,‚Äù which are vaguely defined. This does not do much to help understand the extent of existing climate adaptation planning.	Thank you for your comment. Given the scale of this report is at the national level, we tried our best to capture at a high-level the progress made across each state on adaptation. We realize that adaptation happens at the local scale and is climate hazard-specific. However, given our page and word count limits, we included this figure as a high-level graphic to illustrate progress made across the US and provided more localized examples throughout the chapter.
Melissa	Shapiro	Table	31. Adaptation		5		1		Table 31.1. In the description of ‚Äúfinancing,‚Äù actions, chapter authors should consider adding ‚Äúphilanthropy‚Äù and ‚Äúgrants.‚Äù	Thank you for your comment. We have included "grants" to this list but did not specify the origin of the grant given there are grants from public and private sector entities.
Brittany	Gutermuth	Text Region	31. Adaptation		5	5	1	8	Add ‚Äúlack of formal climate change education standards,‚Äù	Thank you for your comment. We have added "There is a lack of formal climate adaptation education standards," to the barriers to awareness as this is true.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Angelica	Greco	Figure	31. Adaptation		5		2		What exactly is being measured in Figure 31.1? Consider explaining what counts as "adaptation activity" as this is not obvious without context. Is "progress" of adaptation activity the same as "number" of adaptation activities that are supposedly taking place?	Thank you for your comment. We have included a bit more context in the figure caption and liniked it to the actions summarized in Table 31.1.
Reid	Sherman	Text Region	31. Adaptation		5	5	33	39	I think this is a wide sweeping statement on flood control - if the measures that have been taken are primarily hard infrastructure with designs and/or construction that doesnt account for climate data, why would we expect them to be effective? I recommend striking this or replacing it with a statistic that is in keeping with the topic sentence.	Thank you for the comment. We have updated this section and no longer reference the effectiveness of such measures.
Benita Lily	Cheng	Whole Page	31. Adaptation		5				Propose adding in blue green infrastructure: this can include floodable parks, retention and detention ponds, blue roofs, and rain gardens for the purpose of managing urban flooding.	Thank you for your comment. We have added "and Blue" to the "Green Infrastructure" section of the table on page 5 and included a few of these examples. Based on space, we may or may not be able to include all of these examples.
Juanita	Constible	Figure	31. Adaptation		5				It is not clear what this figure includes (is it only state-level actions, only planning actions, etc.). Without clear definitions it risks being inaccurate. For example, by some definitions, the past couple of years have seen several adaptation projects in the Charleston, SC area (see, e.g. https://floodcoalition.org/2022/04/charleston-chief-resilience-officer-dale-morris-on-flooding), but the figure says the whole state has had fewer than 10 since 2018. Even with a clearer scope, tallying up adaptation actions doesn't seem particularly useful for this chapter. Many actions that further adaptation or increase adaptive capacity are not only or specifically adaptation actions. Instead, they are everyday actions across sectors (e.g., land use decisions, policy changes, real estate transactions, implementation of social programs) that take current and future climate change into account and aim to address the underlying sources of vulnerability. In fact, the chapter text describes this very issue on page 27, lines 1-7. It might be more useful to just illustrate which states (and perhaps municipalities, etc.) have adopted formal adaptation plans, as that is used as a metric in Box 31.1.	Thank you for your comment. We have included "and have been formally documented" in the caption so it's clear that the actions that we're counting are those that have been fomrally captured and documented through the IPCC reports or GCC website.
Ariela	Zycherman	Figure	31. Adaptation		5				Figure 31.1 What adaptation activities are captured in the map? Is it everything from Table 31.1 if so, then say that. Otherwise, it's really unclear how we are to interpret the map.	Thank you for your comment. We have included a bit more context in the figure caption and liniked it to the actions summarized in Table 31.1.
Reid	Sherman	Whole Page	31. Adaptation		5				What is missing from this discussion is any mention of cobenefits of adaptation actions or community priorities that go beyond climate action and EJ. There's a lot more benefits to be had, particularly that have nothing to do with climate change. We should be making the point that even if a state is performing a mandatory clean water act activity, there is added benefit for climate resilience.	We agree that co-benefits can be important for particular adaptation actions, and mention that adaptation can provide co-benefits in the introduction. However, this chapter prioritizes the importance of articulating the multiple objectives that are importance to consider as part of adaptation action choices, consistent with the NCA3 Decision Support chapter (Ch 26).
Reid	Sherman	Figure	31. Adaptation		5				Unsure how to use this figure - the actions in one location may not necessarily be equivalent to another. Elaboration on what we should take away, and how these data should inform our monitoring of activities is needed.	Thank you for your comment. We have included an introductory sentence to describe what the audience should take away from this table so the intent is clearer.
Nick	Procopio	Text Region	31. Adaptation		6	6	2	2	Why is there no recognition of the increase in publicly available tools and climate storytelling as evidence of progress? Is it because there is limited peer-reviewed research that points to this? Climate news and discussion of climate impacts in all sorts of settings (from home buying & selling apps to credit ratings to post-disaster news coverage) is much more pervasive a part of most people's everyday conversations than was the case in 2018 when NCA4 was published.	Thank you for your comment. We agree and have included this in our evidence of progress for the assessment stage of adaptation.
Craig	Hanna	Text Region	31. Adaptation		6	27	16	19	Chapter 31 cites that 88% of U.S. companies have assessed their climate-related financial risks in alignment with the Financial Stability Board's TCFD framework (Chapter 31, page 6 line 18), but that the available private-sector information related to adaptation efforts especially related to transition planning is limited (Chapter 31, page 27 lines 29-32). Data related to private-sector investments in adaptation is often available through financial statement or sustainability report disclosures that may be based on TCFD principles.	Thank you for your comment. We have added a few words to this suggestion in the section referenced. We agree that climate risks can be disclosed through financial statements and sustainability reports, but oftentimes are not unless the risks are considered material by the organization disclosing the risks. We see very little disclosure on adaptation actions and investments at the private sector given the intense focus still on climate mitigation and the transition to a low-carbon economy.
Melissa	Shapiro	Text Region	31. Adaptation		6		20	27	On ‚ÄúEvidence of Progress and Barriers of the U.S. Along the Five Adaptation Stages,,Äù the second stage of Adaptation,Äôs ‚Äúevidence of barriers,Äù could include a mention of the inherent time lag in the scientific peer review process (which often means that latest assessments are still undergoing review when decisions are made.) The challenges of scientific translation and communicating science into actionable policy might also be mentioned as an evident barrier, as well as the obstacles or lack of clear pathways for sharing datasets and tools between multiple jurisdictions.	Thank you for your comment. We agree and have added this to our evidence of progress under the Assessment stage.
Reid	Sherman	Text Region	31. Adaptation		6	6	21	21	Adaptive capacity should be defined at first use in this chapter.	Thank you for your comment. We have defined briefly adaptive capacity the first time it is mentioned in our chapter.
Juanita	Constible	Text Region	31. Adaptation		6	6	34	34	The way this is currently phrased, it's unclear how this is evidence of a barrier. If more states have adaptation plans now vs. at the time of NCA4, that seems like progress (albeit slow progress). It might be clearer to state how many states/jurisdictions do NOT have formal adaptation plans, how much of the country's population that represents, etc. to make it clear that this is an example of a lack of progress.	Thank you for your comment. We have added some content related to this comment into the barriers and evidence of progress section.
Ariela	Zycherman	Whole Page	31. Adaptation		6				Page 6 Box 31.1 Suggest re-writing the title to be more accessible. E.g. Progress for and barriers to adaptation in the US	Thank you for this comment. We have adjusted the title to reflect your suggestion, but feel it important to include that the progress and barriers included here are examples and align with the traditional five adapation stages that have been included in NCA3 and NCA4 to keep that connection.
Melissa	Shapiro	Text Region	31. Adaptation		7		1	15	On ‚ÄúEvidence of Progress and Barriers of the U.S. Along the Five Adaptation Stages,,Äù the lack of the following are also barriers to planning (‚Äústage 3‚Äù): standardized processes for decision-making; widely-accessible forum for local participation, particularly of Indigenous communities living in remote and vulnerable locations; streamlined and transparent processes for integrating local and traditional knowledge into adaptation planning.‚Äù	Thank you for your comment. We have added in a few of these suggestions to the planning stage per your recommendation.
Reid	Sherman	Text Region	31. Adaptation		7	7	9	14	This is an awesome statement! But it is buried at the very end of the Introduction. I recommend making this point earlier on when discussing how best to track effectiveness of actions.	Thank you for your comment. We have moved these two paragraphs up to the top of this section to reflect this comment.
Melissa	Shapiro	Text Region	31. Adaptation		7	8	27	11	On ‚ÄúEvidence of Progress and Barriers of the U.S. Along the Five Adaptation Stages,,Äù the authors have aptly identified critical barriers to implementation of adaptation action (‚Äústage 4‚Äù) to include the too-narrow focus on incremental adaptation responses that respond exclusively to ‚Äúacute, extreme weather events rather than the systematic, chronic changes in our environment,,Äù as perhaps best demonstrated in the context of permafrost thaw in the Arctic, which is causing ground collapse and flooding. Real time experiences of those living in this region also confirm the authors‚Äô conclusions that ‚Äú[e]xisting disaster frameworks, policies, and governance systems are inadequate,Ä¶Äù that there is a ‚Äúminimal degree of investment in and funding for adaptation,Ä¶Äù and that there is ‚Äúa lack of coordination across government agencies,Ä¶Äù These findings are essential and are welcomed in this chapter.	Thank you for your comment. We appreciate the positive feedback.
Stephen	Yaeger	Whole Page	31. Adaptation		7				On page 31-7, the report says that ‚ÄúThe continued reliance on fossil fuel economies that discourage transition and economic diversification limits the buy-in of collaborative planning with these high-emitting industries.,Äù It is correct that fossil fuel companies act as a barrier to the transition to a sustainable economy. However, the second half of this sentence presents a limited perspective. While it is true that fossil fuel companies are unlikely to collaborate on the most effective pathways to climate action (especially transformative climate action), this sentence makes it seem as if their lack of involvement is a barrier that needs to be overcome. Good-faith cooperation from the fossil fuel industry is unlikely and solutions should be sought that do not rely on its assistance.	Thank you for your comment. We have added a phrase to reflect this suggestion.
Reid	Sherman	Text Region	31. Adaptation		8	8	36	36	Align this statement beginning with "Immediate..." with the terminology and focus of Ch 16. Recommend review by those chapter authors.	Thank you for your comment. We will align with Chapter 16 on this statement.
Stephen	Yaeger	Whole Page	31. Adaptation		8				On page 31-8, the report‚Äôs authors discuss how the disparate adaptation approaches of the federal government, private sector, and civil society are increasingly sequestered from one another. They indicate that most advocacy and action on justice and equity comes from civil society. In this section, it is important to emphasize that justice and equity should be central to all discussions about climate adaptation and should be coming from all sectors and actors. While civil society can help act as a guide for this, it should not just be consulted as a partner contributing expertise on justice and equity. That expertise should also be actively cultivated within the federal government and private sector. This should be emphasized more clearly in this section.	Thank you for your comment. We have added some content related to this comment into the "planning" section of the evidence of progress and barriers section.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Nick	Procopio	Text Region	31. Adaptation		9	12	5	38	Agreement/appreciation of naming the need for transformative adaptation practices and naming justice & equity work as central to the adaptation action. Consider referencing, and/or alluding to principles of a just transition. It may be helpful to refer readers to the Climate Justice Alliance's Principals for a Just Transition which are summarized here: https://climatejusticealliance.org/wp-content/uploads/2019/11/CJA_JustTransition_highres.pdf	Thank you for this suggestion. We have added a line about just transitions and four references (including the Climate Justice Alliance Principles) to the role of just transitions in climate adaptation.
Reid	Sherman	Text Region	31. Adaptation		9	9	18	20	This sentence is contradictory. I would recommend being consistent with the way we talk about adaptation actions creating or not creating inequities which is different from addressing EJ concerns.	The sentence identified by this comment notes that some adaptation actions are transformative but most are not. So this does not seem to be the contradictory sentence the commenter means to identify. The comments on equity and EJ and important, and in the revised KM2 we have provided language on both how climate impacts affect communities differently (EJ concerns), how future adaptation resources might be dispersed (EJ), and how adaptation might further create inequities in the future.
Melissa	Shapiro	Text Region	31. Adaptation		9		21	34	The chapter authors importantly recognize that ‚Äú[a]daptations, have, to date, also been largely driven by emergent, acute disasters rather than proactive plans for future conditions,‚Äù and subsequently name examples of incremental adaptations. This list of examples should include incremental responses to storms in Alaska, which compound risks of flooding and erosion along the 1,000 miles of coastline. FEMA will provide temporary housing structures following a storm, but those living in areas most prone to hurricanes remain at risk of losing their homes, as well as schools and buildings providing groceries, clean water, and medical care as the land becomes increasingly unstable. Authors could also mention the use of sand-filled Supersacks that are annually delivered to North Slope communities as a temporary reinforcement of the eroding coastline, which have long served as a short-term alternative response to managed retreat and relocation.	Thank you for your comment. We have added "temporary reinforcement of eroding coastlines" to the introduction to reflect this incremental measure being taken and not being sufficient, and we have added "use of sandbags to resist coastal erosion" in KM1.
Reid	Sherman	Text Region	31. Adaptation		9	9	21	21	Citation needed for sentence "Adaptations have, to date, ..."	We have added four references that both describe the relative dearth of proactive adaptation to date and make the case for more proactive adaptation in the future.
Reid	Sherman	Text Region	31. Adaptation		10	10	7	7	Doesn't seem helpful/useful to cast a general, sweeping statement that adaptation actions that neglect climate change mitigation are unsustainable. The opposite can also be said that mitigation actions that fail to address adaptation may be unsustainable. Moreover, there are some specific actions that may be short-term adaptation measures that may not consider mitigation, yet be valuable adaptation in the very near-term. Recommend including specific citations/examples and/or ensuring other sector chapters agree with this statement.	We have revised this statement to be less sweeping by instead noting that adaptation actions that also affect greenhouse gas reductions will have the most co-benefits.
Reid	Sherman	Text Region	31. Adaptation		10	10	26	26	Encourage review by Ch 13 authors "For example, 26 transforming a transportation system to emphasize walkable cities rather than car-focused ones 27 might offer less support for people with limited mobility, depending on how it was designed and 28 whether people with limited mobility were engaged in the transformation from the start."	Thank you for this comment. We have coordinated with Chapter 13 for consideration and have revised the wording of the line based on their suggestions.
Reid	Sherman	Text Region	31. Adaptation		10	10	32	32	Encourage review of this statement by Ch 16 authors "Transformative actions are also likely to be needed to address numerous systemic inequities that can inhibit adaptation implementation, such as recognition of Indigenous peoples, racism, wealth inequality and distribution, and economies based on extractive industries."	Thank you for this comment. We have coordinated with Chapter 16 for consideration and have revised the wording of the line based on their suggestions.
Melissa	Shapiro	Whole Page	31. Adaptation		10				The authors have importantly documented the existing trends and short-comings of the traditional emergency management approaches to addressing extreme weather events rather than mitigating adverse impacts through equitable and transformative actions that better account for the complex systems-interactions that result from climate change.	Thank you for this positive feedback!
Melissa	Shapiro	Text Region	31. Adaptation		11		5	10	The text and example cited allude to ‚Äúmaladaptation,‚Äù but this concept is only introduced on the following page.	We have re-organized sentences within this section so that maladaptation is now introduced before this example.
Ariela	Zycherman	Text Region	31. Adaptation		11	11	6	10	Page 11 Lines 6-10 I love this example of the sea wall, however, it's a fairly traditional (incremental) way of thinking about sea level rise. One which you just suggested was limited. It could be useful to provide an example of off shore barriers like those in the Netherlands, which reduce wave action.	Thanks for this comment. We have removed this reference to seawalls and one other, to prevent overuse, and we have referenced a table in Ch 9 that provides more examples and discussed cobenefits of transformative adaptations for people and ecosystems.
Melissa	Shapiro	Figure	31. Adaptation		11		19		Figure 31.2. As printed (while permission for reproduction remains pending), the caption for figure 31.2 does not appear to correspond to the figure itself,Äîit would be helpful to better understand why the examples cited as ‚ÄúTransformative Approaches‚Äù range from significant proactive societal change (community relocation) to minimal and reactive behavioral shifts (increased use of air conditioning heat waves)	Thank you for this comment. We have revised the caption to help explain the image, and we believe that the figure will make far more sense when both panels are visible (since one panel was greyed out for public review).
Stephen	Yaeger	Whole Page	31. Adaptation		11				On page 31-11, the report acknowledges that there is still a lot of work to do to effectively evaluate adaptation capacity on the US. The report‚Äôs authors say that ‚Äúefforts to evaluate trade-offs, effectiveness, sufficiency, and long-term consequences of incremental and transformative adaptation actions are still largely theoretical and will need more work to implement and track over time.‚Äù This is an important acknowledgement and reinforces the inadequacy of figure 31.1. More thought and research are needed to more effectively quantify and visualize disparities in adaptation capacity across the US.	Thank you for this comment. We are updating the figure, but agree that more research is needed to quantify and visualize dispareities in adaptation capacity across the US. This has not currently been conducted or peer-reviewed so unfortunately, we cannot get into this level of detail or cite literature that supports this statement.
Ariela	Zycherman	Text Region	31. Adaptation		12	12	9	10	Page 12 -- lines 9-10 Define what status quo bias is for those that don't know. There are also a range of other cognitive biases beyond status quo bias including the ambiguity effect (preferring options that are known), endowment effect (valuing items more that belong to us), and loss aversion.	Thanks for this note. We have revised to clarify that status quo bias is just one example of the cognitive biases that might influence adaptation decisions, and we have added a phrase to explain the status quo bias.
Jim	Titus	Text Region	31. Adaptation		12		16		Another way of looking that this question, that perhaps should be added, is that some responses can be implemented incrementally without causing a problem, while in other cases, what one might do on an incremental basis goes in the opposite direction of a long-term response. Dikes to protect land for sea level rise may work at first, but eventually it becomes too costly; conversely, elevating land in place or retreat can be done incrementally.	Thank you for this comment. We have revised the caption to Figure 31.2 to make this point (that some types of incremental adaptation add up to transformation while others may be maladaptive) and have added that language to the text.
Nick	Procopio	Text Region	31. Adaptation		12	16	33	38	The reference to local government capacity should be further developed. The idea of local governments being ill-prepared to manage/direct adaptation action is introduced at the end of page 31-12, but not discussed again until Key Message 31.3 Adaptation Governance -- and even then, it is nested in a variety of points regarding vertical scales of governance, and sectoral interactions. The governance section should consider explicitly calling out the critical role of local governments in adaptation planning and implementing adaptation outcomes.	Thank you for this comment. We have added a cross-reference in KM31.1 to note the need for adaptation governance at local scales. We have also expanded the discussion in KM2 on how capacity causes challenges in accessing state and federal resources for adaptation and why reforms in these systems are needed (and how some preliminary reforms are being made). Finally, throughout KM3, we have changed the language to emphasize that adaptation governance is not just the domain of the federal government and that local actors play a key role.
Melissa	Shapiro	Text Region	31. Adaptation		12		33	35	Authors should further explain what it would mean to take a ‚Äúsystems approach‚Äù to adaptation in practice, as this is a widely cited concept among academics and experts but rarely implemented by policymakers.	Thanks for this note. We have added additional lines on systems approach, including an explanation of what this would involve and why it would be a benefit and references to practitioner and academic sources.
Juanita	Constible	Text Region	31. Adaptation		13	13	4	7	The last sentence of this key measure is accurate (and important), but perhaps incomplete, as NOT adapting will also exacerbate social inequities and increase exposure to harm.	This is a good point. We rephrased this sentence as ".. where, how, and to what degree adaptation occurs can exacerbate social inequities" to note that we meant both whether adaptation occurs and the way adaptation occurs.
Melissa	Shapiro	Text Region	31. Adaptation		13		22	24	The text should be amended to state ‚ÄúFor example, higher proportions of Native American, Hispanic, Asian and Pacific Islander, and African American populations live in places prone to extreme fire, heat, floods, and permafrost thaw.‚Äù Permafrost underlies roughly 38% of Alaska‚Äôs land area (Pastick, N. J., Jorgenson, M.T.,Wylie, B.K., Nield, S.J.,Johnson, K.D., & Finley, A.O. (2015). Distribution of near-surface permafrost in Alaska: Estimates of present and future conditions, Remote Sensing of Environment, 168: 301-315, https://doi.org/10.1016/j.rse.2015.07.019);); Native Americans identifying as identifying as either American Indian or Alaska Native make up at least 15% of Alaska‚Äôs population according to the U.S. Census Bureau‚Äôs 2021 American Community Survey (https://data.census.gov/profile?g=0400000US02). The state of Alaska has recognized that Native Villages, such as Point Lay on the North Slope are disproportionately affected by permafrost thaw, which can cause subsidence and compound other environmental hazards such as floods and erosion. (Denali Commission (2019). Statewide threat Assessment: Identification of Threats from Erosion, Flooding, and Thawing Permafrost in Remote Alaska Communities. Report #INE19.03. p. 99. https://www.denali.gov/wp-content/uploads/2019/11/Statewide-Threat-Assessment-Final-Report-20-November-2019.pdf)	Thank you. We have added permafrost thaw as a hazard incuded in this sentence so the text now reads: "For example, higher proportions of Native American, Hispanic, Asian and Pacific Islander, and African American populations live in places prone to extreme fire, heat, and floods, and permafrost thaw". The report by the Denali Commission is an excellent supporting source.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Ariela	Zycherman	Text Region	31. Adaptation		13	13	33	35	Page 13 Lines 33-35 In what way can understanding drivers of vulnerability provide policy support? Is there an example of this in action?	Thanks for this question. We have clarified the language here by revising the sentence to say that a greater understanding of the social drivers of vulnerability can illustrate why transformative adaptation may be needed to address those complicated issues.
Ariela	Zycherman	Whole Page	31. Adaptation		13				Page 13-15 I was surprised that no where in the adaptation and equity section was there ar reference to the Justice40 Initiative which is a whole-of-government initative to ensure that 40 percent of overall benefits of certain Federal investments flow to disadvantaged communities... https://www.whitehouse.gov/environmentaljustice/justice40/ Such initatives are more tangible ways to ensure that federal funding is more equitably distributed. Suggest including potentially in the last paragraph (page 16, lines 9-25)	This is an excellent idea, and we've included a paragraph on Justice40, its focus area, and emerging tools for identifying disadvantaged places (e.g., CJEST) would not only profile a major initiative, but provide an concrete example of a federal inititaive for equitable adaptation. The investment focus of Justice40 also potentially dovetails with KM5.
Ariela	Zycherman	Text Region	31. Adaptation		14	14	6	7	Page 14 Lines 6-7 Another way in which adaptation is determined aside from risk perception, is through social capital, where participation in strong community groups can provide access to resources and networks to share information (Shinbrot et al., 2019). Traditional food sharing networks is a common way of distributing risk in places like remote Alaska Native communities, where food availability and economic opportunities are more limited (Walch et al., 2018). Suggest including the below citations. Shinbrot, X. A., Jones, K. W., Rivera-Castaneda, A., LV≥pez-BV"ez, W., & Ojima, D. S. (2019). Smallholder farmer adoption of climate-related adaptation strategies: The importance of vulnerability context, livelihood assets, and climate perceptions. Environmental management, 63(5), 583-595. Walch, A., Bersamin, A., Loring, P., Johnson, R., & Tholl, M. (2018). A scoping review of traditional food security in Alaska. International Journal of Circumpolar Health, 77(1), 1419678.	Thank you for this note. We have added social capital to the list of social factors.
Ariela	Zycherman	Text Region	31. Adaptation		14	14	18	18	Page 14 Line 18 consider rephrasing: "considering home elevation or relocation"	Thank you. We have edited this sentence.
Ariela	Zycherman	Text Region	31. Adaptation		14	14	19	32	Page 14 Lines 19-32 This paragraph focuses on community capacity and alludes to federal and state resources specifically for vulnerable populations, like Indigenous peoples. However, it stops short of actually naming some of the resources available which exacerbates the already stated issue that they must know about the available resources. Many of the capacity issues named (e.g. personnel, power, English-language skills) are outside the ability of the authors of this document to change. However, the authors could provide a new Box on examples of adaptation funds available, particularly for vulnerable populations like Indigenous peoples, which is what I would suggest doing. If there is a new Box created there are two specific federal funds that I would recommend including: The Bureau of Indian Affairs¬í Tribal Climate Resilience funds for ¬iclimate adaptation planning, community-led relocation, managed retreat, protect-in-place efforts, and ocean and coastal management." Additionally, the US Environmental Protection Agency¬ís Tribal General Assistance Program, which also supports the development of Climate Adaptation plans.	Thank you for this comment. We have added a discussion of some federal programs that are being taken to address systemic barriers to resources (such as Justice40 and reforms in the BRIC funding). A comprehensive resource guide is beyond the scope of the chapter.
Melissa	Shapiro	Text Region	31. Adaptation		14			21 24	When addressing the obstacles faced by tribes in accessing revenue sources to support adaptation, the chapter authors should also acknowledge the systemic disadvantages of smaller tribes and the geographic disadvantages of those living in more remote areas. Alaska Native communities, for example, must compete for federal grant funding with tribes in the lower 48 that have far greater administrative capacity to apply for grant funding and far greater visibility and influence. Moreover, in the more remote and harsh environments of Alaska, costs of adaptation measures are much higher, which inevitably places these communities at a competitive disadvantage when applying for federal technical assistance and support.	Thank you for this point. We have added language specifically on challenges faced by rural, remote, and less populous areas when applying for federal support.
Melissa	Shapiro	Text Region	31. Adaptation		14			25 29	The explanation of equity concerns fails to account for the obligations of federal and state governments to improve access to resources, including through the failure to translate applications and other supporting documents or failure to accurately translate such materials (as was recently the case when FEMA attempted to translate disaster relief applications into two Alaska Native languages: https://www.kyuk.org/alaska-state-news/2023-01-07/lost-in-translation-fema-sent-unintelligible-disaster-relief-application-information-to-alaska-natives-impacted-by-typhoon-merbok?fbclid=IwAR0D659uD_ImtVXM-ILKZROAoHqEQTFvXX563-95a-eU7L83iJeWHYqs3rM). This section of text should not only focus on the barriers faced by those who have been historically marginalized but must recognize the failure of government to remove those barriers.	Thank you for this comment. We have added language noting that state and federal governments are taking action to address inequities in access to resources and that these efforts need to continue and expand to provide equitable access. (see also response to 17580S on adding a paragraph about the Justice40 initiative and why these types of initiatives are needed to break down systemic barriers for access)
Reid	Sherman	Text Region	31. Adaptation		15	16	38	1	This sentence is an overstatement and not consistent with how we describe adaptation.	Thank you for this comment. However, the literature on adaptation governance--including the references cited throughout this key message--supports the text that adaptation policy and governance is far less developed than for climate mitigation or for other environmental policy domains. This is not to say that adaptation is not occuring, but rather that the policies and institutions to support adaptation are underdeveloped.
Ariela	Zycherman	Figure	31. Adaptation		15				Fig 31.3 I'm not understanding how these factors (or options) are grouped. What does light blue and dark blue mean? If it is suggesting that some factors are immutable (e.g. history, culture, values), I would move risk perceptions and tolerances from light blue to dark blue. Risk perceptions do in fact change, particularly depending on experience with those risks (e.g. natural disasters). Secondly I would suggest using Scoones' (1998) model of adaptation, which more specifically describes 1. What kinds of resources/capabilities can lead to adaptive outcomes (i.e., financial, physical, natural, social, and human capital), and 2. What the adaptive outcomes can look like, i.e. pooling risk across space (e.g. through migration); pooling risk across time (e.g. storing foods); pooling risk across households (e.g. through community investment). See Shinbrot et al., (2019).	Thank you for this feedback. We have revised the caption to make it easier to understand and we have proposed several changes to the colors and labels in the figure. (Submitted requests to TSU)
Reid	Sherman	Text Region	31. Adaptation		16	16	4	4	If this is the finding in the "e.g.", then say it directly - "Likewise, 4 adaptation for some people (e.g., wealthy) may lead to maladaptive outcomes for others (e.g., 5 low-to-moderate income communities)."	In this instance, it is not the sole finding. Other population characteristics are also germane here, so we highlight wealth as only one example.
Ariela	Zycherman	Text Region	31. Adaptation		16	16	14	15	Page 16, Line 14-15 This sentence could be more clear. ¬ëEmploying intersectionality as an organizing principle¬í not only uses jargon of intersectionality (which excludes those that are interested but uninformed) but also is vague on how to employ intersectionality. Suggest reword, for example, "Planning for adaptation requires understanding individuals¬í multiple, overlapping identities which interact with climate change in differing ways and can compound social inequity"	Very helpful suggestion on terminology. We have rephrased this sentence to swap the term intersectionality for the specific aspects of it intended.
Reid	Sherman	Text Region	31. Adaptation		16	16	36	39	I understand what this citation is saying but I am seeing the wording "wealthy neighborhoods" used multiple times and I don't think that's an accurate term for the actual research summarized here.	Thank you. We have revised to state neighborhoods with high value properties.
Melissa	Shapiro	Text Region	31. Adaptation		16	17	37	2	The text should be strengthened to account for the absence of federal adaptation governance, as follows: ‚Äúá Compared to many policy fields, formal governance of adaptation at both the federal and state level is either non-existent or relatively underdeveloped.Ä¶Äù The chapter authors should otherwise explicitly state that federal governance of adaptation is de facto non-existent; there is currently no coherent and enforceable legal or policy framework dedicated to climate adaptation or to facilitating long-term solutions in the most severe situations, such as community-wide relocation.	The text has been revised to incorporate this suggestion. The text notes that policies and governance structures to support adaptation is relatively underdeveloped, and to strengthen this we have added that there is "no overarching federal policy framework for adaptation". However, we disagree with the characterization that federal governance of adaptation is "absent". As this introductory paragraph is about adaptation governance in general, we are not adding specifics about governance of particular types of adaptation (such as community-wide relocation, as suggested by the commenter).
Reid	Sherman	Whole Page	31. Adaptation		16				KM 31.3 - I find this section to use a useful critique and assessment of what has been tried with adaptation governance, however it is lacking a distilled statement that describes what the reader should take away to improve their own decisions or institutions. See comment from p21 for a great example of how you did this for another section.	Thank you for your feedback. We have reordered the text of KM31.3 to better emphasize the key approaches supporting effective governance (e.g., collaboration, vertical and horizonal linkages), rather than having them buried in between text describing the challenges.
Reid	Sherman	Text Region	31. Adaptation		17	17	1	1	Citation needed for sentence "Nonetheless, numerous organizations..."	We added references to Shi & Moser (2021) and Berrang-Ford et al. 2021.
Angelica	Greco	Figure	31. Adaptation		17		14		Figure 31.4 could be more clear. What do the arrows pointing sideways mean? For example, in the top left, Tracking and monitoring has arrows pointing left and right on either side of it. What does that mean? Consider whether this figure furthers reader understanding.	Thank you for this comment, we have taken it into considertion in our edits to Figure 31.4 aimed at making it more understandable. We have requested changes to the figure to reflect this.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Stephen	Yaeger	Whole Page	31. Adaptation		17				On page 31-17, the report states that ‚Äúadaptation networks have become more complex in the last decade, involving more stakeholders from more diverse organizational backgrounds. The stakeholders involved often have distinct (and at times conflicting) views of the problem, risk tolerance levels, priorities, and ideal futures.‚Äù This section would benefit from a discussion of the implications of this development. How has this increased complexity changed adaptation approaches?	Thank you for this comment. We elaborate on the implications of the increased complexity two paragraphs later, highlighting that adaptation governance is fragmented and uncoordinated. However, there is not sufficient research linking adaptation governance to specific adaptation actions to conclude whether this complexity has changed adaptation approaches.
Reid	Sherman	Figure	31. Adaptation		17				I think this figure is too simplistic - it is worth breaking out the state and federal governments. I also think it is worth adding academia, private sector, and others that represent various sectors or disciplines.	We are working with TSU to edit the figureto more clearly include additional stakeholder types and the actors and actions they take towards climate adaptation. Different jurisdictional governments are already separated in the figure.
Melissa	Shapiro	Text Region	31. Adaptation		18		6	8	The selected text describes the fragmentation and lack of coordination among stakeholders that may be undermining the efficacy of adaptation governance. The authors could also recognize that scientific gaps and uncertainty, and a lack of clear thresholds and indicators set by governments and informed through local consultation may also be exacerbating these challenges.	We appreciate this suggestion, but space is limited. As scientific uncertainty is covered in more detail in KM4, we have decided not to highlight the role it plays in challenging adaptation governance (KM3).
Melissa	Shapiro	Text Region	31. Adaptation		18		26	37	The chapter authors have detailed the scenario in which adaptation is particularly effective (due to interagency coordination by a single government entity ‚Äì existing in parallel with the adoption of a federal legal framework). The authors should provide a concrete example of this interagency approach to adaptation with the US or explain that this is a model for future action.	We appreciate this suggestion, but space is limited. The author team has deliberated and prioritized the information and illustrations to include. Based on these agreed priorities, we have not added new examples. However, we have restructured KM3 so that the examples of effective coordination are hopefully more visible.
Melissa	Shapiro	Text Region	31. Adaptation		19		1	6	The finding that much adaptation has been governed through disaster policies of FEMA and HUD should be more strongly and explicitly named as insufficient, particularly in the context of slow-onset and compounding disasters, which are often outside the scope of disaster response and recovery. Local adaptation needs of communities living on land underlain by permafrost are not adequately addressed through federal disaster policies, as ground collapse and gradual flooding do not qualify as ‚Äúdisasters.‚Äù within the confines of these policies.	Thank you for this suggestion. We have mentioned traditional hazard mitigation - oftentimes led by FEMA - are insufficient for the transformative adaptation we need.
Ariela	Zycherman	Text Region	31. Adaptation		19	19	21	21	Page 19 Line 21 Why is 'scaling out' italisized?	Thank you for your comment. Scaling out is not a technical term, so we have removed the italics.
Nick	Procopio	Text Region	31. Adaptation		19	19	23	23	This line references challenges emerging from ¬¡unfunded mandates". An additional connection could be made between this issue and the matter of needing aspirational/transformative vision & leadership. Transformation is necessarily ¬¡unfunded" in that transformation projects are likely to implode the way we think about projects/programs/policies/initiatives. Case in point: one of the primary ways post-disaster funding is allocated depends on local/regional governments doing some degree of pre-planning of projects and initiatives for which there is no funding currently available, and hoping that by including them in a plan or a list of possible projects they will get funded when post-disaster dollars start to flow.	Thank you for the suggestion. We have added a sentence noting that "Additionally, supporting transformational adaptation benefits from aspirational vision and leadership, as transformational adaptation can upend existing norms and practices "
Melissa	Shapiro	Text Region	31. Adaptation		19		31	38	Among the knowledge gaps and need to improve the translation of findings into on-the-ground implementation, the chapter authors could also explain that local communities are often unable to obtain research and information that is both spatially and temporally relevant to their adaptation needs. There is also a dearth of resources that explain how local stakeholders should lead and guide research that would meaningfully inform adaptation plans. Local planners that are already resource-constrained (as noted by the authors) may therefore lack the information necessary to effectively identify the synergies and trade-offs associated with various adaptation measures.	Thank you for your comment; we agree that lack of research is absolutely a challenge for decision-makers. Access to research and translation of findings for decision-makers is covered in detail by KM31.4. Because we are limited in our word count, we are not adding additional text on this point to KM31.3.
Ariela	Zycherman	Text Region	31. Adaptation		19	19	33	33	Page 19 Line 33 ¬ñ Revise "Adaptative" to say "adaptive"	Thank you for catching this typo. We have edited the text accordingly.
Reid	Sherman	Text Region	31. Adaptation		19	19	33	33	"adaptive" has some text in "strikethrough" mode.	The strikethrough was the remnant of a track changes edit, and has been removed.
Melissa	Shapiro	Text Region	31. Adaptation		20		5	11	This content of this paragraph is too abstract; suggest providing some concrete examples or explanation to better contextualize this discussion.	Thank you for this comment. The short paragraph was rewritten to be more plain language and be more accessible to the audience. Due to the word count limitations of the chapter additional examples were not included.
Ariela	Zycherman	Text Region	31. Adaptation		20	20	18	18	Page 20 Line 18 -- Knowledge should be capitalized when it's referencing Indigenous Knowledge	Thank you for clarifying this. We've capitalized Knowledge.
Reid	Sherman	Text Region	31. Adaptation		20	20	21	21	There needs to be greater clarity, cohesion, and references to the underlying research in this section. This section reads too much like a policy brief and lacks fluidity with the rest of the Chapter.	We have re-structured the final paragraphs of KM 31.3 to enhance fluidity and clarity.
Reid	Sherman	Text Region	31. Adaptation		20	20	21	25	I am wondering if the key message on adaptation science should go first, as it underpins all the other activities discussed in the other key messages?	Thank you for this comment. Based on this and other feedback, the authors reordered the Key Messages.
Stephen	Yaeger	Whole Page	31. Adaptation		20				Page 31-20 includes a discussion of how new governance arrangements will be challenged by the inertia of existing institutions. As a part of this discussion, the report,Âôs authors state that ‚Äúcreating adaptive systems will require fundamental changes across multiple systems and sectors.‚Äù While the goal of this report is not to make policy prescriptions, this assertion would benefit from examples of the kinds of fundamental changes that will need to happen.	At the end of the section, we note that there is insufficient research to conclude exactly what types of "institutional and systemic shifts" would support such change. However, to this note, we did add a sentence earlier in KM3 that, "Additionally, supporting transformational adaptation benefits from aspirational vision and leadership, as transformational adaptation can upend existing norms and practices "
Angelica	Greco	Whole Page	31. Adaptation		20				The term climate services is vague. This may be because the definition divorces the actors from the product. The examples provided on page 21 make it seem like the term is referring to tools or resources. Yet later on that same page (line 22), the listed examples seem like things that a service provider would offer.	Thank you for this comment. Based on this and other feedback, the authors edited this text so that there is not confusion with the concept of climate services being solely technical services.
Nick	Procopio	Text Region	31. Adaptation		21	24	5	8	The discussion of the factors that describe effective climate services as well as the useability/accessibility of climate services is appreciated, especially the sentence clause ¬¡the salience of the information provided (e.g., production of climate variables relevant to end users and quantification of variables according to meaningful metrics) remains an important criterion for assessing their useability".	Thank you for the positive feedback.
Ariela	Zycherman	Text Region	31. Adaptation		21	21	8	10	Page 21 Line 8-10 I love that you've provided the climate data portals -- yes!	Thank you for the positive feedback.
Reid	Sherman	Text Region	31. Adaptation		21	21	20	20	I find this structure to this bulleted list to be really helpful to distill a set of concepts into characteristics or actions that the reader can use to apply the assessment to their own actions or decisions - I encourage the authors to consider applying this formatting and structure to other sections where large blocks of text make it challenging for the reader to understand what they should do next with the presented information.	Thank you for this comment. We are glad to hear the the structure is helpful in communicating the insights to the reader.
Ariela	Zycherman	Text Region	31. Adaptation		21	21	23	23	Page 21 Line 23 -- suggest defining briefly what the difference is between credibility, legitimacy and salience as these are technical terms that not all will know.	Thank you for this suggestion. We have included the definitions in the glossary for those who are not familiar with the use of these terms.
Nick	Procopio	Text Region	31. Adaptation		22	22	5	9	We recommend that the authors consider rephrasing the second half of the sentence. Currently it reads: ¬¡For example, in developing a municipal stormwater 6 management plan, multi-criteria analysis may help to optimize stormwater improvements by considering exposure to intense rainfall and the cost of infrastructure upgrades together with socioenvironmental factors like exposure to contaminated floodwaters in industrial areas that may be home to low-income communities." This reads like industrial areas came to be before low-income communities, which seems to be an inaccuracy that is likely to be triggering wording for residents living along the fence line of polluting industries.	Thank you for this comment. We have edited the text to reflect this comment.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Melissa	Shapiro	Text Region	31. Adaptation		23		5	18	The chapter includes a far too narrow and insufficient explanation of ‚Äúcoproduction.‚Äù The Inuit Circumpolar Council Alaska (ICC Alaska) and Kawerak, Inc.‚Äôs 2022 publication entitled ‚ÄúA framework for co-production of knowledge in the context of Arctic research: Negeqlikacaarni kangingnaulriani ayuqenrilnguut piyaraitgun kangingnauryararkat,‚Äù cautions against the cooption of this term and its interchangeable use with ‚Äúcollaboration.‚Äù The chapter authors should consult the ICC‚Äôs publication among other resources and include a more appropriately nuanced and comprehensive explanation of coproduction (see also Bronen, et al., Usteq: Integrating Indigenous Knowledge and Social andPhysical Sciences to Coproduce Knowledge and Support Community-Based Adaptation 43 Polar Geography 188, 188-205 (2020)). Cited examples could include ongoing efforts by scientists to work closely with climate-change researchers & Alaska Native tribes who live on land underlain by permafrost to apply monitoring and modeling tools to assess the current and future impacts of permafrost thaw and to co-create equitable adaptation plans. This effort involves partnerships with 10 Alaska Native communities, including Kuigilnguq, Nunapicuaq, Golovin, and Chevak; the development and local deployment of a storm damage & permafrost impact app; and the convening of state & federal agencies to establish relocation site assessment guidelines informed by scientific data, local knowledge (please see https://permafrost.woodwellclimate.org/).	We have added new text on co-production that is intended to provide a more nuanced representation of a continuum of different engagement approaches.
Juanita	Constible	Text Region	31. Adaptation		23	23	5	5	Copy editing comment: It seems like the end of the sentence is cut off after DECISION-MAKERS.	Thank you for this comment. The authors believe it is referring to the end of the second paragraph after Figure 31.4 The sentence is correct as written.
Nick	Procopio	Text Region	31. Adaptation		23	23	16	16	The first reference to ¬ítrust" as a key component of effective/successful climate services is mentioned here. It would be helpful to introduce trust in Section 31.2 as well as earlier in this section (31.4) where the matter of inclusive/equitable governance is first discussed.	We have highlighted the importance of relationships and trust building as key components of technical engagement associated with adaptation services.
Ariela	Zycherman	Text Region	31. Adaptation		23	23	29	29	Page 23 Line 29 Suggest omit the word 'even'. I would say most communities are unfamiliar with the terms climate services and co-production.	Thank you for this comment. We have removed the word "even" from the text.
Angelica	Greco	Whole Page	31. Adaptation		23				Line 20 (Some communities may even be unfamiliar with the terms climate services or coproduction and what they provide). I work in this field and was not familiar with the term climate services as it was used in this chapter. Consider an alternative.	Thank you for this comment. Based on this and other feedback, the authors edited this text so that there is not confusion with the concept of climate services being solely technical services.
Melissa	Shapiro	Text Region	31. Adaptation		24		9	38	The discussion on economics of adaptation and adaptation finance fails to address ‚Äúloss and damage,‚Äù which is inextricably linked to adaptation costs. While international climate negotiations have recently moved the needle on a financing facility intended to compensate those experiencing ‚Äúloss and damage,‚Äù in small island developing states and other developing countries, the same ‚Äúloss and damage,‚Äù is occurring in the most vulnerable communities within the US,‚Äîparticularly in the Arctic where the permafrost thaw, erosion, and flooding due to changing climate is rendering lands as uninhabitable for many Alaska Native communities.	Thank you for this comment. How to treat loss and damage is still emerging and under discussion at the international level. We believe it would be premature to address it in the chapter right now.
Melissa	Shapiro	Text Region	31. Adaptation		24		22	26	The authors could elaborate on non-economic costs/losses that are difficult to attribute a monetary value to (recognizing the citation back to key message 19.1). The text could reference emotional and physical trauma from experiencing extreme weather events, loss of community due to displacement, loss of biodiversity, loss of traditional ways of living (including fishing, hunting, other methods of food procurement, storage, and preparation) and cultural heritage, loss of sites of cultural significance (See Serdeczny, O., Waters, E., And S. Chan (2016). Non-economic loss and damage in the context of climate change: Understanding the challenges. Available at: https://climateanalytics.org/media/dp_neld_3.2016.pdf)	Thank you for this comment. Although the text currently includes reference to "non-monetary costs of climate change", we have added examples to describe what this means. We are reviewing the literature for citations.
Reid	Sherman	Text Region	31. Adaptation		25	25	21	21	Citation needed for sentence "The robustness of costing methodologies varies..., although ..."	Thank you for this comment. We have revised the text preceding this sentence to clarify the factors that lead to differences across methodologies and estimates and added citations.
Melissa	Shapiro	Text Region	31. Adaptation		25		24	26	The absence of no comprehensive national-level adaptation costing for the US is a critical issue that could be more forcefully stressed,‚Äîespecially considering recent assessments from the federal government on ‚ÄúFederal Budget Exposure to Climate Risks,‚Äù and a new section on the ‚ÄúLong Term Budget Outlook,‚Äù that focuses on climate change.	Thank you for this comment. We believe that the chapter is clear on the challenges a lack of national-level costing creates.
Stephen	Yaeger	Whole Page	31. Adaptation		26				On page 31-26, the report states that multiple streams of adaptation finance are necessary: personal, private, and public. It summarizes and projects the current and future roles for these sectors. However, it does not go into detail on the roles that would be best suited for each funding source. This section could be supplemented with a discussion of how these three funding streams can best complement each other to finance climate adaptation most effectively.	Thank you for this comment. It is not appropriate for the NCA to be prescriptive on how different funding streams can/should be leveraged to support adaptation.
Reid	Sherman	Figure	31. Adaptation		26				Transportation & Coastal Chapter leads should review this figure and reference this figure in Transportation & Coastal Chapters.	Thank you for this comment. We have revised the figure to remove the coastal property data due to caveats that we do not have space to address in the text. We will also be including data from 2090 in addition to 2050 for the roads and rail sectors. We have coordinated with the Transportation chapter and they plan to reference this figure in their chapter.
Juanita	Constible	Text Region	31. Adaptation		28	28	6	6	Consider adding another barrier, the challenges associated with paying for actions with hard-to-quantify benefits. This is particularly important for intangible activities related to capacity building, partnerships, and social connection.	Thank you for this comment. We have added text to the second barrer, "Upfront or operational costs of adaptation are or are perceived to be high or are inhibited by other factors" to address this point.
Nick	Procopio	Text Region	31. Adaptation		28	29	8	11	The section listing the challenges to cataloging/tracking adaptation costs may itself be a deterrent to solutions generation if the possible solutions or at least approaches that are helpful are not also discussed. Could the content be restructured to point out the problems towards the beginning and the ¬íbright spots" towards the end of the chapter? It might be worth the time/effort to catalog how/where tracking costs of adaptation action are taking place, and perhaps which methods are preliminarily proving to be most effective.	Thank you for this comment. The chapter references challenging is cataloguing/tracking related to adaptation investment and finance as opposed to adaptation costs. The chapter does point out that adaptation investment and finance tracking is most robust at the international level, in both the aggregate and across borders. We have added text suggesting that "Work to establish a process for the tracking these data [in the US] would be an important first step in better understanding the sufficiency and efficacy of adaptation investments."
Juanita	Constible	Text Region	31. Adaptation		31	31	17	17	Copy editing comment: ADAPTATION GOVERNANCE at the end of this line should be a header, not part of the paragraph.	Thank you for this comment, which references the KM 31.3 section in the Traceable Accounts. We are working with the TSU to make the change.
Juanita	Constible	Text Region	31. Adaptation		33	33	3	27	Copy editing comment: The paragraph beginning on line 3 appears again beginning on line 16.	Thank you for this comment. We have deleted the redundant paragraph.
Craig	Hanna	Text Region	31. Adaptation		34	35	4	37	The Academy has conducted research that highlights some of the limitations to comparability of TCFD-based narrative disclosures. While this research was limited to insurance companies, the resulting themes related to comparability may be considered for other private-sector entities as well. This may add to the description of the evidence base (Chapter 31, pages 34 through 35) that describes the challenges of finding publicly available information related to adaptation that is both robust and comparable among companies. The Academy's Climate-Related Financial Disclosure Work Group has also been examining climate disclosures as they apply specifically to insurers. In the first part of that research, presented to the National Association of Insurance Commissioners (NAIC) in December 2020 and January 2021, that work group examined the climate-related financial disclosures that about 70% of the insurance industry completed in response to the NAIC's Climate Risk Disclosure Survey. That survey consisted of nine Yes/No questions, with eight narrative responses required to provide additional elaboration. In the second part of that research, presented in January 2022, the work group compared the NAIC Climate Risk Disclosures with the TCFD Disclosures for the same companies.	Thank you for this comment. The authors have revised the text to highlight some of the limitations of using information obtained from climate-related disclosures, including difficulty with comparing across responses.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Craig	Hanna	Text Region	31. Adaptation		34	35	4	19	Six insights from Academy analysis of climate risk disclosures might be quite useful to the NCA5 while considering the level of usefulness of the TCFD disclosures: TCFD reports generally provide more information than do NAIC survey responses; The increase in information provided by the TCFD reports is accompanied by an increase in the variability of responses, however; Certain topics---governance, metrics and model results, and opportunities provided by climate change---are significantly better covered by the TCFD than in the NAIC survey responses; Certain other topics---operational risk, underwriting risk, and engagement with policyholders and key stakeholders---are less completely covered than in the NAIC survey responses; Only companies that are relatively large as measured by market capitalization have been voluntarily submitting a TCFD report; and The TCFD responses, as is also true of the NAIC survey responses, are very difficult to benchmark. The absence of clear, objective questions and the inclusion of narrative responses make the creation of benchmarks difficult and, thus, makes it difficult to assess individual companies against those benchmarks.	Thank you for this comment. The authors have revised the text to highlight some of the limitations of using information obtained from climate-related disclosures, including difficulty with comparing across responses.
Craig	Hanna	Text Region	31. Adaptation		34	35	4	19	The findings from Academy research raise the following issue: The Carbon Disclosure Project survey and the ClimateWise survey are both used by many companies voluntarily, and both are designed to satisfy the requirements of the TCFD reporting guidance. As a result, the U.S. Global Change Research Program might consider studying these two surveys (and others that meet the same criteria of widely used, systematic, and meeting TCFD requirements) more closely to determine how best to draw from them to improve the information related to adaptation planning and accomplishment. As a result, both regulators and other stakeholders are likely to learn less from the responses---even when companies spend considerable resources producing robust responses---than they would if the TCFD framework were revised and implemented in a way that produced quantifiable metrics based on the responses. Whether the questions are closed-ended or are scored independently once submitted, quantifiable responses will provide regulators and stakeholders the opportunity to benchmark, assess, and compare.	Thank you for this comment. It is not within the scope of NCA5 to review and revise climate disclosure frameworks.
Craig	Hanna	Whole Page	31. Adaptation		34				Chapter 31 cites that 88% of U.S. companies have assessed their climate-related financial risks in alignment with the Financial Stability Board's TCFD framework (Chapter 31, page 6 line 18), but that the available private-sector information related to adaptation efforts especially related to transition planning is limited (Chapter 31, page 27 lines 29-32). Data related to private-sector investments in adaptation is often available through financial statement or sustainability report disclosures that may be based on TCFD principles.	Thank you for this comment. The authors have revised the text to highlight some of the limitations of using information obtained from climate-related disclosures, including difficulty with comparing across responses.
abi	jones	Whole Chapter	31. Adaptation						Date: 23rd November 2022 Subject: NCA5 Chapter 31 Comment Letter Dear NCA5 Authors and Contributors, Thank you for your contributions to the Adaptation chapter of the 5th US National Climate Assessment. I found the chapter very thorough and insightful, and was pleased to see both depth and breadth in the assessment of climate adaptation throughout. In terms of both structure and content, the chapter has many successes. The writing is clear to understand, and the text and sections flow coherently throughout. Similarly, the plethora of examples for each section, alongside useful and clear figures, make the content easy to understand, digest, and relate to applications of adaptation. Within this, the examples were well sourced from a variety of peer-reviewed studies, which provided a strong background of information for the concepts within the chapter to be built upon. In addition, the description of confidence and likelihoods referred to throughout provides a helpful and useful way to follow the content and highlight some important key aspects of the discussion. These descriptions also align with the structure of the latest IPCC reports, which adds consistency across climate report documents. It was useful to see the five adaptation stages at the start of the report, as this provided an important foundation for the rest of the chapter. It was also vital that the process was highlighted and some key barriers to each stage of adaptation were discussed. Particularly, the attention drawn to the lack of implementation of adaptation plans to date was key in starting off this chapter in a way that focussed the perspective on implementation as an essential improvement needed in US adaptation. To expand on this, the significance of stages of adaptation and implementation were further aided by the regular discussion of differing stakeholders, as well as levels of decision-making, throughout the chapter. There is a consistent mentioning of federal, state, local and tribal, which demonstrates and emphasises the importance of action and decision-making at all scales in order for adaptation approaches to be coherent within local contexts and communities as well as on larger spatial scales across the country. This approach will play a vital part in successful adaptation going into the future, and so it is promising to see	Figure 31.6 shows projected climate change damages with two time periods 2050 and 2090 and across two emissions scenarios RCP 4.5 and 8.5 and three adaptation scenarios. The NCA follows a specific structure that does not allow for additional subheadings. References will be interactive in the final web-based report. The primary audience for the NCA is national lawmakers and national scale decision-makers. However, USGCRP will seek every opportunity to explore use, learn how people currently use, and develop new ways to use the NCA.
Abhinav	Banthiya	Whole Chapter	31. Adaptation						November 23, 2022 Dr. Allison Crimmins Director, National Climate Assessment U.S Global Change Research Program 1800 G Street, NW, Suite 9100 Washington, D.C 20006 USA Submitted via review.globalchange.gov Subject: Public Comment on the Draft Fifth National Climate Assessment (NCA5) United States Global Research Program (USGCRP) Dear Dr. Crimmins, Thank you for the opportunity to comment on the draft National Climate Assessment report. I am currently a student at Climate School, Columbia University. I am studying Climate Change and how it will impact society. My research interest mainly lies in Adaptation and climate resilience ,Âi working with and for vulnerable communities in areas of food security. The comments are on Chapter 31, Adaptation, of the draft National Climate Assessment report. The draft assessment report is comprehensive, and as a student studying Climate Change Impact, I support and commend the work done by the team in writing the chapter. However, I also have some suggestions to make it more friendly for the layman that doesn,Âôt necessarily have knowledge or background in climate science. According to UNFCCC, Adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts (United Nations Climate Change, n.d.). Adaptation solutions depend on context and geography; hence, there is no one solution for everyone. Instead, the solutions need to be tailored to the needs of the communities. Also, Adaptation is a vital component of the long-term global response to climate change to protect people, livelihoods, and ecosystems. 1.The Draft report repeatedly addresses the issue of equity and the need for adaptation solutions to be	We agree definitions are helpful and defined as many terms as possible throughout the chapter. We introduce and define equitable adaptation including related principles. The chapter does cite studies specific to geographies (e.g., coastal areas, specific states, and urban areas). The Economics chapter is clear about its use of discount rates and the considerations that need to be accounted for when making temporal choices in the economic analysis. We reference this Key Message in the Adaptation chapter. KM31.5 also states that among considerations that are implicit or explicit in economic analyses is the question of what stakeholder interests are reflected in the valuation (both cross-sectionally, in terms of different stakeholder groups, and temporally, as in the choice of discount rate). The figure shows a comparison of estimates costs across a no adaptation, reactive adaptation, and proactive adaptation scenario.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Kristen	Lubawski	Whole Chapter	31. Adaptation						1. Accurate Representation of Scientific Information The document reads like a literature review in many instances. The science and studies appear to be accurately represented, though at times every sentence within a paragraph is cited. The document could be improved with a bit more original information or additional summation and centering of the research to set it up and increase its impact in helping drive this assessment. In other cases, statements are made without evidence. Both can affect how accurately data is represented. The Traceable Accounts section does an adequate job of explaining how research was conducted, though it may be better served at the beginning of the document rather than the end to preemptively answer questions on methods as readers move through the document. In some cases, data is not represented clearly which affects its accuracy. On page 31-6 in lines 9-11, an overview of American understanding and prioritization of climate is presented: ‚ÄúThere is an increase in the understanding that climate change is happening (72% of American adults (Marlon et.al. 2022; Howe et al. 2015))...,Äù This sentence is unclear. Has there been a 72% increase, or do 72% of Americans now understand that climate change is happening? If the latter, what was that statistic in the previous report? How has it increased? The rest of the sentence is similarly unclear, ‚Äú...and climate should be a top priority to ensure a sustainable planet for future generations (Over 50% of American adults (Tyson et al. 2021))‚Äù Is this 50% increase or do 50% of American adults believe this? And though the science may be accurate, and many pieces are heavily cited, I think there are a number of places where text isn‚Äôt cited. For example, on pages 31-6 and 31-7 evidence of barriers are listed without context or citation. While some of the items may seem obvious, it would be good to cite examples of where these barriers were encountered or research that determined them as barriers. 2. Clarity Some improvements could be made to the organization of the document and structure of the text to make it more clear to understand. With a document of this length, clarity and simplicity is paramount to ensure the material is thoroughly and correctly processed. If I only read section 31: Adaptation, the concept of ‚Äúchange‚Äù is not obvious to me, and maybe it difficult to understand the hierarchy of	This statement is citing a series of longitudinal studies and the current NCA is focused on the most recent. However, we have revised the text for clarity. We point the commenter to the Six Americas report series. We provide references where available and appropriate, and we based some on expert judgment. A full accounting of progress on the federal level is outside the scope of the report. Each chapter must follow the structure of Key Messages and supporting text, and conclusions are not a part of the format.
Julie	Souza	Whole Chapter	31. Adaptation						Chapter 31: Adaptation from the Fifth National Climate Assessment claims climate adaptation should address historical inaccuracies, engage diverse groups of people, focus on equity, address differential access, leverage different governance systems, and finally address both extreme climate events and continual, gradual climate stressors. As a general statement, these claims are excellent starting points, but for real communities and local governments to engage with this assessment, there needs to be a clearer climate risk assessment, perception, and management framework. As it currently stands, the assessment provides an introduction, with evidence of progress of the five stages, and key messages pertaining to: Transformative Adaptation, Adaptation and Equity, Adaptation Governance, Science and Services in Support of Adaptation, and Economics of Adaptation and Adaptation Finances. In terms of a proper climate risk assessment, some key terms are not defined for the reader in the chapter (eg. equity). For the climate risk perception to match the climate risk assessment, the chapter should communicate with clarity and brevity. Defining key terms allows for a more accessible assessment, as well as, a better foundation for how climate risk management will not only involve the experts, but local actors as well. The transformative adaptation section acknowledges the importance of not perpetuating climate injustices by addressing a necessity for transformative adaptation: planning for the future, so that incremental adaptation does not lead to maladaptation. However, there is no clear definition of historical, social, and climate injustices. These terms may be defined differently by different groups of people. While the necessity for transformative adaptation was clearly explained, it is unclear how that adaptation may actually address injustices since there is currently no explicit definition of injustice in the assessment. If climate justice actors are meant to use this assessment to conduct their own climate risk management, then clear definitions and considerations of how to engage with transformative adaptation should be communicated for the general public. Another consideration for climate risk management is to give more priority to the ways funding could propel climate adaptation. While this assessment does highlight the ways funding lacks in each key message, there is no explicit demonstration of scientific evidence that claims how an increase in funding	We agree definitions are helpful and defined as many terms as possible throughout the chapter. The comment regarding an increase in funding is inconsistent with the author team's thorough assessment of the science. By showing how the costs of climate change decrease across adaptation scenarios, the authors are attempting to show the benefits that adaptation can provide. We have addressed the need for increased research and the current minimal level of reserach focused upon this question. The Social Systems and Justice chapter also covers more detail on social equity and the specific populations within the US. A different chapter is dedicated to Tribes and Indigenous Peoples. Increasing diversity and representation in future assessments is a priority.
Jaad	Benhallam	Whole Chapter	31. Adaptation						Jaad Benhallam Columbia Climate School 11/23/22 5th National Climate Assessment: Public Comments on Chapter 31 ‚Äì Adaptation Dear Dr. Allison Crimmins, Thank you for allowing concerned citizens the opportunity to publicly comment on the draft version of the 5th National Climate Assessment. As an activist, researcher, and current master‚Äôs student at the Columbia Climate School in New York City, the National Climate Assessment series presents a powerful body of the latest research and analysis on the state of the climate. Much of my current research and coursework focuses on adaptation and resilience to climate change. This is why Chapter 31 of the assessment is of particular value. As is deftly mentioned in this chapter, even if our mitigation efforts work, we will continue to see the effects of climate change for generations to come, due to the emissions that we have already released into the atmosphere. The need for our society to rapidly adapt to climate change has never been more critical, making the work of the NCA essential reading material for policymakers, scientists, and concerned citizens alike. It is imperative that adaptation plans are implemented at the state level. Unfortunately, as this assessment points out, 88% of states do not have adaptation plans or measures put in place. Even those 40% of states that have assessed their climate risks, the plans that have been put in place are rather lackadaisical. This report touches on the lack of transparency concerning climate risks and adaptation plans; however, it would be beneficial to expand research on this. The clearer these plans can be, the more impetus it would give for states to implement them. Additionally, the need for transformative adaptation itself is also crucial. Currently, most adaptation measures in the US are incremental. Efforts are focused on the aftermath of disasters instead of addressing the systematic issues that need to be changed. The latter is referred to as transformative adaptation. Climate change will force us to move away from preserving the status quo. Innovative long-	We thank the reviewer for positive feedback. We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. The Social Systems and Justice chapter also covers more detail on social equity and the specific populations within the US. A different chapter is dedicated to Tribes and Indigenous Peoples. Increasing diversity and representation in future assessments is a priority.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Aaron	Stockel	Whole Chapter	31. Adaptation						To the NCA5 Adaptation Chapter (31) Author Team: This draft of the Adaptation Chapter does an excellent job of communicating complex information ‚Äì about a relatively new field that still contains significant uncertainty ‚Äì in a comprehensible way. The chapter is broadly accessible not only to an expert audience, but to policymakers at all levels of government and the average reader as well. The chapter is internally consistent and logically structured. This commenter has identified a few areas where improvements can be made, generally revolving around the context and clarity of the information presented. The chapter is laid out to successfully present a cohesive adaptation narrative to the reader. The flow is intuitive, beginning with a general introduction, followed by detailing progress made since NCA4, explaining the largest current hurdles, devoting sections to each of the most salient factors relevant to successful adaptation,Ã¶etc. The writing is generally straightforward and easy to understand, although in some cases additional definitions, context, and/or examples would be helpful to improve clarity. For example, definition of terms like ‚Äúcoproduction,‚Äù and ‚Äúbusiness as usual‚Äù would be helpful to lay out early on for context. This is done already for terms like ‚Äúclimate services,‚Äù (pg 20), and the chapter even recognizes later on that communities may be unfamiliar with coproduction and climate services (pg 23, line 29), but nonetheless only defines one out of those two within the text itself. Especially given the breadth and novelty of the adaptation field, defining key terms is critical as even if an individual has familiarity with a complex concept like coproduction, their understanding may differ from the authors,Äô or other readers. The scientific literature synthesized is clearly represented accurately ‚Äì the information is clearly and robustly presented. The commenter would only note that the early pages of the chapter do seem to rely heavily on Hicke et al. 2022 (up to about pg 10), which is not necessarily an problem but seems surprising for such a broad literature review chapter ‚Äì the reason is likely that there is not a sufficiently broad pool of literature to pull from about this specific area, but it may be worth specifying this in the text or a footnote to avoid the appearance of an overreliance on a single source. The chapter seems to generally be very useful for human institutions with better access to resources	We agree definitions are helpful and defined as many terms as possible throughout the chapter.We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter.
Olivia	Smith	Whole Chapter	31. Adaptation						Upon review of the November 7, 2022 draft of the Fifth National Climate Assessment (NCA5) chapter on Adaptation, below are my comments and considerations for chapter improvement. These suggestions are based on criteria related to the document,Äôs clarity, scientific informational accuracy, relevance to policy makers, community actors and investors and finally on author choice for content prioritization. Throughout the chapter, main areas for improvement revolve around increasing language specificity, including material more relevant to policy makers regarding budgeting and investment. The following comments are in order of appearance within the chapter. The chapter,Äôs introduction needs improvement to refrain from an to initial lack of specificity and negative tone. The chapter correctly states, ‚Äúln some instances, humanity may have passed the point where reactive and incremental measures such as energy efficiency, cooling centers, and elevating homes will sufficiently prepare communities for the scale of physical climate change underway. Given this, there is an increasing need for both incremental and transformative adaptation at all levels and sectors across the US,.‚Äù (NCA5, p.31-3). While likely intended as a point of motivation and demonstration of the importance of adaptation, the first sentence quoted above reflects a doomsday tone to the lay reader. Moreover, if readers are involved in any of the listed initiatives, this point stands to be interpreted as accusative of insufficient work or even blameful. Understanding that this is not the intention of the chapter,Äôs tone, this sentence should explain more as to why these initiatives aren,Äôt enough. The following sentence could be where clarification is included, as the distinction between incremental and transformative adaptation is not made explicit. Clarification here would amend the tone of the above sentence as well. In table 31.1, ‚ÄúManagement and Planning,,‚Äù an already abstract category relative to the others listed, is then defined with the same terms ‚Äúplanning and management,‚Äù in the table,Äôs description field (NCA5, p.31-4). While the text provides important inputs into this category such as risk, cooperative governance and cultural adaptation, this field would be improved by more specificity into the scope of management specifically. Of course there are constraints on this specificity based on the overall project's goals to balance broad and prescriptive language	Thank you for this comment. We have removed the first paragraph, have started with the definition of adaptation, have highlighted more success stories, and have emphasized opportunities for growth and improvement.We revised the table for clarity and specificity.We have updated the box to include financial and economic constraints.We worked to improve the synthesis of the state of adaptation as is reflected in the scientiifc literature throughout this chapter and other exemplars can be viewed in other report chapters. This report is not policy prescriptive. We have included a discussion on maladaptation and equity, including a discussion on how maladaptation can displace risk or create greater inequities.The chapter text has been revised to touch on the strengths and limits of coproduction and how that relatest to different forms of knowledge. We defined as many terms as possible throughout the chapter and edited to minimize jargon.
Ziyi	Lai	Whole Chapter	31. Adaptation						The report generally provides a description of the process which could be adapted by the United States in seeking to cope with the effects of climate change in the future. The proposals made largely focused on risk management and mitigation as it seeks to ensure further degradation which causes climate change does not happen. The role that the federal government plays and must play, is highlighted in the proposed solution as well as the highlighted actions. With the involvement of local communities, the report focuses on the collective responsibility of the United States which emanates from actions taken at the state level to address this persistent problem. Generally, the adaptation s considered an effective way through which change can be undertaken smoothly, and existing obstacles can be overcome to enhance the efficacy of the proposed solutions. There are significant actions taken in seeking to reduce the impacts of climate change, which has been referred to as climate adaptation within this report. The adaptation seeks to mitigate the impact and enhance the aspect of resilience in the communities that have been affected by the problem. The text highlights many of the issues that have already been addressed in various approaches as well as the challenges which are encountered in the process of implementing the solutions. The aspect of adaptation that is highlighted in this chapter is almost similar to the concept of sustainability presented in other debates on climate change. The main difference lies in the fact that adaptation presents the actionable solution to the challenges which continue to be faced in different settings. The text has been written in what could be considered to be a fairly simple language without complex terminologies which might be difficult for a layman to comprehend. With many people already having some insight into the effects of climate change and a considerable proportion of the population within the nation accepting the need to adapt climate change policies, society remains keen on understanding the underlying foundational facts about the problem. This text provides insight for the readers to gain an understanding of some of the actions that have been taken in the process of seeking to mitigate the effects of climate change. Many people only have the perception of the governments and other entities providing policy actions but are never sure whether such actions are taken as the effects of climate change continue to worsen	Thank you for your comment. The International chapter addresses your suggestion to identify how the US is and might continue to play a role in various other regions of the world to address climate change. Since this chapter is intended to summarize adaptation in the US, we focused mainly on what is happening in this country.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Hailey	E Basiouny	Whole Chapter	31. Adaptation						Thank you for drafting a clear and informative assessment of climate adaptation here in the United States; the first success is the overall readability in terms of language and scope for such a nuanced subject. By addressing a brief historical context, the current trends, and what our uncertain future requires of us, the text as written already has potential to effectively ground community, local, and state governments in a shared basis of terminology and the most generative processes from which to engage in climate adaptation actions. What follows are a couple of concrete suggestions on which the team might refine the text. This chapter is arguably grounded more in discussing the social sciences, based on the physical sciences of climate that are often perceived to be more complex; as Dr. Kate Marvel has said, however, ‚ÄúEvery molecule is governed by and responds to the laws of physics. People‚Äôre complicated; we just don‚Äôt know what people are going to do.‚Äù The chapter focuses on transformative adaptation, equity, governance, (communicating) science and services, economics are useful pillars for orienting to the work of adaptation. While politics might prove challenging with the language throughout, but a more accurate representation of the science would more explicitly and granularly emphasize ‚Äúthe continued reliance on fossil fuel economies that discourage transition and economic diversification.‚Äù This reliance is the underpinning of the funding, regulatory, and governance and leadership barriers that precede its mention in the text. Relatedly, the text itself also notes that ‚Äúadaptation actions that neglect climate change mitigation are fundamentally unsustainable.‚Äù This is the crux of current wavering in taking substantive action, of not declaring a climate emergency. On the matter of text clarity, it would be useful, if possible, to adjust the in-text citations to be footnotes; such a revision would improve the readability of the text further, thereby enhancing its efficacy, which stands out as particularly useful for community organizations that endeavor to take action. As the chapter itself states, ‚Äúadaptation networks have become more complex in the last decade,‚Äù and ‚Äúlinking adaptation policy to governance involves timely and salient communication.‚Äù Speaking of, the salience (as well as the credibility and legitimacy) of the chapter would be augmented by both revision and additions to the visual inventory. First, the Figure 31.2 looks pretty like a wall decor	We agree the suggestion, but space is limited. The chapter will be re-formatted in its final form. We attempted to revise the figure to avoid confusion. The table has been revised to be alphabetical.We will explore the hyperlink option. The section currently references the ASAP Ready to Fund Resilience, among other resources. KM 4 also references the difficulty accessing federal funding. Regional chapters also cover details on resources for underserved communitiesWe thank the reviewer for the comment. The KM has been renamed and expanded focus on diverse forms of technical support.
Benjamin	Preneta	Whole Chapter	31. Adaptation						The assessment chapter (31) of the NCA5 is a quite well rounded survey into the current state of science on adaptation, problem spaces, and potential solutions to be mapped out. It has a generally quite thorough structure and displays a strong overview of both the environmental and social sciences behind adaptation and makes a strong attempt at outlining policy without being prescriptive. The key positive aspects of the assessment worth highlighting are: the well-researched and accurate representation of the science, policy-minded focus, and importance placed on collaborative knowledge. Looking at areas of improvement there are two main categories. The first is more simply the framing and contextualization of the assessment (medium of discussion) and the second is the depth and focus of certain topics (content). An upfront definitions section, description of why certain ‚ÄúKey Messages,‚Äù were selected, and having a stronger concluding section are all framing issues that could be improved. In regards to content, the ‚Äúgovernance,‚Äù section should focus more on state and local interaction both laterally with community groups and also upwards with larger agencies. Additionally, the ‚Äútransformative adaptation,‚Äù section ends rather abruptly and leaves room for further discussion on pathways to this end. Finally, there should be more discussion of the costs and benefits of adaptation specifically in regards to government not just private sector. While the contextualization issues need only be touched on briefly, they are particularly important since they provide ease of access to local governments and decision-makers who are likely to be short on time or technical expertise. While obviously, this assessment is more geared towards a sustainability or climate services professional, it is still worth nothing that accessibility of information is key to collaborative adaptation. One powerful method seen in the National Climate Adaptation and Resilience Strategy Act (and federal bills in general) is the placement of a definition section towards the front of the literature. While for the assessment there may not be as clearly agreed upon definitions for many of the terms discussed within, it still is a powerful grounding point. This is examined very briefly towards the end of the chapter with the caveat comparing ‚Äúresiliency,‚Äù to ‚Äúadaptation,‚Äù but this could be expanded to include many of the more specific technical terms used and put towards the front of the chapter. Additionally, while the ‚Äú‚Äúkey Messages‚Äù are well determined and cover many of the topics	We agree definitions are helpful and defined as many terms as possible throughout the chapter. The author team determined that the current references are appropriate and adequate given the chapter's space limitations.Throughout KM3, we have tried to be explicit that adaptation governance is not solely the domain of federal agencies, highlight the many different types of actors that make decisions relating to adaptation and the way they interact. To ensure that this intention was clear, we have reviewed the text to make sure that we are adequately highlighting all levels of government, as well as civil society groups.We address the costs and benefits of adaptation in Key Message 5. We thank the reviewer for this comment, but the suggestion to prioritize adaptation actions is outside the scope of the report.The author team determined the Key Messages through a thorough review of the current references and deemed them to be appropriate and adequate given the chapter's space limitations.Key messages are meant to provide the high-level summary points. Additionally, a synthesis chapter will be created for the whole report. Estimates of the aggregate costs of climate change and the costs and value of adaptation have in the literature been limited to a subset of sectors. The information presented in this section reflects this reality.
Morgan	Nightingale	Whole Chapter	31. Adaptation						Overall Adaptation chapter 13 provides a broad, while feeling slightly underdeveloped, assessment on the current situation regarding climate adaptation in the United States. However, given NCA5 is still in draft form, there is hope this chapter might be made more comprehensive/complete after incorporation of considerations from comments by the public following the current review period. In no particular order, this letter will attempt to outline areas where the assessment is lacking in clarity, requires attention to grammar, sentence structure, repetition, or sections where authors should consider prioritizing certain areas and deprioritizing others. First, table 31.1 Example Climate Adaptation Actions or Measures to Enable Adaptation directly followed by figure 31.1. Progression of Adaptation Activity Across the US provides almost right from the beginning of the chapter, helpful descriptions of actions and visuals to orient the reader to the topic of Adaptation, providing definitions and an easily understandable map/visual, clearly depicting the amount of adaptation projects in each state. While on the topic of visuals, the beginning of chapter 31 has considerably more visuals than the latter half of the chapter. A recommendation would be to prioritize more visuals in the latter half of the chapter, for both purposes of consistency in conveying the message and more generally as visual aids are helpful for understanding. Lastly, figure 31.3 on page 15 could be improved upon, appears to have potential, but also is lacking and is not very institutive to understand. I was excited to read the suggestion of incorporating the lens of intersectionality in chapter 13 page 16 as an ‚Äúorganizing principle of adaptation,‚Äù to address ‚Äúcompounding social inequities,‚Äù and think another sentence could be added here to say a bit more about how this would be a useful lens. Saying a bit about why or how an intersectional approach would be helpful is one suggestion. In a similar vein, while chapter 13 does accomplish uplifting the need to incorporation equity and justice into adaptation planning, decision making, metrics, etc. there is little discussion of how this task might be achieved. While cognizant the purpose of this document is as an assessment of the current literature and scientific consensus, and not meant to be policy prescriptive, there is a noticeable gap in elaborating on what equity and justice looks like vis-√†-vis adaptation in comparison with other topics in chapter 13 such as economics of adaptation and adaptation financing. For example, the Key messages 31.2, Adaptation and	We appreciate the suggestion, but space is limited. The author team has deliberated and agreed on the most relevant information/illustrations to include. The chapter has not been revised to include more figures. The colors and labels in figure 3 are being revised to clarify the intent and purpose of the figure. We were not referring to intersectionality and have revised the text. We refer the commenter to the Complex Systems chapter which expands on the idea of intersectional vulnerabilities. We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues. The text has been revised to incorporate the reviewer's suggestion on page 33. We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Juliet	Tochterman	Whole Chapter	31. Adaptation						On the one hand, the Adaptation Chapter does a good job of providing an overview of the state of scientific literature on adaptation. The chapter mentions several topics related to adaptation widely covered in the literature including ‚Äútransformative adaptation,‚Äù (31), ‚Äúequity,‚Äù (14), ‚Äúco-production,‚Äù (23), and ‚Äústakeholder engagement.‚Äù (18). However, the vagueness of the chapter and its overemphasis on scientific literature might make it difficult to be used by legislators in practice. Many solutions proposed in the Adaptation Chapter are intangible or non-specific. For instance, the framing of the problem of inadequate adaptation is unclear. The Adaption Chapter begins by warning that ‚Äúif adaptation measures are not in place, we can expect to experience more deaths, ecosystem, failures, health problems, economic failures, greater inequalities, and increased stress on government services,‚Äù (9). While this statement is true, it is vague. Who is ‚Äúwe?‚Äù This statement does not apply equally to all people in the U.S. and certainly not abroad. Additionally, what is meant by ‚Äúmore?‚Äù Specific impact values would be helpful to fully understand the scope of the problem of improper adaptation and its possible consequences. The vagueness of the Adaptation Chapter also applies to its proposed solutions. For example, the chapter proposes that ‚Äúsystematic changes can be facilitated through changes in laws, codes and standards, data collection (e.g., disaggregated demographic data), and regulations that shape decision-making for intentional and equitable adaptation,‚Äù (20). The chapter suggest that such ‚Äúsystematic changes,‚Äù to decision-making protocols could, among other things, better incorporate indigenous knowledge and engage stakeholders (20). However, it is unclear what these ‚Äúsystematic,‚Äù changes would entail and how they could better incorporate indigenous knowledge. Furthermore, as the authors acknowledge ‚Äúsystematic changes,‚Äù (and ‚Äútransformative adaptation,‚Äù in general) is a vague concept that, on one hand, ‚Äúhas the potential to address complex climate and non-climate stressors,‚Äù but ‚Äúalso has the potential to create winners and losers and to perpetuate or exacerbate social injustice,‚Äù (10). In other parts of the chapter, the authors more explicitly suggest using the Tribal Climate Adaptation Menu in Minnesota as a model framework to incorporate indigenous knowledge (21). However, the authors fail to describe this framework or how it would be created elsewhere (21). The vagueness of the	We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter. We agree that vulnerability discussions should be nuanced and context-specific. We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues. We are adding a discussion of some federal programs that are being taken to address systemic barriers to resources (such as Justice40 and reforms in the BRIC funding). Additionally, there is a separate chapter that deals exclusively with tribal knowledge and organizations. A comprehensive resource guide is beyond the scope of the chapter. We agree that vulnerability discussions should be nuanced and context-specific. We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues. The chapter text has been revised to touch on the strengths and limits of coproduction and how that relatest to different forms of knowledge. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.
Jonah	Kasdan	Whole Chapter	31. Adaptation						This chapter is a welcome inclusion in the National Climate Assessment. For the past few decades, the climate field has been focused largely on mitigation, rather than adaptation, and understandably so. Now that the impacts of climate change are manifest, however, and are not confined to words on a page describing some far off model scenario, it is vital that government and the policy making communities devote greater attention to adaptation. This chapter will serve as an incredibly useful guide to policy makers and government officials looking to implement adaptation measures in their community, or at the state or federal level, although it could be improved by going into more detail on issues of equity and climate justice. To start, the authors did an excellent job collecting and summarizing the most accurate and up to date science on adaptation. As mentioned towards the end of the chapter, the authors reviewed hundreds of scientific papers and government reports on climate change adaptation, and used those peer reviewed sources to inform their discussion and recommendations regarding adaptation throughout the chapter. Commendably, the authors also highlighted key uncertainties and research gaps for each section, which increases the reader‚Äôs confidence that they only included information in the chapter that was sufficiently supported by the literature. The chapter is also eminently readable. The authors did an excellent job of consistently and clearly defining key terms and concepts they employed throughout the text. Notably, they did so for foundational concepts like transformative change, that may seem obvious at first glance, but could in fact be understood differently by different audiences, and therefore require clear definition. In contrast, the chapter also defined incremental adaptation measures and gave multiple examples of what those would look like, which helped further clarify the kinds of transformative change that is needed. There were also an assortment of tables and boxes throughout the chapter that helped further clarify key terms and ideas. For example, table 31.1 listed and described ten major adaptation actions, such as capacity building, policy, and green infrastructure, while Box 31.1 laid out evidence of progress and barriers in the U.S. for the five adaptation stages, both of which were very helpful. Similarly, figure 31.4, which explained the different jurisdictional scales of climate governance and the various stakeholders involved	Thank you for your comments about the importance of addressing adaptation in the NCA and for the readability and research that went into drafting this chapter. We especially appreciate your comments on the equity and justice framing within the adaptation chapter. We agree that a truly in-depth treatment of these issues would require greater discussion of the root causes and greater details about how inequity and injustice affect people and communities. We are unable to provide a thorough treatment within the word limits of the chapter (1,500 words to cover all of equity and climate justice necessitates an overview approach). We agree that vulnerability discussions should be nuanced and context-specific. We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues.
Weiyi	Shen	Whole Chapter	31. Adaptation						This Chapter is doing an excellent job on illustrating the big picture of adaptation to government and communities. It introduces the main progress and challenges that the country is facing. The chapter is organized into five main sections considering the aspects including: transformative adaptation, adaptation and equity, adaptation and governance, science and service in support of adaptation, economics of adaptation and adaptation finance. The five sections introduce adaptation related topics from earth science, social science, to economics and politics aspects. The chapter is neatly arranged which is beneficial for conveying knowledge to its audience,√Ç local governments and communities. Under the five major categories, the author mentioned detailed adaptation strategies of capacity building, management and planning, practice and behavior, physical infrastructure, early warning or observing systems and green infrastructure. The simple and accurate language with clear structure played an important role for even readers with non-professional background to grasp the main idea of the chapter at the first time. The science is accurately represented in the chapter both by graphs and by text. There is a graph showing the number of adaptation activities in each state, a chart showing the estimated annual average change in costs due to climate change across adaptation scenarios and there are simple diagrams showing how adaptation options lead to outcomes. The texts and the graphs together are conveying the science and adaptation concepts professionally for the public to easily understand. Though with the overall high quality of the chapter, there are few points that might be helpful to further improve the chapter. First, there are several times that the author mentioned that ‚Äúmore research is needed,‚Äù in order to make a more accurate description and estimation of the topic. On the one hand, it is showing the preciseness of the author and the encouraging attitude to government and science institutions to invest more on adaptation related topics. Being responsible for the proper conclusion is essential for the chapter, but on the other hand, the chapter failed to provide further guidance and advice on how to increase the number of research that are useful for the purpose of adaptation. There is a need for more related research, but details on the ‚Äúroad-maps,‚Äù for achieving the goal is quite lacking. For instance, the author can include information on what sort of specific research topics in a certain typical	We thank the reviewer for the comment. The Traceable Accounts identify Research Gaps. The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy, including science policies. USGCRP is integrally involved in the development of the NCA and oversees a cross-cutting global change research agenda for 14 different federal agencies. The research gaps identified in the NCA inform agency research priorities. Prescribing which agencies endeavor those priorities is beyond its defined scope. We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Arjana	Ejupi	Whole Chapter	31. Adaptation						The introduction provides clear definitions of what adaptation means and provides detailed examples and descriptions of different types of adaptation actions. This is again very beneficial for the public readers since it provides a clear understanding in the beginning. It also clearly calls out the lack of adaptation across the U.S. which is crucial since there isn‚Äôt much investment in adaptation in the U.S. While the introduction does provide an holistic overview, there isn‚Äôt much introduction to the science of adaptation. Transformative adaptation was defined as making in-depth systemic changes however there was a lack of examples of transformative adaptation, which could‚Äôve been used in order to strengthen the potential of transformative adaptation. Adaptation and equity is a very crucial component in this report, it covered in detail the disproportionality of marginalized communities. Specific examples of marginalized communities were used which helps the public clearly understand the issues are being addressed and represented. Perhaps more figures and diagrams would be helpful to portray this issue in better detail. Since this report will be seen by local governments and communities, more visual aid is recommended in order to get an in-depth grasp on the issues with adaptation and equity. The comprehensive diagram that shows the general flow of stakeholders involved in adaptation governance provides an easy view of the different scales of governance. However it was mentioned that adaptation is most effective when a sole government agency coordinates an interagency team to handle adaptation initiatives. This is particularly interesting since different groups are coming together to work collaboratively and yet there is a single agency controlling the group which could potentially lead to some issues. While it is important to have some sort of coordinator, there should be a system in place where everyone is held accountable and decisions are being heard. Another concern is if issues rise among the different scales of governance. A protocol could be added to address issues that arise between decision makers and guarantees the avoidance of maladaptive practices. We know what groups should be involved with adaptation initiatives but how will these activities get initiated? There should be a mechanism in place to make sure the adaptation initiatives are being put into action especially if some involve long negotiations	Thank you for the suggestion to include more figures to illustrate these points. However, we are constrained by overall length of the chapter, so we will work on revising our main figure to make it as clear and helpful as possible.
Saxon	Stahl	Whole Chapter	31. Adaptation						In review of Chapter 31 - Adaptation for the 5th National Climate Assessment, minor areas of improvement are present along with strength areas throughout this Chapter that range from simple visual decisions to logistical processing of overcoming adaptation barriers. To begin, when it comes to Adaptation, why wasn‚Äôt Resilience referenced in conjunction with the introduction? Is this because the authors view resilience and adaptation as interchangeable or are they viewed as separate entities. If the latter is true, why was Resilience omitted from mention as both concepts carry their own metric of analysis? Chapter 32 references Mitigation, so the decision process of why Adaptation and Mitigation were included while omitting Resilience would be beneficial to explain even in just a short mention. In addition to the introduction, Figure 31.1, Progression of Adaptation Activity Across the US, seems a little misplaced, in connection to the Adaptation Stages different states in the US are at. A more explicit graph depicting which state falls under which stage category would‚Äôve been a better visual. The figure is scaled to number of adaptation activities rather than adaptation stages so this may be misinterpreted. Finally, a major strength of the introduction is Key Message 31.1: Transformative Adaptation, as it is very thorough and provides an understanding of the definition that can be understood to different stakeholders, including the general public. The consideration of this practice highlighting historical injustices and ground equity is praiseworthy, including the potential of how transformative adaptation can either benefit or hurt communities under the context of complex climate and non-climate related stressors. Furthermore, the examples given to describe barriers of Transformative Adaptation which include the status quo bias is resoundingly relevant as the state of being comfortable with risks until during or after they occur is a cycle that happens time and time again with major catastrophes on communities here in the United States. Another strength found in the beginning of the chapter was the acknowledgment that vulnerability levels differ across different risks as conditions uniquely affect each of the diverse demographics analyzed in risk management. However, the example on page 13 providing detail of Native American, Hispanic, Asian and Pacific Islander, and African American populations experiencing regional risk to extreme fire, heat, and floods, would be better explained through how each racial demographic listed is	Thank you for this comment. We were intentional about using the term adaptation throughout this chapter. Adaptation is one component of resilience which is defined in the Overview chapter and the Glossary. Unfortunately, the underlying data does not provide the level of detail to break adaptation actions down by category.We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues. Thank you for your comment on Figure 31.3. The tribal boundaries map is in development; it will not be blank in the final version, but was not available in time for public review. We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter. A different chapter is dedicated to Tribes and Indigenous Peoples. We are adding a discussion of some federal programs that are being taken to address systemic barriers to resources (such as Justice40 and reforms in the BRIC funding). Additionally, there is a separate chapter that deals exclusively with tribal knowledge and organizations. A comprehensive resource guide is beyond the scope of the chapter. This is somewhat of a chicken and egg scenario, but fundamentally what matters is the fact that our governance instutions are lagging behind climate change. Laying blame to one side or the other doesn't help move the system forward in the same way that acknowledge and managing the mismatch does.A different chapter is dedicated to Tribes and Indigenous Peoples.The Key Messages have been revised and reordered to first emphasize equity and we have re-organized the text for better narrative.
Dewei	Liu	Whole Chapter	31. Adaptation						NCA Chapter 31 Comment Letter for Climate Adaptation in the US NCA_ In Chapter 31, the report describes the various methods that the United States can adopt to deal with the impacts of future climate change, assesses the five adaptation stages of the United States, and provides five key pieces of information. The focus is on risk management and how to mitigate the change. When this program comes into effect, the federal government has its own responsibilities and obligations. Trying to adapt to the impacts of climate change is an effective way to overcome some problems and make the proposed scheme work effectively. With the participation of local communities, the report focuses on the collective responsibility of the United States. When this bill comes into force, it may improve our community's response to climate change and find effective ways to adapt to climate change. How to evaluate the contents of this chapter This report proposes the content of climate adaptation. As the name implies, adaptation should first focus on how to reduce the impact of change and achieve the best results with the least loss. In this report, there are many methods and 10 different examples, each of which is representative and interesting. This report uses simple language without complex terms. Whether the reader is a professional or a layman, he can quickly understand the meaning of it and generate his own opinions on the content. For example, in Figure 31.1, this part describes the five adaptation stages that the United States will experience. The content of this part is as clear and concise as it is clear. The reader can understand the content of the report through accurate figures and detailed introduction. Among the five key information, there are corresponding detailed introductions that are very easy to understand. In the other part, I learned in this report that the content integrates the social and scientific aspects of climate change affairs management. The content of this aspect gives a good introduction to the balance between society and science. As far as climate change is concerned, this is a topic that cannot be ignored in scientific discussion, but as far as the impact of climate change is concerned, it is actually a very important sociological issue. Overfocusing on one aspect will unbalance the results, The content proposed in this report has kept a good balance between the two	Thank you for your comment. The International chapter addresses your suggestion to identify how the US is and might continue to play a role in various other regions of the world to address climate change. Additionally the Social Systems and Justice chapter also covers more detail on the specific populations within the US that are vulnerable. Since this chapter is intended to summarize adaptation in the US, we focused mainly on what is happening in this country.

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Emily	Bosch	Whole Chapter	31. Adaptation						The adaptation chapter of the drafted National Climate Assessment is clear, concise, and tackles the key concepts and issues of adaptation. It provides an honest and unbiased review of these concepts while stressing the importance of quick, transformative, and equitable actions. Further improvement of the report could situate adaptation in the broader context of climate issues, include a discussion of climate justice, incorporate more specific, deliberate language in consideration of vulnerability, and condense arguments related to tracking. While the introduction does an excellent job of introducing the concept of adaptation and stressing the importance of quickly implementing transformative adaptive changes, it could go farther in connecting some of the key concepts and situating adaptation issues in a larger global context. While the purpose of the report is obviously assessing U.S. adaptation, it would not detract from this focus to situate context or findings on a broader scale. As is, the lack of acknowledgement of climate change being a planet-wide problem that all countries will be forced to adapt to in some way almost implies that the U.S. is alone in adaptation. Ultimately, just a few sentences placing U.S. adaptation efforts in a broader context may paint a more accurate picture. While the chapter contained a sufficient emphasis on equity in adaptation, climate justice was mentioned only in passing. Furthermore, the terms are used interchangeably without distinguishment. While these concepts are related, they differ in important ways including how each would be incorporated into adaptation measures as well as how successful implementation of each would be measured. Ensuring that a low-income community has equal or even greater access to community centers during extreme floods may be equitable, but the continued existence of and lack of transformational change addressing the flooding (and its interruption to daily life) means that it may still not be just. Given the growth and importance of environmental justice as a movement and as a concept, it deserves a larger discussion and analysis. At the bare minimum, the concept of climate justice should be defined in the same way other important terms are introduced throughout the chapter. Additionally, an expanded discussion of justice would provide an opportunity to mention the significance of grassroots environmental justice movements and give an example. Bottom-up approaches are briefly referred to in	Thank you for this comment. There is an International chapter in this report where this is described in more detail. We agree that vulnerability discussions should be nuanced and context-specific. We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues.
Margaux	ALFARE	Whole Chapter	31. Adaptation						Dear writing committee, I am currently a student at Columbia University in the City of New York, pursuing the MA Climate and Society. As part of one of my classes, we were asked to submit a comment letter on Chapter 31 - Adaptation from the NDA report. I am not in any case an adaptation professional. However, considering the set of questions from Dr. Allison Crimmins (Is the science accurately represented? Is the text clear to understand? Does this meet the needs of state and local governments and communities? What should authors consider prioritizing/ deprioritizing?), and given the knowledge I,Âôve gained over the past semester, I have identified some elements throughout this chapter that raised questions and that would require some clarification. I will structure my comment around the various sections presented in this chapter, in order of appearance for the sake of clarity. Table: Example Climate Adaptation Actions or Measures to Enable Adaptation (p.4) Table 4 offers a great overview of the various tools and strategies available to implement adaptation measures and eventually achieve transformative change. The table is extremely exhaustive, but not very illustrative: an example of Capacity Building is Community Building. What does it mean? I understand that the report cannot provide examples for every single concept presented, but some concepts listed in the table are hard to grasp. One suggestion would be to include a hyperlink for each of those concepts that would lead to a glossary with a definition and an example to illustrate it. Except for the ‚Áúchanges to diet and food waste‚Äù solution included in the ‚ÄúPractice and behavior‚Äù column, there is very few emphasis on behavioural change (i.e. change in individual habits). This is an aspect of adaptation that I find is often lacking from reports such as this one. Most reports focus on institutional, systemic change, but rarely on consumption habits (which is also closely linked to mitigation strategies). Is this lack of focus intended? Why is individual behavioral change not included as an adaptation strategy? There is no definition for ‚ÄúGreen Infrastructure,‚Äù which I believe could be useful, especially given that the report is addressed to diverse audience who may not be familiar with this concept. The Evidence of Progress and Barriers of the U.S. Along the Five Adaptation Stages gives a broad	Thank you for this comment. There is a Glossary for this report and these terms will be hyperlinked to the Glossary so the reader can follow along with these terms in the main content of our chapter. Since this is a national report on adaptation, we remain light on going into explicit detail on individual actions for adaptation, which is why we've included Table 31.1 that provides some select examples of adaptation measures, but is not exhaustive. In KM2, we have language on the lack of capacity for local governments to navigate state and federal bureaucracy. We hope the examples (e.g., English language skills, personnel, resources) make this clear. This sentence has been revised to make the concept clearer and how it could be one example of ways to integrate equity into adaptation. The author team has deliberated and prioritized the information to include. Here, we point to the references for more detail on how to structure effective communication.We agree definitions are helpful and defined as many terms as possible throughout the chapter. Space constraints limit the number of examples that we can include in the text. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter.
Kaitlynn	Zack	Whole Chapter	31. Adaptation						The National Climate Assessment,‚Äôs intention is to compile and assess the science behind climate change and how it impacts the whole of the United States, in present day and into the future. The Adaptation Chapter of the Fifth National Climate Assessment does just that. The chapter starts with a clear breakdown of the progress and barriers within each of the five adaptation strategies mentioned in the chapter, acknowledging what has worked and what needs to be focused on more/improved in the future (pages 6-8). Breaking down the strengths of current adaptation measures and assessing the barriers that have halted progress helps to increase legitimacy and transparency. This has the potential to create future progress by helping to break down some of the barriers mentioned. In saying this, it‚Äôs important to note that the chapter is simply relaying what barriers are present. The mention of these barriers is not a weakness of the chapter itself but of the system at large and of the adaptation efforts/measures currently in place. Without addressing barriers and acknowledging their existence, they cannot be broken down and worked through. In this way, the mention of them is actually a strength of the chapter. In learning to evaluate different climate science reports and assessments, one must cover the importance of maintaining salience, legitimacy, and credibility. The Adaptation Chapter of the Fifth National Climate Assessment strives to achieve all three in a number of ways. One of the biggest examples of it doing so can be seen in its discussion of Transformative Adaptation. It very importantly defines the differences between ‚Áúadaptation,‚Äù and ‚Áúresilience,‚Äù (page 29), distinguishing the two to support the chapter,‚Äôs points and the science it discusses. The in-depth evaluation of short-term vs. long-term adaptation strategies is also essential to support the argument for adaptation measures that no longer preserve the status quo, but rather encourage more bold action to be taken (Page 9). The chapter distinguishes these short-term vs. long-term strategies using examples that affect people in their day-to-day lives and proves how conventional coping mechanisms and the incremental adaptation that we,Âôre used to will no longer suffice. Instead, the chapter suggests we utilize a combination of incremental and transformative adaptation, recognizing that both have their strengths and weaknesses but can work much better when used together. While the chapter stresses the need for transformative	Thanks for the comment. It is not appropriate for the NCA to be prescriptive on how different funding streams can/should be leveraged to support adaptation.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Olivia	Cosio	Whole Chapter	31. Adaptation						Overall, the draft of the 5th NCA,Âõs Chapter 31: Adaptation covered all of the most essential aspects of adaptation including risk perception and tolerance, barriers to adaptation, and some of the uncertainties that are considered when discussing adaptation. Most of the document was accessible and the use of graphics and clear headings made it easy to navigate and understand. However, some sections could be strengthened by including some of the barriers to adaptation that are not mentioned, such as biases and heuristics among folks which create difficulties in adaptation efforts that promote equity and resilience. Key Message 31.2 ‚ÄúAdaptation and Equity,Âù was one section I was happy to see because of how crucial equity is when it comes to both incremental and transformative adaptation. Equity and humanity should be at the forefront of adaptation efforts, as many of the most vulnerable communities are the ones which face the greatest risk of climate-related consequences such as susceptibility to flooding, rising insurance premiums, and lack of resources to make evacuation plans in the face of natural disasters. The draft,Âõs explanation of vulnerability was clear yet broad, encompassing the various aspects of wellbeing that contribute to vulnerability. It would be helpful in adaptation efforts to have this definition as a framework for how to address the complex idea that is vulnerability within the context of climate change adaptation. It was also great to see that the document mentioned the relationship between vulnerability and marginalization of disenfranchised groups, and how systems of oppression have heightened the risks and vulnerabilities these groups face today (Chapter 31, p. 13). All of these messages were cited with high confidence as well, strengthening the argument for addressing the systemic challenges of vulnerability within the context of adaptation. Box 31.1 Evidence of Progress and Barriers of the U.S. Along the Five Adaptation Stages was one section I feel could be improved by addressing some of the social factors that may act as barriers to adaptation. For instance, Adaptation Stage 1: Awareness includes evidence that there are still some who do not fully understand their climate-related risks, which is a barrier to awareness (Chapter 31, p. 6). However, it is also worth noting that political and social biases influence how people respond to climate change. Heuristics are evident in the ways in which particular populations perceive climate change as well. The availability heuristic often comes into play when those who have not experienced climate	Thank you for these comments. We appreciate your positive feedback! We direct the commenter to the Social Systems chapter. We address these points more thoroughly in the main text. KMs 1 (equity) and 3 (governance) both go into detail regarding challenges to collaboration and coordination, so we do not expand on them here for space constraints.
Lingchao	Ye	Whole Chapter	31. Adaptation						Comment for NCA_5 Chapter 31 Adaptation Introduction The NCA_5 Chapter 31 mainly focused on the adaptation for climate change around the globe, evaluate the five adaptive stages stage for U.S and provide five key messages as suggestions for policy makers and the public as a reference on what to expect for the future of climate change adaptation and how these changes have weight in each sector. By the time this bill is in effect and execute, it is expected to bring improvement for our communities in combating climate change and understand the methodology of effective adapt to climate change. Strengths of Chapter 31 The overall structure of bill is precise and clear for any audience since the second page give a clear chapter content and each part can be easily located with a clear title on the table of content. The introduction part is well formatted and clear, especially with table 31.1, example climate adaptation actions or measures to enable act. In the table, 10 different examples are mentioned, and each example are from different but closely connected field. Personally speaking, the highlight of this part is that it gives audience, no matter you are public or experts in climate change field a quick warmup of what the bill is concerned with and clear any possible barriers for misunderstanding of the content. The next main structural part is Box 31.1 which demonstrate five adaptations stages for U.S and mainly focused on the progress and barriers of what we have been facing. The structure for this part is clear as well since in each adaptation stage, the current situation is separated into two sections, and it is easy for audience to view and understand. In addition, the reference, and data in this part, even though not as detailed as main five Key message part, served its purpose and precise demonstrate how the process have gone so far and which part need more effort. For the five Key message, every part has similar structure that start with a general introduction of the key message that conclude the content, sufficient reference and graph that further support the claim so that the conclusion being made is strong and persuasive. Take key message 31.2 as an example. The first part gives an introduction for the whole part and each sentence have so called ‚Äúconfidence level Âù to	We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. The Key Messages have been revised and reordered to first emphasize equity and we have re-organized the text for better narrative.
Iqbal	Lisan	Whole Chapter	31. Adaptation						The adaptation section of the US National Climate Assessment (NCA) is simple to understand. There are five sections discussed, and each one is clearly explained. The science has also been appropriately conveyed, as well. For each chapter, nevertheless, there are several comments provided. The comments' specifics are as follows: Comments on the introduction section and Box 31.1: Only the capacity building column in the table of examples of climate adaptation initiatives includes the term "coproduction." Co-production should be specified for all types of actions, such as management and planning, policy, information, and so forth. This seems to suggest that coproduction only takes place while developing capacity. Coproduction must therefore be rethought not just as a program but also as a "concept" or ‚Äúprinciple,Âù for carrying out adaptation. (page 31-4) Evidence of awareness progress is only mentioned in Box 31.1 and only applies to "American adults." As a result of numerous polls on American knowledge of climate change, efforts are required to further define this category. By describing the level of American awareness based on factors such as gender, age, socioeconomic status, political preferences (republican or democrat), environmental factors, and so forth. (pages 31-6) The document only provides evidence of advancement at the level of researchers and practitioners who are attempting to monitor adaptation practice and implementation in the adaptation stage four: implementation part. Participation from the local community, CSOs, NGOs, and the commercial sector can help to improve this. Additionally, since this might occasionally be a very big barrier to the implementation of adaptation, it is important to mention "lack of political will from the authorities" in the evidence of barriers section. (page 31-7) Comments on the transformative adaptation section: Although transformative adaptation has been explained, a firm definition has not yet been provided. Additionally, adaptation that integrates climate change within the development of socio-political relations of class, ethnicity, gender, production, and livelihoods is known as transformative adaptation. In order to "look beyond" the climatic causes of change and into the intricate entanglements of social	Thank you for your comment. We have included a sentence in the introduction of this table that emphasizes the co-design and co-production aspect of these actions. The authors felt it would not be helpful to disaggregate by segment of American adults based on our thorough review of the literature. We have added "lack of political will from officials" as a barrier in this section. We agree definitions are helpful and defined as many terms as possible throughout the chapter. The chapter text has been revised to touch on the strengths and limits of varying levels of engagement in science. We have included a more in-depth discussion of the social and equity aspects of maladaptation in KM2. We agree that vulnerability discussions should be nuanced and context-specific. We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues. KM3 notes that effective adaptation governance is flexible and responsive. Additionally, we highlight that both top-down and bottom-up adaptation approaches have been used to date. We concur that there is not a single approach (centralized or decentralized) which is more appropriate for all settings. KM 2 (Equity) discusses ideas of intersectionality and diversity in depth. Due to space contstraints, we have not added a discussion of stakeholder mapping to KM3 (Governance), other than highlighting the roles that different types of organizations play in governance. We agree about the importance of cross-sectoral and cross-scale collaboration, and KM3 has been written to emphasize this. We provide a definition of equitable adaptation that speaks to both intentionality and accountability. We also discuss evaluation of adaptation processes as well as outcomes in KM 4. KM3 discusses the need to include diverse voices in decision-making, including special attention to disadvantaged and underrepresented groups. We also highlight the challenge of building adaptation governance in existing institutional structures. The chapter text has been revised to touch on the strengths and limits of coproduction and how that relatest to different forms of knowledge. We believe the section is clear on the challenges created by a limited knowledge on where adaptation-related investments are being made.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Ece	Bilen	Whole Chapter	31. Adaptation						Dear Dr. Allison Crimmins, This is a letter of comments regarding the Fifth US National Climate Assessment Report Draft,Äôs adaptation part that has been open to public comments since November 7th, 2022. First of all, in a general scope, National Climate Assessment Report Draft for Adaptation part would be helpful and relevant for policy and decision-making processes of government, states, and cities in the US. The introduction on page 3 is clearly written, and the context is understandable. However, the part where examples are given about adaptation actions or measures is not detailed enough. To make it more understandable, more detailed real-life examples can be given, and definitions can be explained for the general public who does not know the terms very well to understand the concepts easier. Secondly, starting from page 6, in the adaptation stages part, the planning stage is demonstrated well and concisely. However, as it is done in the adaptation stage of planning, this stage is lacking, and the strengths of these stages should be added to the report for other stages as well. It would help to show people possible shortcomings and strengths so they can understand the adaptation stage better and decide on which stage they are in, in the adaptation process, or how to apply those stages in real life. The next comment includes the topic of what would happen if these adaptation measures will not be followed on page 8. It is highly important that the report mentions the challenges and severe consequences if the adaptation strategies will not be applied, and adaptation measures will not be taken. Also, on the topic of Transformative Adaptation, which is on page 9, the difference between transformative adaptation and incremental adaptation is explained well and it is easy to understand with the given examples. One of the most important weaknesses of the report is starting from page 13, the report starts to get harder to read and understand due to the usage of field-related jargon. In the report, there are various jargon and field-related specific terms, which are not known by most people, are used which is confusing to individuals who do not have much experience in this field or do not know the meaning of these terms. For everyone to understand it, it should be clearer and more concise. It is important for everyone to understand it because it affects lots of people. If all people can understand it, there would be more	We greatly appreciate the reviewer's comment.The text has been revised to incorporate this suggestion/information. We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter. Given the lack of space and word count, we cannot go into as much detail as recommended with this section. We have referenced the five stages of adaptation so the reader can go to NCA3 and NCA4 to understand each stage. We have strengthened the language in the introduction to emphasize the urgency of adaptation.We agree definitions are helpful and defined as many terms as possible throughout the chapter.Thank you for your comment. The Social Systems and Justice chapter also covers more detail on social equity and the specific populations within the US. A different chapter is dedicated to Tribes and Indigenous Peoples. Increasing diversity and representation in future assessments is a priority. We include text on evaluation research to help determine what situations call for what level of interaction and modes of technical support. We agree that vulnerability discussions should be nuanced and context-specific. We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues.
Molly	Kimball	Whole Chapter	31. Adaptation						To Dr. Allison Crimmins: My name is Molly Kimball. I am a student in the Climate and Society Master‚Äôs in Arts program at Columbia University. I have reviewed Chapter 31 ‚ÄúAdaptation,‚Äù of the Fifth National Climate Assessment (NCA 5), which aims to analyze and review the impacts of global change in the United States. Chapter 31 focuses on Adaptation in the United States. The assessment includes both applicable and theoretical analyses including the Current Progress and Barriers of Adaptation, Transformative Adaptation as a Strategy, Adaptation Equity, Adaptation Governance, Sciences and Services in Support of Adaptation, as well as the Economics of Adaptation and Adaptation Financing. This NCA 5 assessment critique will include commentary on the whole Adaptation chapter. In general, chapter 31 ‚ÄúAdaptation,‚Äù is clear and concise. This makes it comprehensible to various audiences including those who may not be as familiar with climate adaptation in the United States. The assessment includes brief descriptions of key terminology throughout the text. This is helpful to include as it reduces risk of any confusion and a lack of understanding. Additionally, arguments are strengthened by providing additional context,‚Äîit reduces any gaps in the literature. There is a lack of scientific jargon or communication barriers within the text which also aids in clarity. The assessment remains organized with each section broken into ‚Äúkey messages,,‚Äù which focus on different areas of adaptation within the United States. The science in the chapter of this assessment is both accurate and robust. The use of graphs and figures throughout the chapter to showcase the scientific findings is helpful because it explains complexity through the use of visuals, tables, and graphs. This aids learners at many areas of understanding. Furthermore, most of the sources used in this chapter of the assessment include the latest research to date, which makes the arguments made in this chapter of the assessment most relevant and robust. Overall, chapter 31 of the NCA 5 assessment does indeed meet the needs of state and local governments and communities. It broadly touches on many aspects of adaptation in the United States. This broadness allows it to be open to interpretation and may have a wide array of Adaptation strategies and background that could be fitting for different kinds of communities within the United States.	We agree that vulnerability discussions should be nuanced and context-specific. We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues.
Nicklaus	Smith	Whole Chapter	31. Adaptation						Hello! I‚Äôm Nicklaus Smith, a current Master‚Äôs candidate at the Columbia University Climate School. I‚Äôm commenting in accordance with an assignment for a class called ‚ÄòManaging and Adapting to Climate.‚Äô The views expressed here are my own but are by no means a recommendation to the authors, for my expertise is limited. Thank you for your work, and I hope my contribution proves to be insightful for anyone reading. Overall, this chapter on Adaptation is incredibly well-executed and sounds the call for proper governance in regard to climate adaptation. The graphics, design, and statistics used throughout the piece are incredibly engaging and easy to follow, which is incredibly important in making climate adaptation measures more accessible to individuals who may lack the scientific literacy to deduce climate issues themselves or may not be privy to the NCA‚Äôs extremely important work. Additionally, identifying research gaps and the calls for future research to be done makes this an incredibly astute report that acknowledges the need for continued revision as we receive new data and information regarding climate trends and projections. The point that adaptation plans are largely reactionary to acute disaster is particularly poignant. If retroactive measures are implemented solely based on previous data collection and findings, how can we adequately plan for the uncertainties of regional climate impacts? As we project multiple different emissions scenarios, it is difficult for policymakers and scientists to select which preventative and adaptive measures might be the most effective in the face of climate uncertainty. However preemptive adaptation measures would most likely soften the blow as regional climate impacts continue to compound with frequency and intensity over the coming years. This is contingent upon another excellent point made in the chapter: that local governments‚Äô adaptation abilities remain inequitably distributed across geographic regions. While a systems approach is absolutely necessary for realizing the interconnectivity of large-scale system components, local governments differ in their economic allowance for adaptive capacities, making the systems-based implementation of preemptive and reactionary measures far more unattainable for immediate use. Yet, the mere decision to even implement adaptive measures on a policy level is largely dependent on	We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Camila	Arzola	Whole Chapter	31. Adaptation						Dear NCA Director Dr. Allison Crimmins, I hope this letter finds you well. My name is Camila Arzola and I,Âôm a graduate student at the Columbia Climate School. The first draft of the Adaptation Chapter (31) in the US National Climate Assessment is a well articulated and clearly expressed chapter on the adaptation measures that need to be taken moving forward. It is relevant for policy and decision-making, without forgetting the complex array of aspects and stakeholders that must be addressed and taken into account. Throughout the entire chapter, the text was clear to understand. The introduction set the stage for what will be discussed, and why it should be discussed. Adaptation and everything it encompasses is defined early on in the text. In the first third of the document, the adaptation progress that needs to be adopted and the barriers that need to be overcome in the United States were highlighted in a five adaptation stages model. The actions needing to be taken, both incremental and transformative at all levels and sectors across the United States, were stated. The text also demonstrates the clear limitations, referred to as barriers, of how far adaptation capacity assessments have gone and the imminent threat that will come if these measures are not taken. Towards the end of the chapter, the key messages are outlined with a description of the evidence base to back them up, but also the major uncertainties and research gaps that must be taken into account, and whether there is a high degree of confidence or not in the quality of the literature. Giving this sort of skeleton to the chapter gives a very clear and concise way for the reader to understand the logic behind the steps that must be taken. This is one of the stronger aspects of the report, as it gives a clear picture of where adaptation measures are in the United States. In the introduction section of this chapter, the anthropogenic climate changes were stated clearly and accurately. The harmful effects on the planet we have already started to experience are described in an easy to follow and simple manner. This is a good way to start the chapter as it enables the reader to understand why the measures wanting to be implemented are relevant to the climate crisis. Throughout the chapter, scientific evidence and data are factually represented. It is explained that the translation of said data and its usefulness may pose a challenge to the non-scientific community. It is mentioned that	We thank the reviewer for the comment. We clarified that psychological and other qualitative barriers mostly represent soft limits, meaning they can be overcome with financial, cultural, technological, or institutional changes.
Adam	Stickney	Whole Chapter	31. Adaptation						The introduction is clear and intelligibly articulates the impacts (frequency vs intensity) of climate change on the human world. It equally well addresses what exactly is meant by ‚Äúadaption,Äù within the climate nomenclature. Being a chapter on adaption, the assertion made that climactic hazards would continue to intensify even if CO2 emissions are ‚Äúmitigated,Äù is essential -this should evoke more attention and importance to adaption. Chapter 31 does a good job at explaining the current climate situation and policy within the US. It explains why there are difficulties currently within implementing adaption, and that incremental and transformative changes need to happen -but the direction of the change is considerably vague. Of course, different regions and localities have their own hazards and barriers, and they can,Äôt all be addressed, but ‚Äútransformative change,Äù doesn,Äôt significantly help the situation. The hesitancy to avoid prescribing specific policy detaches it too far from engendering tangible climate adaption policy. There should be room in the middle to help steer the specific direction of change and prevent unproductive ambiguity. The chapter is full of equivocal sentences like: ‚ÄúCreating adaptive systems will require fundamental changes across multiple systems and sectors,Äù (page 20 line 8). Terms like ‚Äúnovel,Äù when addressing transformative change are also vague and can be misleading. Novel doesn,Äôt mean good and could lead to maladaptation. Perhaps including explanations as to what makes a novel change good, and how novel changes could also be detrimental and counterproductive. Novel changes in local governments and communities could lead to increased risk and uncertain outcomes. However, the vagueness of Chapter 31 does allow for more freedom from local governments and communities when trying to make policy change. While it may not help them with specific policies, it can be used to support a plethora of adaption policies. Most of the chapter can be easily referenced to help endorse a wide range of adaption policies, and hopefully this will help pass climate adaption legislation. It,Äôs clear that equity is a high priority in this chapter. Environmental justice has come a long way in the past few decades, and equity would not be as prioritized 20 years ago. This is a good change seen in society, and while it Äôs difficult to quantify, the chapter is persistent in recognizing the complex	There is no data available at the scales mentioned in the comment. We thank the reviewer for this comment, but the suggestion to summarize conclusions from independent studies - beyond the bulleted list early in KM 5 - is outside the scope of the report. Each chapter must follow the structure of Key Messages and supporting text, and conclusions are not a part of the format.
Katherine	Parker	Whole Chapter	31. Adaptation						To Whom It My Concern, As of November 7th, 2022, the Fifth US National Climate Assessment Report Draft has been open to the public for comments. Regarding this report, I was able to review the 31st chapter based on adaptation and compile thoughts and considerations for improvements. The overall understanding of this chapter is to present a clear definition of climate adaptation and the need this to occur. The use of tables, graphs, and specific lists can make it easier for the public to prioritize their focus. On page 4, the table describing different adaptation policies are a good way to educate those who are not familiar with the terms. However, what may be more beneficial would be to frame a similar setup with details on how to promote these actions and how local communities and governments will implement this. Additionally, the layout of adaptation stages on pages 5 and 6 promote a framework for adaptation and provide a clear goal. However, the layout of having the barriers to each stage may provide to be confusing if placed right after the description for each stage. The barrier sections may be discouraging to a reader and could distract them from the purpose of each stage. It may be more beneficial to state the barriers in another section so that the stages are presented in a more direct and well-defined way. Another example of a clearly defined goal was the label of transformative adaptation being the main goal for communities and governments to focus on. This adaptation was defined as involving fundamental shifts in systems, values, and practices to address current and future climate risks. While there is less framework on how this may be done, having a defined consensus of what goal to achieve, it is easier then to start to build a framework on how to reach it. Throughout the report, there is insufficient detail on the climate science that should go behind the adaptation goals. Mentions of climate have been observed in the report detailing that across the US climate change has resulted in changing precipitation patterns, sea level rise, and higher temperatures. Another positive thing about the report is that it mentions that climate change will increase the severity and frequency of weather and climate hazards as well as change baseline conditions as stated above. However, what may be more beneficial would be to provide data on how this will create extreme	Thank you for this comment. We have adjusted the format of this table to address this suggestion. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.There is a separate chapter dedicated to the physical science of climate and climate change. Research gaps are highlighted in the Traceable Accounts.We have included a more in-depth discussion of the social and equity aspects of maladaptation in KM2. We have included references to risk perception and risk tolerances as drivers of adaptation choices. Unfortunately, given our space constraints, we are unable to fully review all the important factors (e.g., risk tolerance, place attachment, social capital, perceptions of fairness). The chapter discusses the potential value of proactive adaptation, but also notes the barriers to enabling it.Ways to better finance adaptation are covered in depth in KM5.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Savanna	Patino	Whole Chapter	31. Adaptation						To the Authors of Chapter 31: Adaptation, My name is Savanna Patino. I am a graduate student in the Climate and Society Master of Arts Program at Columbia Unviersity. The following are my comments on the US National Climate Assessment (NCA), Chapter 31 entitled Adaptation. Chapter 31 (Adaptation) does well in meeting the objective of the Assessment in the context of the US National Climate Assessment (NCA). It presents a logical synthesis of the current body of scientific and technical knowledge regarding climate change adaptation. It includes data and analysis from individual studies and models, and it applies best professional judgement in order to bridge any uncertainties between findings. This chapter presents a consensus-based view of the state of science, and it remains relevant for policy and decision-making. It does not prescribe any specific policy interventions or advocate for a particular viewpoint. However, it does present some examples of the types of interventions and strategies that are mentioned to aid in explanations. The chapter appears to be fairly objective, while also prescribing to the idea that action is necessary to properly minimize risks from today,Äôs changed climate conditions and to prepare for future impacts. This chapter appears fully compliant with the Global Change Research Act (GCRA), as well as any other applicable laws. It makes these policies authoritative, timely, and transparent. Overall, this chapter does well in meeting the standards of Assessment set out by the US National Climate Assessment (NCA). In regards to the Key Message 31.1. Transformative Adaptation section, the current body of science is accurately represented. The text is clear to understand, especially for the purposes of this assessment. It meets to needs of the state and local governments and communities, especially when it comes to addressing vulnerabilities across different modes of a system. This section of the chapter holds a slightly more subjective tone regarding incremental change vs. transformative change. However, it is important to establish that transformative adaptation will result in more sustainable change, so this tone is warranted. The authors should consider prioritzing the topic that transformative adaptation can be more difficult to implement based on demographics of an area, and that it should be taken into consideration by assessing hotties when developing strategies for adaptation. It is more important to break the barriers	We greatly appreciate the reviewer's comment about the report/chapter and hope that the content is useful. We agree that vulnerability discussions should be nuanced and context-specific. We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues. We have included a discussion on maladaptation and equity, including a discussion on how maladaptation can displace risk or create greater inequities. We have reordered the KM3 text to hopefully make the benefits of coordination and collaboration more explicit and visible.We thank the reviewer for the comment. The KM on sciences and services has been renamed and expanded focus on technical assistance. We agree definitions are helpful and defined as many terms as possible throughout the chapter.
sunera	rahman	Whole Chapter	31. Adaptation						Dr. Allison Crimmins Director, National Climate Assessment U.S. Global Change Research Program Office of Science and Technology Policy Re: NCA5 Third Order Draft (Ch. 31 Adaptation): Public Review Dear Dr. Crimmins, I appreciate the opportunity to provide suggestions during the development of the important climate assessment of the draft 5th National Climate Act (NCA5). This comment is based on Adaptation (Chapter 31). Chapter 31 delivers key messages about observed and projected impacts of climate change to the United States, along with significant challenges and gaps in knowledge regarding vulnerabilities and adaptation concerns. The 56-page unit represents a robust foundation of climate change science derived from diverse literature. The important topics are well-designated and presented as key messages. The information and analyses are equally comprehensive. The introduction presents the concepts of incremental vs. transformative adaptation and stresses the need for long-term planning, implementation through ‚Äúnew governance mechanisms, models of civic engagement, and processes for valuing, developing, or sustaining a wider range of societal benefits,‚Äù (pg.3). Table 31.1 recommends a summary of ten adaptation actions, Figure 31.1 displays a progression of adaptation across the US, and Box 31.1 gives evidence of progress and barriers of the US along five adaptation stages: awareness, assessment, planning, implementation, and monitoring and evaluation. The section highlights the urgency for better adaptation management with considerations for equity and justice. The unequal nature of climate vulnerabilities, on varying social, physical, and ecological levels, are raised throughout the document, appropriately highlighting the focus on historically marginalized populations. Throughout the document, ideas of credibility, legitimacy and salience are given adequate priority. Recommendation:	Thank you for this comment. There is an Overview chapter in the report, we have cross-referenced the regional chapters, and have added case studies where appropriate. We agree definitions are helpful and defined as many terms as possible throughout the chapter. The chapter text has been revised to touch on the strengths and limits of coproduction and how that relatest to different forms of knowledge. We have included a discussion on maladaptation and equity, including a discussion on how maladaptation can displace risk or create greater inequities. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. The chapter text has been revised to incorporate this perspective. The chapter text and figures have been revised to address missing elements and add clarity.
Hannah	Lin	Whole Chapter	31. Adaptation						To Whom it May Concern, Thank you for the opportunity to comment on the National Climate Assessment (NCA) Chapter 31 Adaptation. This comment comes from a current graduate student of Columbia University,Äôs Climate and Society program, with a four-year working background in green workforce development and residential weatherization. I would like to share some thoughts and answers about the NCA Adaptation Chapter in response to four questions posed by the NCA Director: Is the science in the chapter accurately represented? Is the text clear to understand? Does this meet the needs of state and local governments and communities? And what should the authors consider prioritizing or deprioritizing? Science Overall, one strength of the chapter is how systemically it is categorized. As a result, the method behind the science of tackling adaptation is clearly laid out. The climate science throughout the assessment is cited clearly and represents a variety of perspectives from stakeholders across different industry and geographic backgrounds. In that sense, the science seems accurately represented. On the other hand, I would argue that there are limitations for how well the science behind adaptation is represented, particularly as a field dominated by social science. The chapter itself recognizes this, and transparently several times the challenges, major uncertainties, and research gaps of evaluating a field that is nascent, extremely local and fragmented, and not well understood (p30-36). The science behind adaptation, however, could greatly benefit from community-based knowledge systems that are legitimized as important data and information. Specifically, in Table 31.1 of the chapter, explicitly including community-based knowledge can help further facilitate knowledge exchange and create the foundation for equitable partnerships. There was one section I wanted to see more evidence of on page 6, line 13-14, where the text states ‚ÄúThere is low risk awareness still and a lack of clear understanding of adaptation and its importance in the solutions space.‚Äù Where is the science behind this statement? Or is it a misunderstanding of the term solution space?	We thank the reviewer for the comment. The chapter text has been revised to touch on the strengths and limits of coproduction and how that relatest to different forms of knowledge. We agree definitions are helpful and defined as many terms as possible throughout the chapter. We agree that risk perception and psychology are important aspects and drivers of adaptation. We have included references to risk perception and risk tolerances as drivers of adaptation choices. Unfortunately, given our space constraints, we are unable to fully review all the important factors (e.g., risk tolerance, place attachment, social capital, perceptions of fairness). We talk about tansformative adaptation in the introduction. The full figure (31.3 in the public review draft) will be available in the final report. The definition of equitable adaptation includes evaluation and in key message 4 we have included qualitative metrics as important evaluative approaches.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Chloe	W	Whole Chapter	31. Adaptation						Dear Contributors to the 5th National Climate Assessment, Thank you for your contributions in the text. This comment will specifically focus on chapter 31 on Adaptation. The chapter on adaptation is insightful and covers a range of topics in the consideration of how to implement successful measures to reduce climate change related risks now and in the future. This chapter especially points out what is lacking in the process and what kinds of supports are needed to carry out better climate adaptation plans. However, it is obvious that the NCA can be improved in many aspects to serve its purpose. This essay would serve as a comment for potential improvements in this draft of the NCA. First, while acknowledging the many valid statements the text is providing, the text itself is broad and includes materials that should be better organized. In the section with Table 31.1 on Example Climate Adaptation Actions or Measures to Enable Adaptation, the sections are divided into separate action plans with more detailed action items in the description section. While it is conclusive of what areas we should direct our adaptations measures to, it misses a better organization of the structure of this table. Currently, the table is not clearly presenting the actionable items by local governments and communities. With that said, the table is detailed but it lacks directions for local communities and governments to act on. The actionable items should be better organized in terms of importance and the units responsible for each action. For example, the table could add another column after actions and before description to further clarify and sub-categorize the action items. In the row for practice and behavior, the items are not sorted in a logical order. The added column could suggest the order of importance and could help organizations to find their own relevant sectors and responsibilities. Secondly, as the NCA research paper also points out on page 31-8 27, currently, more efforts are put into ‚Äúplanning to adapting‚Äù rather than the works to actually ‚Äúadapting‚Äù. This paper itself is also largely doing the work of planning rather than sharing insight on the actual plan. Since we are already observing many disasters and effects of climate change in the news and in our communities, the NCA should make it clear and provide some details in the solutions and suggestions in solving this issue rather than merely pointing those out. The NCA must be urging the community more positively in their	We thank the reviewer for the comment. We revised the order alphabetically and clarified terms. We do not imply a judgment on order of importance. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues. The Social Systems and Justice chapter also covers more detail on social equity and the specific populations within the US. A different chapter is dedicated to Tribes and Indigenous Peoples. Increasing diversity and representation in future assessments is a priority. The chapter text has been revised to touch on the strengths and limits of coproduction and how that relatest to different forms of knowledge.
Alexandra	McGrath	Whole Chapter	31. Adaptation						The adaptation reasoning and strategies outlined in Chapter 31 were clearly presented and well outlined overall. The chapter fell short in areas that could have defined specific solutions for certain regions of the country and details regarding how the government would engage with communities to focus on transformative action. The science behind climate change is acknowledged and clear though not explained in depth in this chapter. This did not take away from the chapter as the main focus of this specific section was defining adaptation, discussing the costs to implement, and illustrating the consequences of using certain plans over others. The text and tone of the section was easy to understand and summarize, which makes the information accessible to a broader audience. The area that could be the most improved in the chapter would be prioritization of strategies and a more detailed action plan for implementation. Weaknesses Throughout the chapter, the audience should understand what must be done to combat climate change in the most effective manner. The chapter often left the reader unsure of what exactly governments and local leaders should do in terms of next steps. Also, there seemed to be no solution presented for the lack of funding towards climate adaptation efforts. Without sufficient funding, none of the transformative actions presented can be accomplished. Therefore, a primary point in the article should have been how local and state governments can get more funding for climate change adaptation projects. There was discussion of certain transformative adaptation in the chapter, but little explanation regarding how the action will be funded. None of the strategies presented in this chapter can be implemented without adequate funding. The chapter does mention that many states face difficulty in determining whether funds should be earmarked for adaptation or mitigation. Chapter 31 claims that funding is a significant barrier to implementation efforts; however, the section would have benefited from detailing how additional funding could be obtained on the federal, state, and local level. The audience would have benefited from learning about new and creative methods community leaders are using to obtain funding for their residents. Early on in the chapter, the assessment cartips discusses how only 40% of states	We thank the reviewer for the comment. The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Discussion of policy options is beyond its defined scope. The chapter text has been revised to touch on the strengths and limits of coproduction and how that relates to different forms of knowledge.
Olivia	Shehan	Whole Chapter	31. Adaptation						After reading the prepared chapter draft, the following observations and suggestions have been organized for the authors review. These guiding questions from NCA Director Dr. Allison Crimmins were used to evaluate the chapter and structure feedback: Is the science accurately represented? Is the text clear to understand? Does this meet the needs of state and local governments and communities? What should authors consider prioritizing/ deprioritizing? Overall the science in the chapter has been accurately presented and thoroughly researched. It is clear that a significant literature review was conducted, pulling research from the thirteen supporting government agencies and beyond. Dozens of sources were cited to support the evidence and recommendations shared in the chapter, highlighting instances of adaptation progress and obstacles across the United States. If anything, a weakness of the chapter is that too much information was provided. There was a constant stream of facts presented throughout the chapter, making it hard for the audience to walk away with a deeper understanding of climate adaptation in the United States. One suggestion for improvement, is to select some key points that can be illustrated further using examples from the vast library of cited materials. For example, on page 31-19, the Coastal Zone Management Act (CZMA 9972) is noted as example of federal, state, tribal, and local government coordination that could be a model for other adaptation programs, but the authors do not include why the CZMA 1972 gets it right when so many other programs do not. Obviously details cannot be given to each point made due to length considerations, but here and in other key sections, two to three more sentences for elaboration will help add depth that is currently lacking. Not only will it strengthen the science being presented, it will also help make the text clearer to the audience. Another strategy to increase the clarity of the text is to utilize more figures. It seems that there is already an effort to procure more figures based on some of the placeholders used throughout the chapter. This is a step in the right direction and the authors should review if there is an opportunity to add more. This could also be another way to incorporate more case study examples into the chapter	We thank the reviewer for this comment, but the suggestion regarding CZMA and additional examples of adaptation is outside the scope of the report. We are revising figure 31.4 to include cross scale interactions and that some actions are undertaken by multiple actors.We also direct the commenter to the Regional Chapters, where far more detail is provided on regions.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Victoria	Hamilton	Whole Chapter	31. Adaptation						To whom it may concern, The US National Climate Assessment (NCA) is a unique opportunity to provide policymakers the most up to date information on climate change and more importantly how to respond to it. Below is a synthesis of comments highlighting the strengths and weaknesses of the Chapter 31: Adaptation. To begin, an assessment like this must include a proper evaluation of a body of scientific or technical knowledge that summarizes individual studies, data, models, and assumptions. A strength of the NCA is its ability to properly assess the science. Climate change is a complex problem because it spans both the physical and social sides of science. For example, the NCA clearly examines the concept of adaptation from both angles. In the Introduction, adaptation is well defined in terms of increasing resiliency across social, economic, and ecological sectors. To add on to the scientific accuracy, the NCA stresses the difference between planning for adapting and adapting itself. Under Adaption Stage 5: Monitoring and Evaluation, it lists both environmental and human consequences for not adapting. This includes from death, ecosystem failure, health problems, economic inequalities, and increased stress on government services. Once again, the NCA bridges both physical and social science together well throughout this chapter. Another strength of the NCA is the text is clear and transparent. Part of the reason for this is the assessment,Âôs inclusion of several definitions regarding adaptation. For example, Table 31.11 defines the following terms: capacity building, management and planning, practice and behavior, policy, information, physical infrastructure, early warning or observing system, green infrastructure, financing, and technology. All of which are important to understand when policymakers are assessing and/or creating adaptation measures. Throughout the document there are several figures which both science and non-science audiences can understand. For example, Figure 31.1 shows a map of the United States and the overall progress of adaptation activity, the color coding has dark green representing the highest numbers of adaptation activities. This is easy to read, easy for non-traditional science audiences to comprehend, and effectively demonstrates which areas need the most attention in the adaptation space. Another figure (Figure 31.3) simplifies how a variety of social factors, which can result in unequal	Thank you for your comment. We appreciate the feedback and observations. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. We agree that vulnerability discussions should be nuanced and context-specific. We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues.
Skyler	Nourse	Whole Chapter	31. Adaptation						Dear NCA5 Authors, I am a student at Columbia University in a Climate Change Managing and Adaptation class; we are reading and leaving a comment for our homework assignment. Firstly, in chapter thirty-one, page six, there is a statement made about how ‚Äúthere is low risk awareness still and a lack of clear understanding of adaptation and its importance in the solutions space,Âù (Ch 31, Page 6). What does risk awareness refer to? This is not clear to someone who is not a specialist within the field of adaptation measures. Within this section, it could be useful to show what research indicates as a successful way to help risk awareness go up in regard to climate adaptation. How communities perceive risk also has varying factors, such as cognitive, experiential, socio-demographic, social, and cultural factors, and other biases and heuristics (Hornsey et al. 2016). Even though this resource strays away from being policy prescriptive, it can be helpful to incorporate principles on how people perceive risk since it is so heavily correlated to climate adaptation action. Including successes in expanding the public,Âôs climate risk awareness would be beneficial within this report, and this should be prioritized at a higher level because it can help meet the needs of state and local governments as well as communities that need to implement climate adaptation. This assessment was able to concisely state where the United States continues to lack in Climate Change Adaptation and management; page seven of chapter thirty-one gives a list of what the lack of barriers to planning. This is relevant to include as it can succinctly give an outline of significant ways Climate Adaptation is currently lacking (Chapter 31, Page 7). This can help the public understand where measures still need to be focused on. On page seven in chapter thirty-one, it states that ‚Äúimplementation of adaptation actions has made some progress since the Fourth National Climate Assessment was released,,Âù this is helpful to include but would be necessary to expand on; it is not apparent where there has been progress, and perhaps areas that have not made progress can learn from the examples of other areas that were able to make improvements. On Page 7 of the NCA5, it states that ‚Äúresearch is now focused on implementing adaptation actions, identifying adaptation-enabling governance structures, and evaluating barriers to adaptation (Nalau and	We thank the reviewer for the comment. We agree definitions are helpful and defined as many terms as possible throughout the chapter.We agree that risk perception and psychology are important aspects and drivers of adaptation. We have included references to risk perception and risk tolerances as drivers of adaptation choices. Unfortunately, given our space constraints, we are unable to fully review all the important factors (e.g., risk tolerance, place attachment, social capital, perceptions of fairness). We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter. The reference to Berrang-Ford et al and Hicke et al was intended to cover the entirety of the quote. We have moved the reference to make this clear. KM 3 has been revised to address how collaborative governance helps navigate competing goals and interests. Multiple sources have documented the need for multiple streams of investment, from both the public and private sectors. Given the scale of adaptation investment needs, it is very unlikely that all can be met through public sector funding.
Adrienne	La Forte	Whole Chapter	31. Adaptation						Chapter 31 on Adaptation of the NCA5 seems well-researched and well-organized. The study of adaptation methods, progress, and barriers exists largely within the realm of the social sciences, and social science concepts can sometimes fail to translate when transposed over the ‚Äúhard sciences.,Âù However, the authors appear to represent the science accurately, including a diverse list of references and figures to aid reader comprehension. Most of these figures are easy to understand ‚Äì like the layout of Table 31.1 and the accompanying graphic. Some, though, have more confusing designs, which could detract from the readers,Âô understanding rather than enhancing it. Figures 31.3 and 31.4 are slightly unclear and may benefit from a more structured approach rather than arrows indicating the flow of concepts between certain areas. In contrast, Figures 31.5 and 31.6 are clear; readers are most likely familiar with the concept of graphs and axes and should be able to interpret these with relative ease. Most of the text is easy to understand. The writing style is suitable for a variety of audiences; scientists and policymakers alike should be able to understand the contents. However, there are a few instances where the text was confusing ‚Äì most likely from simple typos. For instance, on page 31, line 20, the sentence reads, ‚ÄúPeer-reviewed on the topic has grown moderately in the last five years.Âù There appears to be a missing word here, and the text should more likely say, ‚ÄúPeer-reviewed literature on the topic has grown moderately in the last five years.Âù Another such copywriting error can be found on page 31, line 17: ‚Äú¶depend on efforts to address broader social injustices. Adaptation Governance.Âù The inclusion of ‚ÄúAdaptation Governance,Âù at the end of the sentence seems to be an error and should be removed. In terms of the layout of the document, another potential issue can be found in the lack of headings or otherwise clearly delineated sections. Within the Table of Contents, the sections are clear, but the text within the report is so dense that a reader could be confused as to which section they are in. The authors should include headers at the beginning of each section and at the top of every page identifying the Key Message that the reader can refer to. Additionally, the document could benefit from the inclusion of a glossary. Readers will likely know most terms, especially if they work within the climate community. However, there are certain terms that it	Thank you for your comment. Additional clarifying elements have been added. It was a formatting error introduced by track changes.We have updated the text to include "low carbon" ahead of "transition planning" to be more specific.Thank you for noting the lack of clarity in our terminology. We replaced "candidate" with "successful", to indicate that horizontal linkages can facilitate lateral adoption of adaptations that have been used in other locations. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Georgia	Monaghan	Whole Chapter	31. Adaptation						To the National Climate Assessment Adaption Authors, RE: Call for Public Comment - Fifth National Climate Assessment Following a review of ‚ÄúChapter 31: Adaption‚Äù of the ‚ÄúFifth National Climate Assessment,‚Äù (NCA) and the questions posed by NCA Director, Dr Allison Crimmins, the following letter outlines a number of strengths, weaknesses and recommendations to consider for the next iteration of the chapter. Accurately represented science Throughout the chapter, the authors have comprehensively surveyed the scientific literature concerning climate hazards, exposure, vulnerabilities, cascading and compounding climate risks and adaptation solutions. While the paper draws from the concepts discussed in the Intergovernmental Panel on Climate Change (IPCC‚Äôs) Sixth Assessment Report (‚ÄúClimate Change 2022: Impacts, Adaptation and Vulnerability,‚Äù), the authors should have actively drawn out the connection to the international literature. This would have both grounded the US science within an international context and provide the opportunity for comparison or evaluation against global progress. Box 31.1 provides a high-level yet comprehensive, science-backed assessment of the progress and barriers of the US along five adaptation stages. However, there are few solutions offered to these barriers. Recommended remedies to the barriers or a direct connection to the ‚ÄòKey Messages,‚Äô across the following sections would help translate these insights into something more practical for the report,‚Äôs audience to implement. Illustrative figures and diagrams are provided throughout, which help visualize the Key Messages and underlying science (e.g. Figure 31.3 ‚ÄúFigure 31.3. Adaptation Actions and Outcomes Defined by Multiple Factors). In some places, however, more granular detail as to the underlying sources,‚Äô data, assumptions and findings would have been beneficial to help visualize figures. For example, while Figure 31.1 provides an informative heatmap of the progression of adaptation activity across the US, it would be helpful to interpret this map with the addition of information regarding the scope, assumptions and data of the underlying resources. The report does a good job of synergizing Indigenous knowledge and governance approaches, and even	Thank you for your comment. The International chapter addresses your suggestion to identify how the US is and might continue to play a role in various other regions of the world to address climate change. Additionally the Social Systems and Justice chapter also covers more detail on the specific populations within the US that are vulnerable. Since this chapter is intended to summarize adaptation in the US, we focused mainly on what is happening in this country. The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Discussion of policy options is beyond its defined scope.The traceable accounts and figure metadata include details on the adaptation activities summarize in Figure 31.1. A different chapter is dedicated to Tribes and Indigenous Peoples. We agree definitions are helpful and defined as many terms as possible throughout the chapter.The suggestion to identify adaptation options for state and local governments is outside the scope of the report.The author team has deliberated and agreed on the most relevant information/illustrations to include. It is beyond the scope of this report to review adaptation impact models, and few exist.
Karl	Greenfield	Whole Chapter	31. Adaptation						This 5th National Climate Assessment reflects a turning point in our collective understanding of the threats climate change poses. Essentially now we know that we know less about what will happen, something well explained in lines 14 and 15 of chapter 31. However the consensus gleaned from the literature review is that the negative effects will certainly fall on those who live at the margins of society. Climate change will ‚ÄúCause extreme variability in weather conditions, a trend called non-stationarity that challenges current management systems,‚Äù and planning for these changes is further evidence of the turning point we have reached. The assessment does well to show that adaptation means acting now to prepare for the future. This means changing from incremental adaptation to transformative adaptation. The text is clear: transforming society will require remedying historic inequalities and bringing into the conversation a diverse group of stakeholders. Capacity building which entails community building, coproduction, and other methods is a good idea. However, not adequately delving into the federal, state, or local laws that have reinforced inequalities over the last hundred years at least does not provide adequate information for policy making. Certainly a lack of partisanship of policy prescription is key, yet simple history be it legal or social would serve those interested in crafting transformative policy interventions at all levels of government. Adaptation is necessary because tipping points have rendered gradual adaptation unfeasible. Figure 31.1 shows adaptation activity across the USA. We can see that coastal states are those most likely to have a greater number of adaptation activities. The review handles the need to expand cost estimation of adaptation outside of traditional realms like coastal zones well. Proactive adaptation has greater benefits regarding cost reduction of transformative or incremental change. A deeper dive into the types of adaptation in coastal states would be informative. Coastal states are in many cases wealthier and more populous, could this play a role? Are the projects in the states based around coastal adaptation, or energy, or environmental justice: perhaps all of the above? Defining projects would allow us to accurately assess the need for further improvement nationwide. On the local level the interpretation of the psychology of risk is something that should be prioritized. Political action in	We agree definitions are helpful and defined as many terms as possible throughout the chapter.Thank you for this comment. We agree that risk perception and psychology are important aspects and drivers of adaptation. We have included references to risk perception and risk tolerances as drivers of adaptation choices. Unfortunately, given our space constraints, we are unable to fully review all the important factors (e.g., risk tolerance, place attachment, social capital, perceptions of fairness). The text has been revised to incorporate this suggestion/information. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.
Chinwude	Nwana	Whole Chapter	31. Adaptation						The US National Climate Adaptation (NCA) draft presented the evidence of progress and challenges of different stages of adaptation as well as mechanisms for adaptation seen across states. These evidences of progress and challenges were described according to the confidence and likelihood based on the consensus and quality of literature reviewed. However, there are improvements that can be done to augment the positive attributes of this NCA draft. Although the scope of the document is national, the concepts discussed are accumulated from the regional/local level. Thus, there could be a better incorporation of examples from communities and regions through the use of case-studies to explain concepts that are common to other areas. An instance that a case study would have been useful is in demonstrating how the identification of synergies and trade,‚Äôoffs between adaptation options helps resource,‚Äôconstrained local governance as proposed in the NCA draft. A good example of this could be the Climate risk assessment in Jamaica Bay ‚Äì NYC which analyzed the different adaptation options for handling increasing sea level rise. The adaptation options adopted included the synergy between gray infrastructure and nature-based infrastructure at different edges of the waterfront based on the landscape and hydrology. Another instance could be a case study that demonstrates that the NCA draft,‚Äôs assertion that climate service efforts in the US are not necessarily optimal even when formal risk assessment tools are available. This case study could compare a U.S city,‚Äôs climate risk assessment with the C40 climate change risk assessment guide recommendations to shows gaps that make the risk assessment ineffective for adaptation planning. A third case study that could be useful is to address the NCA draft,‚Äôs observation that the critical mass of adaptation cost analysis in the US focuses majorly on coastal zones and flooding. This presented an excellent opportunity for a case study of adaptation cost analysis of other common hazards such as wildfires or droughts in different parts of the U.S. A value-add could include comparing the difference between the costs of adaptation for different types of hazards. The benefit of these case studies is that they provide real-life examples that supplement the summaries from the literature review making it easier for state and local governments and communities to view their problems (and solutions) in others; if not then, to understand the material in a simpler language	We call attention to the fact that funding for adaptation is difficult to track. Information on green infrastructure is available in the Built Environment chapter among others. Additional comments are beyond the scope of this report. Improved approaches to monitoring and evaluation are covered in depth in KM4. Additionally, we highlight the need for evaluation as part of the definition of equitable adaptation. We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Guiller Lorenzo	Cenizal	Whole Chapter	31. Adaptation						To whom it may concern, I hope this letter finds you well. My name is *Redacted* and I am a Masters Candidate in the Climate and Society program at the Columbia Climate School. I am writing to you with regard to the United States National Climate Assessment Act (NCA). With my expertise being predominantly in policy analysis, sustainable development, and urban planning I found a few interesting points,Âîboth good and bad,Âîto comment on regarding the NCA. As someone who has drafted and analyzed policy, I would like to preface that I do understand the realities of policymaking. Its nature is oftentimes simultaneously semantic and vague; written in a manner that is difficult to consume; and has a large focus on quantifiable metrics. Not to mention that, especially at a national level, advice is particularly difficult due to government partisanship. As a congressionally mandated report, the NCA has to navigate this difficult terrain. With that being said, the ethos or purpose of chapter 31 is meant to address and express the need for adaptation in current and future climate plans,Âiif that is the only goal of this chapter then it achieves this with great effect: vulnerability indeed exists and there is a need for a concerted effort to adapt. The strongest aspect of this paper is its relatively accurate usage of scientific data and information. Oftentimes, where governmental reports succeed the most is in what is quantifiable and observable,Âîhiring and using a number of experts with interdisciplinary backgrounds is easy for governing bodies to do. However, with that being established, the nature of the research and how it is communicated is an entirely different matter. As was stated earlier, writing for and by policymakers is often difficult to digest and read and this assessment is no exception to the rule. The simultaneous need for ambiguity (in order to be able to interpret the outcomes in different ways) as well as specificity (to balance any sort of abuse of said outcomes) are the main reasons why not everything can be covered. From a technical standpoint, since this assessment is mandated by a governing body, using legalese and syntax would be perfect for the audience (policymakers, lawyers, and experts), but with regard to communicating this to a greater public audience, it leaves some to be desired. As this is a draft, my recommendation would be to keep a format like this for the policymakers and experts (as this is what is	To the point about the clarity and jargon, we agree definitions are helpful and defined as many terms as possible throughout the chapter. To the point about the state climate assessments, consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. That extends to science policy recommendations re: states creating formal climate assessments. However, the chapter does reference how many states have them to illustrate the evidence base. We have restructured and reordered the KMs for better emphasis and narrative. However, prioritizing adaptation actions is beyond the scope of the report.
Abigail	Menendez	Whole Chapter	31. Adaptation						To Whom it May Concern, In the following letter, I will discuss essential areas that the authors should prioritize and elaborate more on, ways to increase the clarity of the text, especially to enable individuals outside of the climate field to understand the report, and the ability of it to meet the needs of state and local government. I am a graduate student in the Master of Arts in Climate and Society at Columbia Society. My studies have provided me with both the scientific background around climate change and the societal implications. Coming as someone who has not always been in the climate field, it can be challenging to understand climate reports simply due to a lack of vocabulary knowledge. One of the critical items that can be included in the report to increase the clarity of the text is a glossary of terms that should be included at the beginning of the chapter to ensure the audience fully understands the information. The climate field utilizes a variety of words that are not accessible or part of a shared vocabulary for individuals outside of the field. A glossary is also needed for state and local governments and communities to fully understand the chapter and analyze and implement the information helpfully. The adaption chapter does an excellent job of embedding definitions of terms throughout the different sections of the chapters; for example, page three defines adaption. It is also beneficial that the chapter repeatedly restates the definitions in different sections. However, it would be beneficial to include a glossary of terms at the beginning of the chapter that the audience can read before immersing themselves in the information of the chapter. The terms should still be re-defined throughout the chapter as they are now. On page five, there is a table with adaption actions with descriptions of each. This table is easy to understand, as well as refer back. A similar table or glossary of terms should be included at the beginning of the chapter. Thinking from the perspective of state and local governments, it would be beneficial for the report to elaborate more on different adaptation practices, especially a breakdown by state. Page five includes a figure that illustrates the progress of adaptation activity across the United States between 2018 ,Âì 2021. Including a distinction of state-level adaption on the map, designated by the lines on the map, of adaption activity across the United States is beneficial. The report includes this distinction. However, including a pie chart or table with the adopted types or major adaptation strategies could be beneficial	We agree definitions are helpful and defined as many terms as possible throughout the chapter. Unfortunately, the underlying data on adaptation actions does not provide that level of detail.We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter. The chapter text has been revised to touch on the strengths and limits of coproduction and how that relatest to different forms of knowledge. We are adding a discussion of some federal programs that are being taken to address systemic barriers to resources (such as Justice40 and reforms in the BRIC funding). Additionally, there is a separate chapter that deals exclusively with tribal knowledge and organizations. A comprehensive resource guide is beyond the scope of the chapter. We agree that vulnerability discussions should be nuanced and context-specific. We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues. We agree that vulnerability discussions should be nuanced and context-specific. We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues. We agree that risk perception and psychology are important aspects and drivers of adaptation. We have included references to risk perception and risk tolerances as drivers of adaptation choices. Unfortunately, given our space constraints, we are unable to fully review all the important factors (e.g., risk tolerance, place attachment, social capital, perceptions of fairness).
Guillermo	Martinez	Whole Chapter	31. Adaptation						First and foremost it is important to state that the chapter is well articulated and clearly establishes the adaptation landscape for the US. Overall it follows a conductive structure that facilitates the reading process and makes it easy to understand. The Introduction sets the context for the need of Adaptation and what will be further discussed in the following sections. The Adaptation stages present practical information regarding the advance of each stage and the limitations. This portrays a clear picture on what lines should be followed and what is still needed. The Key Messages section is nicely structured as each one defines the concept utilized in the respective key message (such as Adaptation Services), the problems and issues around them and multiple examples on how to address them. These examples not only focus on the ‚Äúpositive,Âü expected outcomes but provide a bigger picture on the rights and wrongs. Given that the target audience is policy and decision-making persons that do not necessarily have a strong science background, it is important to have a friendly-structure that soothes the process of reading. All sections seem to be science-based as the Introduction sets a background and justification of the urgency for an increased adaptation action. Throughout the Introduction section, science-based facts are presented and clearly define the link between greenhouse gasses (GHG), the anthropogenic climate changes and climate related hazards that require an adaptive response. This is an excellent starting point as it enables an understanding on why adaptation measures need to be implemented. The chapter includes scientific evidence and data that factually back the facts stated. The Key Messages sections include science backed literature too, as the Traceable Accounts section includes the process of development, the evidence and the uncertainties. This structure is extremely helpful as it allows the traceability of the facts presented, and stresses gaps that should be addressed in future editions, without overcrowding the Key Messages section. An area of improvement for all sections is to be more explicit in how to improve the coordination between federal and state institutions. The needs of state and local governments and communities seem to be inconsistently presented throughout the sections. The Introduction section includes a map that compares the Progression of Adaptation Activity Across the US (Figure 31.1, Page 5). The map is	Thank you for this comment. We have added language on the role state and federal agencies will play in reducing barriers for access to adaptation resources. At this point we do not have quantitative information on adaptation-related financing and investments at state and local levels for reasons that are explained in the chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Guillermo	Martinez	Whole Chapter	31. Adaptation						Key Message 1: Transformative adaptation clearly defines the transformative adaptation concept and further compares it with incremental adaptation. Figure 2: Incremental vs Transformative approaches isn‚Äôt very intelligible as it is not clear which side includes transformational examples and which side is incremental. Additionally, regardless of the Transformative concept being constantly pointed out as critical for a better future, some statements contradict the seemingly main idea of the Key Message. One example is the statement that neither incremental nor transformative adaptation is always preferable (Page 12, Lines 1-2). It seems that the chapter wants to introduce an urgent concept, but also includes plenty of examples on why it isn‚Äôt the best option. To address this confusion, including more examples on how to discern when Transformative adaptation may be adequate could be useful. Key Message 2: Adaptation and Equity has a good approach and - again - it clearly defines central concepts such as vulnerability, susceptibility, constraints on adaptive capacity and maladaptation. This section seems a little bit messy as the link between the concepts introduced and equity is not distinctly established. For instance, some paragraphs effectively link the concepts (Page 13, Lines 8-13). Nevertheless other paragraphs fail to display the connection of the concerts with equity, such as the parts that assess in depth the maladaptation concept (Page 16, Lines 6-8). The examples provided (the trees used to reduce urban heat and also representing a risk if a hurricane hits) are not deeply related to maladaptation. It is not necessarily taking into consideration inequities, it seems more about a flawed implementation of a project. In this sense the concepts introduced are relevant for cross-cutting adaptive actions, but the examples of the section fail to display how they relate to equity. Key Message 3: Adaptation Governance asserts that effective and equitable adaptation governance requires more intentional engagement ideally over a sustained period (Page 18, Lines 18-20). The word choice of ideally isn‚Äôt the best, as the purpose of the section is to emphasize the importance of multiple stakeholder engagement over time. It should be a requirement for governance to have a lasting engagement by all parts. The paragraph statement should be more vigorous. The word adaptive (located in Page 19, line 33) has a typo. Key Message 4: Science and Services in Support of Adaptation and Key Message 5: Economics of	We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter. We've removed the tree element to help clarify why the examples provided are both maladaptation and concerns for equity. We have removed "ideally", as we agree that sustained engagement is a best practice. And thank you for noting the typo on p. 19, which we have fixed.Thank you for this comment.
Maya	Korb	Whole Chapter	31. Adaptation						Dear Dr. Crimmins and the authors of Chapter 31, My name is Maya Korb and I am a graduate student at Columbia University. Chapter 31 of the National Climate Assessment provides a clear overview of the progress and continued challenges of climate adaptation planning and programs in the United States. Other chapters in the NCA deal with deep dives on the sectoral (eg. water, transportation, air quality) and regional impacts being experienced or anticipated by climate change. Chapter 31 is one of two chapters on the country's response, looking at how processes can be improved to manage climate risk through the lens of social and economic dimensions. The pathways to building a more climate-adapted country are clearly articulated throughout the work, relying frequently on peer-reviewed studies and government reports that reveal best practices seen in adaptation activities. The report adds immense value to policy and decision makers as it builds on the evidence-based foundation presented in previous chapters on strategies and approaches to protect communities and ecosystems against climate risk. With this in mind, there are a few notable points where feedback can be considered by the authors. Addressing different scales of adaptation needs The authors present a clear thesis throughout the chapter that although actions in the past have been generally small scale and ‚Äúincremental in approach,‚Äù ‚Äútransformative adaptation will be necessary in many cases to adequately address risks of current and future climate change,‚Äù (p.9, line 7-10). Ultimately, it is clear there are more ‚Äúperceived and actual barriers for implementation of transformative adaptation than incremental approaches,‚Äù (p. 12, line 6-7). The analysis into opportunities, barriers and risks of pursuing both approaches is well received and important for policy and decision makers to consider. However, the chapter could be improved through greater detail as to how transformational adaptation exists at different scales (local, state, federal). The chapter leans heavily on local adaptation research, as this is where most adaptation activities take place (p.12, line 36). However, more discussion on what transformative adaptation looks like at each level would be valuable to policymakers, to provide insight into how those processes can be achieved, without being prescriptive.	We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter. The chapter text and figures have been revised to address missing elements and add clarity.The introduction has been revised to clarify the context and the terms and format of the table will be improved in the final report. Unfortunately, the underlying data does not provide sufficient detail to provide additional detail on state level adaptation activity.
Stephen	Yaeger	Whole Chapter	31. Adaptation						Chapter 31 of the National Climate Assessment provides a very useful summary of the rapidly changing climate adaptation landscape in the US. It excels in several areas. Its consistent acknowledgement that the communities most vulnerable to climate change tend to be the ones with the least access to adaptation resources is essential. Its nuanced focus on transformational adaptation is a strength, as is its focus on equity. And overall, its emphasis on understanding local conditions and prioritizing local leadership is very important. The following are instances where the report could be improved, expanded upon, or clarified to make its message even more effective.	Thank you for the positive assessment.
Jillian	Nash	Whole Chapter	31. Adaptation						To whom it may concern: Hello, my name is Jillian Nash, and I am a student at Columbia University studying in the Climate and Society Master‚Äôs program at the Climate School. I have read and reviewed the third order draft of chapter 31 of the NCA 5 and I have a few thoughts as someone who will be working in the field shortly, and will most likely be referencing this document within my career. Thank you for your time, and I am happy to answer any questions that you may have about my comments. You can reach me at jbd2156 at Columbia.edu Overall, the structure of the chapter lent itself to the reader getting lost along the way through it. The flow of the text is confusing, and it was very easy to lose track of where one was and where the information was heading. Having the subsections of Key Messages was needed, but perhaps it would behoove the chapter to include a section that would relate the Messages to one another to help show the complexity of adaptation. With the importance placed on gathering information to support adaptation efforts, a short case study within each Key Message may be useful to demonstrate the types of projects that might help create some of the information that is being sought out. Showing an example will ensure that the reader has a clear idea of what and how information is being retrieved for this research. It might also be beneficial to include an example of a case that did not work as anticipated, or created contrasting information or nonoptimal results. An example of what not to do is sometimes more helpful than advice on what to do. The final part of this chapter, the Traceable accounts on page 29, was seemingly the most important information to receive, so it was not helpful to have it placed at the very end of the text. This section helps establish the legitimacy of this chapter and its contents. It also sets out the very important distinction between resilience and adaptation. The differing definitions are important in our line of work, and as stated, people do use them interchangeably, which can be confusing. Within the chapter, it seems that only the word adaptation is used, which is appreciated, but it is important to acknowledge the role of resilience and what it truly means. Resilience in the context of climate should, as is said on page 29, aim to not just return to the status quo	The Key Messages have been revised and reordered to first emphasize equity and we have re-organized the text for better narrative. We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter. We agree definitions are helpful and defined as many terms as possible throughout the chapter. We thank the reviewer for their interest in outside texts, but the suggestion is outside the scope of the report.
Ja'Pheth	Toulson	Whole Chapter	31. Adaptation						Chapter 31 Page # 9 Transformative adaption has stalled because many plans are reactive as opposed to being pre-active. Involving more stakeholders and having discussions with vulnerable communities can help accelerate and perhaps even change perceptions to influence new adaptation methods to climate change.	Thank you for this comment. We have added language to note the need for transformative adaptation decisions to engage with communities and to think about future conditions.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Alix	Dazin	Whole Chapter	31. Adaptation						Dear Dr Crimmins, Thank you for the opportunity to provide suggestions during the development of the Fifth National Climate Assessment (NCA5) in order to strengthen the draft and improve its ability to reach broad audiences and inform new and continuing adaptation responses to climate change. This letter will focus on Chapter 31 of the draft, which covers the important topic of adaptation. Overall, the draft chapter is easy to follow and logically structured around key messages. It frames the discussion around the topic of adaptation. The chapter accurately presents strong and broad science, with findings documented in a consistent, transparent, and credible way. The assessment of confidence and likelihood is communicated effectively. The chapter references an impressive number of articles and studies from peer-reviewed scientific literature to back up its claims. It also includes examples that align with key messages in the supporting text and figures. As a result of the science-based approach, chapter 31 manages to be relevant for policy and decision-making, while also meeting the needs of state and local governments and communities without prescribing specific policy interventions or advocating for a particular viewpoint. The chapter is also compliant with the Global Change Research Act (GCRA) and other applicable laws and policies, making it authoritative, timely, and transparent. It provides resources for readers wishing to explore any particular topic in more detail. The chapter introduction effectively presents the key messages. It explains why each key message is important and how they link together. The fact that the length of the key messages is mostly consistent across the chapter is appreciated (except KM 31.5.). It is interesting to see how the key messages have changed compared to the equivalent chapter on adaptation in the Fourth National Climate Assessment (NCA4). These changes reflect the fact that scientific research continues to advance understanding of climate change impacts and effective adaptation measures. In particular, the inclusion of key messages related to transformative adaptation and equity is very welcome. The term ‚Äúequity‚Äù features three times more frequently throughout the chapter than in the equivalent chapter in NCA4. The inclusion and emphasis of the concepts of	Thank you for this comment. We are working with our formatting and technical team to rearrange this section so that the five stages of adaptation are clearer.We revised the Introduction to explain the context for the table. "Things" here refers to elements or provisions of the guidelines, not related initiatives from the City of New York. Regarding the public workshops, please see the USGCRP website. The Traceable Accounts generally touch on areas of low confidence by discussing Major Uncertainties and Research Gaps.We had changed the word from "model" to "simulate" in the text.KM1 and KM2 highlight two key components of effective adaptation: equity and transformation. Rather than introucing a separate box, we use the KM headings to communicate those ideas.
Biyu	Yang	Whole Chapter	31. Adaptation						November 28th, 2022 Dr. Allison Crimmins Director, National Climate Assessment U.S Global Change Research Program Comment for the Fifth US National Climate Assessment(NCA) Adaptation chapter Dear Dr. Allison Crimmins, I am writing to comment on the 31, Adaptation Chapter of the Fifth US National Climate Assessment (NCA) Third Order Draft. The assessment does a good job of explaining different scientific words and helps with understanding the science behind climate adaptation, including various types of adaptation, existing problems in adaptation strategies, and how it connects with equity, government, society, and the economy. It provides good background information on current climate change adaptation strategies. Several improvements can be made to make the assessment more understandable, solid, and useful for local communities. First of all, some more details can be added to several statements to help understand the reasons behind them. On page 7, it states that existing adaptation strategies are not enough to adapt to future climate change. Specific case studies examples can be made here indicating what will happen if we remain in the current level of adaptation implementation to make people aware of the severity, and what are some regional examples that can be seen as a failure of adaptation to support this statement. Such as the case in the high Arctic, with more warming, the plant there has a lower survival rate that the adaptation is not enough (vÕgren & Schemske, 2012). In general, it is better to explain it in a way that can make the statement more visual to the audience. Also, the assessment can add more possible foreseeable solutions. On page 10, when explaining why transformative adaptation is implemented less than incremental adaptation, it does successfully explain it is due to its complexity, and how it can be a two-edged sword to different communities and groups of people. However, it does not assess possible solutions to deal with the difficulties or explain what can be done more specifically to deal with the problems. It only points out there is a problem without explaining	We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter. The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter. Discussion of policy options is beyond its defined scope. The suggestion to add a section on all laws related to adaptation is outside the scope of the report. The Key Messages have been revised and reordered to first emphasize equity and we have re-organized the text for better narrative.
Ciaran	McEnroe	Whole Chapter	31. Adaptation						Chapter 31 of the National Climate Assessment focuses on adaptation ability of the United States. The assessment itself defines adaptation as actions taken to reduce risks from today‚Äôs altered climate conditions to prepare for further impacts in the future. What this means is that adaptation is the method by which the US can minimize the damage done by climate impacts, be it through disaster or shifting levels of average temperatures, precipitation levels, or water access. Adaptation is related to, but separate from, mitigation and resilience. These terms are often less well understood by the public and are easy to confuse without prior knowledge or without a satisfactory explanation given by the authors of a particular publication. Mitigation is a series of actions taken to limit predicted future impacts of climate shifts that have not yet occurred, in an attempt to prevent the worst of those impacts from occurring. Unfortunately, the current state of the US, and most of the planet, has surpassed the point of mitigation and entered into a time frame where a focus on adapting to the new reality is required. For this aim, Chapter 31 of the NCS is an extremely timely assessment. This research is imperative to the health and success of this nation and the continued resistance against increasing climate damage. This assessment covers a vast scope of climate impacts in the US and the methods that the authors have identified to help cope with each. Immediately in the introduction, on the first page, the authors specify transformative adaptation will be required. For many years in the past, the lack of willingness to implement physical and social transformation and a resistance to consulting diverse stakeholders has limited the ability of governments to implement mitigative factors. A dearth of discussion with marginalized groups, groups who often face the greatest dangers from climate change, has forced those who fight climate change into various alternative solutions that are limited by the existing structures of power and funding. The only way to resist such a complex and global problem is by accepting and uplifting ideas provided from those communities that are witnessing, firsthand and currently, the changing environments that will eventually become the norm for most of the planet. Having the authors of a government published climate assessment focus on equity and differential access is a huge step forward in identified priorities. Additionally, in the same paragraph, the authors also identify two of the major types of climate impacts. Acute shocks are climate or weather events that are more extreme than	Thank you for this comment. We have rearranged the introduction to reflect the progress being made in the adaptation space more up front and relay the barriers and areas for improvement nearer the end of the introduction. Unfortunately, the underlying data does not provide the level of detail to further categorize adaptation actions at the state level. We have expanded the caption to clarify what "adaptation activities" mean. We agree definitions are helpful and defined as many terms as possible throughout the chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Xinyang	Jiang	Whole Chapter	31. Adaptation						Climate change is true and urgent. Actions are desperately needed to better adapt to the future climate conditions. While the world is actively working on adaptation strategies, there is still a huge gap between what is required and what is at presence. The US national climate assessment (NCA) provides a thorough and professional guide to different sectors across the country. While minor modifications can help to provide even more thoughtful guidance to sectors and the general public, if understood and followed as indicated, governmental and non-governmental organizations will gain great benefits. The assessment is successful at pointing out the existing problems and provide potential guidance. Graphs provided are informative, but the quantity could be more generous. Even if the assessment is not targeted for the general public who has less background in climate-related knowledge, there are multiple occasions in the report that concern their interests. Thus, the assessment should provide more detailed explanations on the potential benefits the public will gain. The assessment has a clear structure. Sectors should be able to understand their tasks easily based on the instruction. The assessment‚Äôs targets can also be easily interpreted given the sectors it addresses, which are governments, academia, and industries. These are the fundamental structures of the society and three sectors that should put in efforts to combat climate change in the beginning stage. Successful progresses exhibited in these sectors will push the other facilities to join the movement. This assessment will indeed help these sectors to develop toward a sustainable future. However, even though actions of the general public are not required as urgently as of the industry, they should still be educated with the current situation. The public needs more time to prepare to act. They must be led through the entire process step by step and rewarded either as a form of benefit or avoidance of punishment. In order to accomplish this goal, the assessment should at least mention potential changes and problems at a regional scale, for example, how climate change induced sea level rises will affect people residing in coastal regions and how can they react to it? Overall, the assessment has a clear illustration of the science. Descriptions are not sufficient to educate audience, but they can justify concerns mentioned in the assessment. After all, this is not a peer-reviewed literature but a guidance for people from all backgrounds who are concerned about climate	Thank you for this comment. The Overview chapter includes a few examples of direct and indirect benefits (or co-benefits) of adaptation, but we have provided a more hopeful overview to our chapter. section on incorporating technology, capital, and policy to solve the problem would be helpful; proactive adaptation will benefit society in many ways. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.
chanyoung	um	Whole Chapter	31. Adaptation						Thank you for the opportunity to submit comments on the notice of draft of the fifth National Climate Assessment (NCA). I am a graduate student pursuing a degree in climate and society and am keenly interested in the climate adaptation discipline.¬† I would like to raise concern regarding the general content in the Adaptation Chapter (31) of the assessment, which did not duly weigh the local and community needs and approaches with insufficiently raised critiques of so-called 'top-down' approaches. Even though the primary purpose of the assessment is policy and decision-making by synthesizing scientific or technical knowledge, it should be required to discuss from various points of view, especially critical discussions regarding the limitations of policy-driven measures in adaptation. Following the majority of research but also the prevailing concept in adaptation, government policy or technical solutions imposed by top-down decision-making has been critiqued due to ignorance of the specificities of place, impractical technologies, involving little to no consultation, and creation of resistance in local communities(Simon et al., 2020). To address these issues, various authors advocate for a more 'bottom-up' approach, seldomly expending Multi-scale or polycentric governance approaches to adaptation that comes from communities (van Aalst et al., 2008; Rouse & Blackett, 2011; PCE, 2015; Bell et al., 2017). At Key Message 31.1, the assessment urges fundamental shifts in systems, values, and practice but fails to suggest proper perspectives and alternatives for the transformative pathways. To tackle the limitation of conventional policy and decision-making and move beyond a silo approach to governance, the assessment should address the inclusion of community and local initiatives to transform the self-driven measures beyond the current discussion for evaluating and building adaptation capacity by local and community. Also, I'd like to add my impression of the part of content, pointing out the vagueness in planning and implementing adaptation for marginalized groups in terms of addressing equity. The adaptation section of the assessment points out the deficiencies of the incremental adaptation and describes the concept of the transformative adaptation method as the desired direction for encompassing the agenda on climate justice and equity. Transformative adaptation tackles the root causes of vulnerability, including unevenly distributed power relations and existing networks of control and influence (Schipper et al., 2021). In	We agree definitions are helpful and defined as many terms as possible throughout the chapter.We address this comment in Key Message 3 on Governance. We introduce and define equitable adaptation including related principles. We appreciate the suggestion, but space is limited. The author team has deliberated and agreed on the most relevant information/illustrations to include. We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter. We also direct the commenter to the Regional Chapters, where far more detail is provided on regions.
Reagan	Cerci	Whole Chapter	31. Adaptation						Hello, I hope you are doing well. I am a graduate student in the Climate School at Columbia University. As part of our course on Managing and Adapting to Climate Change we are leaving comments on this draft of the NCA. Please see the below comments and proposed solutions to Chapter 31: Adaptation. I hope they are helpful and/or productive to your work. Page: All Comment: The sections detailing barriers to adaptation would benefit from proposed solutions, or ways to overcome barriers. While prescribing policy is beyond the scope of this report, giving specific examples of proposed solutions in literature could strengthen the report. Proposed Solution: Add details regarding potential solutions to adaptation barriers. After each section titled ‚Äúevidence of barriers,‚Äù an additional ‚Äúpotential methods to overcome barriers,‚Äù section, or brief paragraph could be added, with examples of research that may lead to a solution. Example: Adaptation Stage 1: Awareness ‚Äì Evidence of Barriers Research indicates that personal experience of climate disasters has the largest impact on the belief that climate change can impact you personally (1). However, waiting for climate change to directly and drastically impact everyone will take far too long. Therefore, it would be prudent to explore potential avenues to increase risk awareness without depending upon personal experience. Research conducted on the Canadian shore indicates that presenting evidence in a clear and compelling format, building trust, and encouraging public dialogue are the most effective techniques to improving public risk awareness. It also details that creating more complex models (3D flood animations and web-based GIS maps) did not drastically improve risk awareness when compared to simple models (2). This and other methods of public information campaigns could be utilized to overcome this barrier to adaptation. Page: 6 Section title: Adaptation Stage 1: Awareness ‚Äì Evidence of Barriers Comment: ‚Äúlow risk awareness,‚Äù is vague and could benefit from further description. Proposed Solution:	We thank the reviewer for the comment. The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Discussion of policy options is beyond its defined scope.We agree definitions are helpful and defined as many terms as possible throughout the chapter. The key message related to science, services, and technical assistance touches on what contributes to actionable research in more detail. We thank the reviewer for the comment. Please see the traceable account for more detail.The colors and labels are being revised to clarify the intent and purpose of the figure. Thank you for your comment on Figure 31.3. The tribal boundaries map is in development; it will not be blank in the final version, but was not available in time for public review. Additional clarifying elements have been added. We agree definitions are helpful and defined as many terms as possible throughout the chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Josh	N	Whole Chapter	31. Adaptation						To Whom It May Concern: I am a graduate student in the Climate School at Columbia University, and I am writing in response to chapter 31 of the fifth NCA draft. It is imperative for climate science to be communicated in the most accessible and understandable language. Chapter 31 provides a thorough and accurate assessment of climate adaptation in the United States, although adjustments can be made to the language in order to ensure that the assessment can be understood by all, regardless of scientific literacy. The introduction begins the assessment with a very strong foundation. Page 3 provides a definition of adaptation which effectively considers notions of justice and equity. Notably, however, the definition of adaptation does not account for resilience. The introduction would benefit from a definition of adaptation that is tied to resilience, in addition to justice and equity. In other words, adaptation, resilience, justice, and equity are all inextricably linked, and those interrelationships could be made evident in the introduction. This would enable all readers to proceed with a common understanding of the foundational elements of climate adaptation. Pages 4 and 5 provide a very useful table with examples of adaptation actions. These are valuable references, although perhaps the list should be alphabetized. Figure 31.1, however, does not define ‚Äúadaptation activity.‚Äù It is assumed that adaptation activities are synonymous to the adaptation actions and measures in Table 31.1, but perhaps that is an incorrect assumption. Figure 31.1 would be stronger if the progression of adaptation activity across the U.S. was broken down by each type of adaptation action, rather than a broad accounting, (i.e. how many states are utilizing green infrastructure versus how many states are enacting adaptation policies). It would be very useful to visualize the diversity of adaptation measures currently in use across the United States. The format of pages 6 through 8 is admittedly confusing. Lines 5 and 6 on page 6 discuss the range of political, structural, psychological, systemic, and normative barriers that routinely limit adaptation in the United States. However, there are no examples of these barriers. The report would benefit from an example of each type of barrier. The adaptation stages do include some examples; however, these are not as robust as they could be. In order to increase the robustness, each adaptation stage could include	We agree definitions are helpful and defined as many terms as possible throughout the chapter. Unfortunately, the underlying data does not provide the level of detail necessary to disaggregate by adaptation type. We have noted the role that historical discrimination and disinvestment play in shaping exposure, susceptibility, and capacity, and the role of state and federal governments to redress those issues. We have included references to risk perception and risk tolerances as drivers of adaptation choices. Unfortunately, given our space constraints, we are unable to fully review all the important factors (e.g., risk tolerance, place attachment, social capital, perceptions of fairness). This is expanded in detail in KM3 as well as in various case studies throughout the report. Half of this figure was unavailable for public review because of copyright concerns, but includes a graph showing prototypical pathways of incremental versus transformative adaptation.We have added a specific reference to the Justice40 initiative. Analysis of the federal funds distributed under the auspice of J40 is beyond the scope of this report. We used terms consistent with cited material and/or NCA guidance. We will continue to ensure consistency.
Brighton	Goh	Whole Chapter	31. Adaptation						Dear Reader, Chapter 31: Adaptation of the fifth US National Climate Assessment (NCA) clearly covers different aspects of adaptation in different sectors to ensure preparedness for further impacts and reduce risks. The fifth NCA accurately analyzed the effects of global warming and the necessary adaptation procedures that should be taken in the US at different scales to help slow down greenhouse gas (GHGs) emissions. Organizations at different scales will be able to act accordingly and respond well to human-caused and natural processes of global change with the help of this report. The science is accurately represented. The introduction clearly states why adaptation is necessary for reducing GHGs in the atmosphere. The report admits that adaptation, specifically in the US, has failed to garner the attention of investments and more needs to be done by following the actions listed in the table on page 4. These actions include planning, policy, green infrastructure, financing, and technology. Each action is required for the process to be smooth sailing. The fifty-six-page report does cover each action in detail. Early in the report, the five stages of adaption are early stated to allow organizations to follow and have a detailed process for implementing adaptation actions. The stages in order are awareness, assessment, planning, implementation, and monitoring & Evaluation. This report went above and beyond to share the progress and barriers of each stage. Doing so shows the audience that hiccups do happen and improvements do happen with the accumulation of baby steps. Figure 31.3 on page 15 shows the importance of hearing the voices of the community. Factors such as history, culture, and values shape the outcome. It is important to include a diverse pool of opinions to best help communities. This will prevent maladaptation which leads to inequality. Equity is one of the key messages as it is important to be inclusive as life experiences are crucial for providing the best aid. The next key message is adaptation governance. Figure 31.4 on page 17 clearly shows that not only are stakeholders, not only governments at the global and state levels, but tribal groups also play an integral role in bringing in knowledge and funding. Including science and services as the main topic is necessary though many do not understand. Deciphering for the reader will help for a smoother process. Funding is needed and an	Thank you for this comment. This figure will be revised in the final report.This comment relates to carbon accounting for greenhouse gas emission reduction, which is not a primary focus of this chapter. Mitigation of climate change is the subject of chapter 32.Key messages are meant to provide the high-level summary points. Additionally, a synthesis chapter will be created for the whole report.
Ally	Pecego	Whole Chapter	31. Adaptation						Dear NCA5 Authors and Contributors, Thank you for the insight and research into the meaning, processes, and need for adaptation identified within the United States. Reading through it, one can see that compiling each section into a concise yet clear explanation in the Fifth National Climate Assessment is no easy task, nonetheless, much is covered conscientiously. Overall, the goal of the NCA5 is to provide just and useful ‚Äúclimate services,‚Äù to relevant actors that can start making or continuing adaptation efforts, whether it be through: conducting more research, informing politicians and leaders, creating mechanisms for investment and funding to be recognized, etc.. Thus, the saliency of this report is dependent on the needs of state and local governments and communities, of those, local governments are explicitly stated as a critical avenue for future adaptation engagement in this chapter. Therefore, ensuring that the information provided in this assessment is applicable and useful for those making adaptation decisions is vital, and to do this the information must be easy to digest for all, but especially some who might not have an extensive background on climate change and adaptation. Since comprehension of this material is essential to its utility, maintaining a compelling narrative about adaptation in the US should be an underlying objective, and this is done through the easy- to-follow format, headings, and pertinent graphs and figures that appear in the chapter. Table 31.1, which breaks down different types of adaptation measures and provides descriptions of climate adaptation actions or measures to enable adaptation is great for readers that come from different areas of the climate field: policy, community activism, engineering, city planning, financing, etc.. Box 31.1 which elaborates the evidence and barriers of progress in the US along the five adaptation stages does a particularly good job of providing a story and timeline for adaptation actions, and acts as a good, albeit general instruction manual to start an adaptation project. Including the barriers within each stage can also help activists, assessors, planners, implementers, and monitors understand and overcome the issues that frequently arise. Within the box however, having examples of successful adaptation projects/actions case studies that clearly show what each stage could resemble would be beneficial. In addition, providing more	We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter. We added the number and percentage for state climate assessments. We agree definitions are helpful and defined as many terms as possible throughout the chapter.We appreciate the suggestion, but space is too limited to cover climate litigation in greater detail. The author team has deliberated and agreed on the most relevant information to include. The chapter has not been revised to address this comment.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
patrick	beckley	Whole Chapter	31. Adaptation						I am an environmental engineering graduate student providing comments on Chapter 31: Adaptation of the Fifth US National Climate Assessment (NCA) report. The NCA should increase the avenues to support equity and justice in adaptation efforts by increasing environmental education and accessibility to information. This can be done using different tools like technology and can help promote equity and environmental justice. Listed are recommendations to help achieve the goals mandated by the U.S. Global Change Research Program (USGCRP), to ‚Äúassist the Nation and the world to understand, assess, predict and respond to human induced and natural processes of global change.‚Äù Section 31.3 Science and Services in Support of Adaptation I am impressed with how contributors considered there would be gaps in addressing all equity issues related to climate uncertainty. Artificial intelligence was mentioned as a tool to help reduce uncertainty and hedge against unknowns by selection actions that work across multiple possible futures. However, any use of such technology should address potential bias when being implemented into communities. Artificial intelligence can have a tremendous impact and should be carefully studied. Reducing bias in data sets is possible with the inclusion of communities in creating tools and placing safety measures to account for information data cannot cover. While Artificial intelligence can help environmental challenges, it is essential to manage them properly. For example, using such tools to extract data sources for land cover and land-use change. Artificial Intelligence systems learn from what they see, so the avid inclusion of diverse communities in areas with high climate risk can help account for any bias throughout the process. Table 31.1 Example Climate Adaptation Actions or Measures to Enable Adaptation The ‚ÄúEarly Warning or Observing Systems‚Äù section should increase access to fire detection and emergency preparedness for rural and disadvantaged communities to help combat wildfires and increase community resilience. Social and economic factors play a role in the occurrence and the severity of wildfires. Disadvantaged communities are more likely to be victims of shoddy electrical jobs or equipment malfunctions than affluent areas. Low-income areas would therefore benefit from promoting high-quality water and standards, such as flammability standards and smoke alarm and sprinkler	Thank you for your comment. Additional detail is included in the section formerly framed as Adaptation Governance and specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count. We have highlighted a few examples of companies that are taking action on adaptation. Unfortuantely, we cannot recommend any specific types of companies who would be good partners and make collaboration with the government effective for adaptation as we believe all company types have a role to play.
Cameron	Corgard	Whole Chapter	31. Adaptation						To whom it may concern, My name is Cameron Corgard and I am a Columbia Climate School masters candidate in the Climate and Society 2022-2023 program. My expertise and writing have been heavily focused upon climate change, radicalization, and peace-building; geo-strategic and political climate security interactions; and sociology of accelerated risks from climate shocks. This letter is in response to requested public comment on draft five of the National Climate Assessment Act (NCA5) specifically chapter 31: Adaptation. Imperative note given to policy writing as a difficult and challenging task, especially through bipartisan political spheres, provides progress for our great nation. A powerful metric for climate adaptation, quantifiable data, is often associated with scientific and economic endeavors. Underscored by the ability to be replicated by others, this chapter holds a great deal of importance as a document to inspire other countries to take immediate adaptation measures in their own ways. Climate adaptation is fundamental to how we shape the future of our country but so too is it important to maintain a stance of leadership that developing nation-states look to for guidance. Our ability to care for our people as well as those abroad has long been highlighted in historical texts and movements, and the climate crisis presents an enormous challenge but within it comes opportunity. Many times over has local government spurred action on a federal level, whereby the opposite has taken place in reciprocal occurrence. In these instances there are plentiful resources that can bolster our adaptation strategy while also shifting away from greenhouse gas producers in increasing intensity and frequency. Social relationships between those who govern and those who are governed have never been perfect, though within a climate realm there is plentiful space to build and rebuild trust and faith in institutions across all scales. Some may see historically contextual periods as oppressed and oppressor while there‚Äôs always individuals and groups who push the ever-charging might of the American economy and political power on a path to victory and prosperity. Insofar as opposition to managing and adapting to climate change, the information must come in ways that are culturally responsive, if not led in part with indigenous and historically marginalized communities. In doing so our climate and people begin	We greatly appreciate the reviewer's comment about the report/chapter and hope that the content is useful.
Marifer	Rodriguez	Whole Chapter	31. Adaptation						After reading Chapter 31 on Adaptation, it is reassuring that the National Climate Assessment encompasses more than just physical climate changes, and there is in fact research going into monitoring and analyzing systemic social patterns. It is crucial to analyze social behaviors and barriers to adaptation because human action is extremely uncertain. Projections and estimates can be made about the physical environment with a decent level of certainty, but trying to predict what humans will do is much harder to measure. Therefore, trying to understand what factors hold people back from implementing necessary transformative action will be really important if there is to be an increase in resilience against climate change. It is appreciated to read about the chapter team and their different fields and varying levels of expertise. It would be unfortunate for an assessment discussing coproduction to ignore their own recommendations but gladly that is not the case here. However, there could be room to involve even more actors and non-technical experts, maybe activists or community leaders, to find out more about the barriers to adaptation and how cases that are successful in their adaptation efforts are taking their actions. The chapter does mention ways to increase coproduction and there are sections where information gaps are discussed so that is refreshing to see in an academic/political work. The science seems to be accurately represented throughout the entire chapter. Nothing stood out where it could seem like data was being used only to further a point. The sources all seem credible and having read some of the cited works, it made the chapter easier to understand. For people reading this, without having read any of the sources, it would still be comprehensive. Referencing the four cases was helpful in understanding how all the concepts exist in the real world. Providing the definition of confidence and truthfully stating the level of confidence in statements made throughout the chapter, will aid in increasing trust in the information presented. It is evident that the chapter team is trying to be transparent about the confidence that they have on the information being shared. To expand on the topic of comprehension, the text and style of writing was very clear. Although there are climate related terms and concepts, and the information was produced by professionals in academia and technical fields, everything was clearly written and explained well. Material like this is extremely valuable when shared	We thank the reviewer for the comment. The chapter text has been revised to touch on the strengths and limits of coproduction and how that relatest to different forms of knowledge.We agree specific examples of existing and potential adaptation measures are helpful. We both refined the description of specific examples and added wherever possible within the word count throughout the chapter. Thanks for the comment. Unfortunately, the underlying data does not provide that level of detail.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Samuel	Lavine	Whole Chapter	31. Adaptation						The authors do a strong job of describing the depth of climate change‚Äôs connection to racialized exploitation. As noted throughout Chapter 31, particularly in page 10, the authors identify systemic racism as a crucial contributor of social vulnerability to climate hazards. The authors stress the potential of transformative adaptation to address historical errors, but the authors still fall short of providing a strong road map to a transformed society. The authors should instead stress the importance of voting and civic engagement as critical tools to achieve transformative adaptation. As discussed in the chapter, systemic racism affects social vulnerability in countless ways. In cities across the US, the communities that were afflicted by redlining experience some of the highest rates of air pollution, extreme heat, and flooding. The authors are accurate in their analysis that only a transformative approach can help marginalized communities to adapt to climate hazards. The problem with the solutions presented by the authors is that redlining was instituted by governments with racist ideals, and unless those governments can be removed, transformative adaptation will never be possible. The rationale for climate scientists to avoid political engagement is obvious, they want to avoid getting bogged down in partisanship. When an issue like climate becomes a partisan issue, then it becomes increasingly difficult to pass legislation, particularly in regions that are dominated by conservative partisans. It is impressive and admirable that the authors of this chapter have identified systemic racism as a perpetrator of the climate crisis, but the authors need to go a step further by identifying systemic racism as an obstacle to transformation, and voting and civic engagement as solutions to this obstacle. The first piece of climate legislation ever passed in the US, the Inflation Reduction Act, was passed along partisan lines. While climate denialism obviously transcends partisan lines, it is notable that the leaders in the White House, Senate, and House of Representatives were each out of power just 5 years ago in 2017. Political organizers emphasized the importance of climate justice and utilize a network based around of [illegible] the leaders of the most powerful US	Thank you for these comments. We are glad you appreciate the attention paid to systemic racism and transformative adaptation within the chapter. We have added to our discussion on why systemic change to social systems is needed to address equity and justice (KM2) and why transformation of these social systems is likely needed to support equitable adaptation (KM1). We have not mentioned voting in particular as an adaptation action as we feel it is beyond the scope of this chapter and we would be unable to do service to the topic within our space limits.
Samuel	Lavine	Whole Chapter	31. Adaptation						The authors of chapter 31 do a strong description of the logistical difficulties behind transformative adaptation, but they leave lots of room for improvement for their guidance. Transformative adaptation requires governmental coordination at the federal, state, and local levels. In many communities, local governance is shared between the county and municipal governments. The authors are correct when they stress the importance of outreach on the ground and in the communities that are positioned to suffer the most. The authors fall short of providing effective guidance for climate planners to lead their communities to transform to adapt to the effects of climate change. The authors should have presented a stronger emphasis on the utility of digital communications and reaching out to community institutions. In a country as big and diverse as the United States, it is obvious that there is no one size fits all solution to any challenge, particularly not a challenge as complex as the climate crisis. These difficulties are exacerbated when factoring in the complexities of federal, state, and local bureaucracies, as well as varying political dimensions. While the authors should not be expected to provide precise instructions on how individual communities can adapt to the climate crisis, there is much more advice and guidance that the authors should have incorporated to this chapter. The two main pieces of advice that the authors should incorporate are utilizing digital communication, including Zoom and Skype, and joining community institutions, including places of worship and recreation centers. Without using technologies like Zoom, community leaders are not able to gain guidance and support from state and federal officials while simultaneously hearing and addressing the needs of members from their own communities. In states where climate adaptation is already underway, digital communications are vital for community leaders to maintain constant contact with state and federal officials while also continuing to be members of their own communities. During the height of the pandemic, climate action planners were able to coordinate with officials at multiple levels of government and community leaders from different sectors of society through Zoom. As the federal government takes an expanding role in climate adaptation, the	Thank you for this comment. We note the need for adaptation in general (KM2) and transformative adaptation in particular (KM1) to engage directly with the communities who will be affected by the adaptation decisions. We appreciate your comments on how such outreach could occur through virtual tools, but we feel this is too large a topic to attempt to cover within our given word limits.
Samuel	Lavine	Whole Chapter	31. Adaptation						The authors could have focused more on the overlap of climate change adaptation and mitigation. Strategies to reduce emissions are frequently perceived as unnecessary because many view emissions reduction as futile, especially at the local level. As a result, governments will ignore spending efforts aimed at reducing emissions. The authors should have put a stronger emphasis on policies that can both reduce emissions and make communities more resilient to the effects of climate change. Many effective strategies at reducing emissions also make individuals and communities more resilient to climate hazards. One strategy for mitigating climate change is by insulating buildings to reduce leakage of heating and cooling. This makes buildings more energy efficient, which reduces emissions, and it helps individuals and communities be more resilient to extreme weather events. With energy efficient buildings, individuals and the entire community they share an electric grid with are more capable of cooling themselves in the summer, heating in the winter, and reducing their energy consumption more broadly. Portraying adaptation and mitigation strategies as competing goals undermines the ability of communities to transform in the face of climate change because they will choose either adaptation or mitigation, and not both.	We have made a change in the introduction to note that adaptation efforts will be most effective when they offer co-benefits, including climate mitigation. We have also revised a line in KM1 to comment on the fact that if climate mitigation is not pursued, adaptation efforts may encounter limits or challenges in addressing the extent of climate change.
Glenn	Branch	Whole Chapter	31. Adaptation						This chapter would benefit from the addition of a discussion of education and outreach efforts with regard to climate change, which are foundational to adaptation efforts. In order to make the best decisions about adaptation, policymakers and voters need to grasp the scientific and social issues involved in meeting the challenges posed by climate change, and what confers them with that grasp is education. The point is acknowledged piecemeal previously in this draft report (e.g., ch. 11, p. 25; ch. 13, pp. 12-14; ch. 15, p. 21), but it would be appropriate to discuss it clearly and in detail here. Overall, it would be best for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change.	The decision to add chapters, appendices, or Focus Boxes is made by the Federal Steering Committee based on comments received on the draft NCA5 prospectus (2020). At this stage of development, the Federal Steering Committee is not considering the addition of additional chapters, especially because such chapters would not have undergone the same rigor of agency, technical, and peer review as the existing chapters. This comment has been conveyed to the developers of the sixth National Climate Assessment and the US Global Change Research Program for consideration in future assessments. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5.
Emma	Conrad-Rooney	Whole Chapter	31. Adaptation						All key messages should be revised to make sure they follow the Risk-Based Framework	Thank you for your comment. We have reviewed the risk-based framing guidance and have adjusted our KMs to reflect this.
Melissa	Shapiro	Whole Chapter	31. Adaptation						While there are some sporadic mentions of scientific research and data, particularly in relation to KM 31.4 on science and climate services (and coproduction), it would be helpful for this chapter to include a more robust discussion of how the scientific community can support adaptation efforts. Too often, the scientific community is relegated to mitigation planning and is not considered in the context of adaptation. There is certainly a role that scientists should and do play in supporting adaptation planning ‚Äì helping to evaluate, for example, the potential viability of relocation sites for communities in the Arctic that are experiencing flooding, ground collapse, and other symptoms of climate change-induced permafrost thaw. These contributions could be highlighted in this chapter.	Thank you for this comment. Based on this and other feedback, the authors edited this section to articulate opportunities for increased participatory approaches, technical services that are focused on needs and adaptation decisions, and the need for knowledge to be useable for integration within adaptation decision-making and evaluation.
Juanita	Constible	Whole Chapter	31. Adaptation						Thank you for the strong focus on equity throughout this chapter, as well as the robust discussion of incremental vs. transformative change and the acknowledgement that adaptation is critical to reduce suffering both today and in the future. The key messages, particularly KM 31.1, 31.2, and 31.3, point to critical components of climate action in the United States.	Thank you for the positive assessment.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Juanita	Constible	Whole Chapter	31. Adaptation						The use of the phrase ADAPTATION ACTION throughout this chapter is confusing. In some cases, it seems to be used more or less to mean hazard mitigation while in others (e.g., in Table 31.1) it could include almost anything. This is a challenging issue because adaptation itself encompasses a broad, variable, and evolving set of both tangible actions and more theoretical items such as methodologies and mindsets. It also means different things to different people. As a result, a clear definition of the phrase, followed by consistent use of it, would likely be helpful not just for this document but for the ongoing conversation about what adaptation fundamentally is.	Thank you for your comment. The authors have reviewed the use of the terms "adaptation action" throughout this document and have been intentional about when they use this term versus "adaptation measure." We see adaptation as at times being active and other times not being as active so when it is active, we are referring to an action. When it is not as active, we are referring to a measure.
Craig	Hanna	Whole Chapter	31. Adaptation						In summary, the task force comments point out the following: Chapter 31 Adaptations: Limitations exist on the comparability and thus usability of the Financial Stability Board's Task Force on Climate-related Financial Disclosures (TCFDs) prepared by private-sector entities as a basis for objective measurement of progress in adaptation.	Thank you for this comment. The authors have revised the text to highlight some of the limitations of using information obtained from climate-related disclosures, including difficulty with comparing across responses.
Joseph	Sollod	Whole Chapter	31. Adaptation						Modern building codes and standards are an important mechanism to drive the achievement of national and community goals (including resilience and sustainability). Recognizing the important role of building codes to serve community resilience, safety and welfare, the White House has developed the National Initiative to Advance Building Codes (NIABC). The NIABC is a government-wide effort to boost national resiliency and reduce energy costs. Under the initiative U.S. federal departments and agencies will review federal funding and financing of building construction to ensure projects follow updated model codes and provide incentives and support for communities to adopt modern building codes. In addition, the Federal Emergency Management Agency (FEMA) launched the FEMA Building Code Strategy which organizes and prioritizes FEMA activities to advance the adoption and enforcement of hazard-resistant building codes and standards for FEMA programs. It promotes integrating building codes and standards across FEMA, strengthening nationwide capability and expertise, and driving public action. However, building codes are not currently adopted universally across the country. Alarmingly, FEMA found that currently 65 percent of counties, cities, and towns across the U.S. have not adopted modern building codes, only 50 percent of cumulative post-2000 construction adhered to the I-Codes, and 30 percent of new construction is occurring in communities with no codes at all or codes that are more than 20 years outdated. The Code Council recommends enhancing the discussion on the essential role of modern building codes in advancing buildings and the building industry towards the emissions reductions necessary to achieve necessary climate targets and the resilience needed to respond to the growing impacts of climate change. The National Institute of Building Sciences (NIBS), a research organization established by the U.S. Congress, found that investments in pre-disaster mitigation can save the U.S. between $4 and $11 for every $1 invested. The continual update of building codes provided the greatest benefit at $11. These benefits represent avoided casualties, property damage, business interruptions, first responder expenses, and insurance costs, and are enjoyed by all building stakeholders ,Äì from developers, titleholders, and lenders, to tenants and communities. Requiring the current International Residential Code (IRC) and International Building Code (IBC) would prevent roughly $14,000 in losses per building in jurisdictions	Thank you for this comment. Adaptive building codes, integration of future climate projections into codes and standards, revised design parameters and ensuring compliance with existing regulations are all mentioned in Table 31.1 as examples of policy-related actions that can enable adaptation. In KM 31.5, the chapter discusses how a lack of resilient infrastructure codes and standards can create barriers to action and investment. In this section, the chapter references KM12.3, which goes into greater detail on this topic.
Joseph	Sollod	Whole Chapter	31. Adaptation						There should be more of a discussion on why building codes and standards need to be updated to include the integration of future climate projections. Climate change is driving the increasing magnitude and frequency of extreme weather events, and the global community is experiencing increasing occurrences of disaster events associated with these climate impacts. Buildings being constructed today face the prospect of experiencing different and potentially more extreme weather than in the past, and possibly in geographic areas where such events have not occurred before or with such intensity. To date, building codes include provisions and reference technical standards for design and construction to take account for most weather-related natural hazards based on minimum performance levels typically informed by historic data generated by past events. Building codes now must incorporate future-focused climate science and data to ensure resilience against the different hazards a building may face over its intended life. It is increasingly necessary for codes and standards to respond to the latest research and data from both the building and climate/environmental science perspective. This will help maintain an expected level of safety, amenity and an appropriate level of climate resilience. The Global Building Resilience Guidelines (Guidelines) is a guidance document which consists of fifteen principles that provide a basis for advancing building resilience through building codes. The Guidelines were developed by the Global Resiliency Dialogue, through the gathering of global data from leading building sector stakeholders, intended to help inform the development of building codes and standards that incorporate future-focused climate resilience. This resource should be used to integrate some more context on the urgent need for building codes to adapt to the potential climate hazards of the future. This resource has been submitted to the NCA committees for further guidance in development of this chapter.	We thank the reviewer for the comment. The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Recommendations for policy options are beyond its defined scope.
Missy	Holzer	Whole Chapter	31. Adaptation						Consider recognizing education and the entire K-12 education community when addressing adaptation. By doing so, we are supporting and encouraging our next generation of problem-solvers, and those who teach them.	Thank you for your comment. We include education as an example of adaptation activities in Table 1.1, and now highlight the lack of formal education requirements as a barrier to adaptation.
Kevin	Schwarzwald	Whole Chapter	31. Adaptation						1.Because the relationships between climate variables and societal impacts are complex and nonlinear, for a given lead time, the sources of the largest future uncertainties in the socioeconomic impacts of climate change may not be the same as the sources of the largest future uncertainties in underlying climate variables. In Chapter 19.1, the NCA5 draft correctly emphasizes the dominance of ‚Àòscenario uncertainty,Âô, or ‚Äòthe trajectory of future emissions,Âô, in long-term projections of the impacts of climate change, based on the dominance of scenario uncertainty in projections of future climate distributions over the uncertainty from the range of climate models outputs (‚Äòmodel uncertainty,Âô) or from the irreducible internal variability in the climate system. ref 1. (cited below) shows that, given the complex relationships between climate and society, the dominant sources of uncertainty in projections of the impacts of climate change may be different from those in underlying climate distributions, because of the shape of the relationship between climate and a socioeconomic variable of interest or the geographic distribution of affected populations. Though long-term changes in climate vulnerability are undoubtedly most dependent on scenario uncertainty, for a given timescale of a certain policy or economic decision, model or internal uncertainty may have a larger impact on the true range of future outcomes. We recommend amending the NCA5, perhaps in Key Messages 31.4 or 31.5, to mention that for a given socioeconomic impact of climate change, the balance of the three primary sources of climate uncertainty (scenario, model, and internal) may be different than that same balance for the climate variables that drive that impact. 2.Internal variability in the climate system can be a substantial contributor to the uncertainty in climate impacts in the continental United States on the timescales of many policy and investment decisions. The NCA5 draft emphasizes the importance of modeling internal variability, the irreducible component of uncertainty in climate projections, in the climate system in Chapter 3.3, and correctly states that the influence of internal variability on climate uncertainty may be larger under certain conditions ‚Äì for example when considering regional and local scales -- than at the scale of large-scale climate variables. These authors show in ref. 1 that furthermore internal variability plays a larger role in the uncertainty in	This is directly addressed in 3OD in Chapter 2 KM 2.3. We have discussed the implications to adaptation given the source of uncertainty in our traceable accounts documentation.
Ariela	Zycherman	Whole Chapter	31. Adaptation						Overall -- I'm wary of pitting incremental vs. transformative adaptation against eachother. I think both are needed, particularly as transformative adaptation is not appropriate (or feasible) in many situations. Consider softening some of these dualities as you have clearly done for figure 31.2 in the caption.	We have added an introductory paragraph to note that both incremental and transformative adaptation will be required in the future.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Ariela	Zycherman	Whole Chapter	31. Adaptation						Overall ~Ñ I was surprised to find almost no discussion of the insurance industry and the role they have to play in local, regional, and national adaptation. Two articles out this year in Nature Climate Change would bolster the discussion (de Ruig et al., 2022; Wagner, 2022; see below for full citations). For example, on page 6, in Box 31.1 on Progress in and Barriers to Adaptation, I'd suggest in stage 2 evidence of barriers for assessment of adaptation, there is some discussion of how all insurance measures climate risks through retrospectives of historical distribution which underrepresent the rapid escalation of impacts, perpetuating misperceptions of risk that lead to low uptake of insurance. Another place where insurance should be included is in Key Message 1 on Transformative Adaptation, there are three areas where insurance can play a role: in reinsurance (insurance for the insurer), reimagining climate models for more accurate risk-based pricing (e.g. NFIP Risk Rating Reform), financial reforms could incentivize insurers to build up tax-deductible catastrophe reserves (see Wagner, 2022 for more discussion on each of these). Finally, the discussion of insurance should be brought into the key message on adaptation and equity, where insurance policies are required to ensure that pricing reflects the true risk of climate change while keeping prices low enough so that the most vulnerable can afford it, particularly as the poorest are often the most vulnerable to climate change impacts and least able to adapt. On page 13, line 30 you refer to Howell and Elliott, 2019, but do not explicitly call out insurance which is a mistake. Wagner, K. R. (2022). Designing insurance for climate change. Nature Climate Change, 12(12), 1070-1072. de Ruig, L. T., Haer, T., de Moel, H., Brody, S. D., Botzen, W. J., Czajkowski, J., & Aerts, J. C. (2022). Climate-proofing the National Flood Insurance Program. Nature Climate Change, 12(11), 975-976.	Thank you for this comment. We have added references to wildfire insurance and flood insurance and have added references about the need to price risk accurately while balancing the need to keep insurance affordable.
Aimee	Delach	Whole Chapter	31. Adaptation						Chapter 31, Adaptation, covers a critical topic because, as noted, the effects of climate change are already being experienced around the country, and even with mitigation efforts these impacts will continue. The chapter as written is very general, covering stages of adaptation, approaches, equity, barriers, costs, etc. The chapter provides a good overview of the topic, but is potentially of limited use for helping practitioners or interested stakeholders in considering how to approach adaptation for their region or sector. My general recommendation for the chapter is that it be expanded to provide a set of tools, resources and examples that relate to each of the National Topics covered in chapters 4-20. To highlight one area of interest and expertise for my organization, a reader of this chapter coming fresh to the topic of Adaptation would be given no impression that an entire field of adaptation exists for biodiversity, wildlife and natural resources. Ecosystems and environmental considerations are mentioned in the chapter only in passing, and only in the context of their relationship to human community adaptation actions. Adaptation actions undertaken in the area of biodiversity and ecosystems are directly relevant to the National Topics addressed in chapters 6-10, as well as 16, and at least indirectly relevant to chapters 4, 11, 12, 14, and 15. There is a vast body of literature, organizations, projects, frameworks and resources associated with climate adaptation for natural systems. Below are a selection that merit inclusion into the Adaptation chapter: "Advancing the National Fish, Wildlife and Plants Climate Adaptation Strategy into the Next Decade" (2020): https://www.fishwildlife.org/application/files/4216/1161/3356/Advancing_Strategy_Report_FINAL.pdf "Voluntary Guidance for States to Incorporate Climate Adaptation into State Wildlife Action Plans and Other Management Plans" (2022) https://www.fishwildlife.org/application/files/6316/7336/2905/AFWA_Voluntary_Climate_Adaptation_Guidance_for_SWAPs_2nd_Edition.pdf "The Climate Change Response Network" (forests) (undated). Web-based tools available at forestadaptation.org and adaptationworkbook.org	Thank you for your comment. We have several of these references already included in our chapter and will try our best to include more mention of adaptations in nature throughout our chapter. The Ecosystems chapter does, however, highlight natural adaptations occuring in the U.S. that we have connected to in our chapter.
Theodore	Weber	Whole Chapter	31. Adaptation						The Adaptation chapter is focused on human society and infrastructure, but should also include adaptation and resilience of natural systems. Humans rely on healthy natural systems for their existence and well-being.	Thank you for your comment. We have tried our best to include examples of adaptation in nature throughout our chapter, but the Ecosystems chapter highlights natural adaptation occuring in the U.S. that we have connected to in our chapter.
Don	Haas	Whole Chapter	31. Adaptation						Chapter 31 is the first of two ‚Äúresponse chapters.‚Äù These chapters are perhaps the strongest candidates of the existing chapters for substantive attention to climate and energy education. Page 3, lines 28-30, reads ‚ÄúFor transformation to be just, it will need to tackle historical inequities and engage diverse groups of people, from the start, to alter the status quo (Shi and Moser 2021).‚Äù This is nearly an explicit call out to the need for education, yet it does not quite make it appropriately explicit. It is difficult to imagine how the ‚Äútackling‚Äù referenced here does not begin with education (in both formal and informal settings). Likewise, frequent mentions of ‚Äúcivic engagement‚Äù are referencing efforts that are at their core education initiatives. Table 31.1. Example Climate Adaptation Actions or Measures to Enable Adaptation on pages 4 and 5 should include a row on education. The row might read: Education: Incorporating climate and energy content across K-16 curriculum; supporting extra-curricular activities that nurture climate action; work-force training; supporting exhibitry and programming at museums, nature centers, zoos, and aquaria; and the development and dissemination of various kinds of educational media. Figure 31.1 (page 5) should be redone so it indicates the number of adaptation activities per capita. As it stands, it is largely a map of population density. Page 6, lines 12 - 14: An additional barrier to awareness is the lack of attention to education in many federal and state efforts. Education is essential for getting to transformative adaptation (Key Message 31.1, pp. 9-12). Engaging youth in climate communication, for example, has promise to educate parents effectively, and daughters are especially effective at educating parents (Lawson et al., 2019) and youth can provoke institutional changes in energy use (Bandura & Cherry, 2020; Cherry, n.d.). The good attention to the principles of complex adaptive systems is an essential and valuable component of the chapter. Education systems are well connected to most of the systems discussed in the chapter, but are not themselves discussed in appropriate depth. In line with the attention to systems thinking is the need to address climate across the disciplines in formal education and across different kinds of	Thank you for this comment. We have included this suggestion in the Introduction and Table 31.1 to reflect education as an adaptation measure.
Reid	Sherman	Whole Chapter	31. Adaptation						The chapter starts out with a lot of discussion of information and operations we dont have in place for decision making, only to go into discussion of how helpful climate data and services can be. It reads a bit contradictory, so language upfront in the chapter may want to reflect key message 31.4	Thank you for your comment. We have revised the introduction to be brief and will connect our evidence of progress and barriers with our KM on science and services.
Reid	Sherman	Whole Chapter	31. Adaptation						Please ensure consistency on the definition and discussion of "climate services" across the NCA5, especially in the Adaptation and International chapters. While the interpretation of climate services may be different by sector and topic, it would behoove the chapter authors to ensure there is a sort of baseline as to not confuse the readers, or at least note where else "climate services" may be discussed.	Thank you for this comment. Based on this and other feedback, the authors edited this text so that there is not confusion with the concept of climate services being solely technical services.
Reid	Sherman	Whole Chapter	31. Adaptation						There are a few 2017 references, but most are current. Thank you for putting focus on recent literature.	Thank you for the positive assessment.
Reid	Sherman	Whole Chapter	31. Adaptation						Most of these examples and case studies focus on flooding.	Thank you for your comment. We have tried our best to diversify our case studies across various climate hazards and believe this is sufficient.
Reid	Sherman	Whole Chapter	31. Adaptation						There could be more concrete examples included throughout the narrative, for example, in the finance section. There are so many great examples out there to choose from. I am wondering if it would help to augment citations to the studies that have been done on various types of adaptation practices to point people to solutions.	Thank you for this comment. Space constraints limited the number of examples that could be included in the text. More examples are also included in the Traceable Accounts.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Reid	Sherman	Whole Chapter	31. Adaptation						The chapter needs to address how emergency management actions, planning are related to the types of adaptation that are discussed in the chapter (transformative, incremental). My read suggests that traditional emergency management approaches do not consititue the type of adaptation the assessment indicates is needed, however they present an important and available set of tools to acheive the outcomes the chapter indicates are needed.	Thanks for this comment. We have modified language in KM1 to note that disaster risk reduction tools are valuable but that adaptation requires longer-term planning.
Steve	Rissing	Whole Chapter	31. Adaptation						Comments on Chapter 31, Adapation. I appreciate the efforts of the authors in this chapter on actions we need to take to adapt to climate change. Table 1 on page 4 lists obvious and effective actions to promote adaptation. I encourage that here and elsewhere in the chapter you include a separate row and discussion of formal, climate change education from grade K to college. In our democratic form of government, we cannot elect policy makers and form effective public policy to accomplish most of the adaptation measures mentioned in this chapter without some basic level of climate change understanding and literacy among the public. Recent studies have revealed great variance in climate change education quality in state-by-state comparisons of K-12 science content standards; see here: https://ncse.ngo/making-grade-how-state-public-school-standards-address-climate-change-0; I served as one of three evaluators of state science content standards for this study. See also here: https://globalreports.columbia.edu/books/miseducation/. Colleagues and I at The Ohio State University have developed and presented an interdisciplinary college General Education course on Climate Change, ES 1911 that has been received well (and always fills) by our students. I encourage the chapter authors in this discussion of adaptation measures to include an explicit section on further development of formal K-12 climate change content standards in the states, extending into higher education Steve Rissing, Professor Emeritus Department of Evolution, Ecology, and Organismal Biology The Ohio State University	Thank you for your comment. We have added education and standards into our Table 31.1 as example adaptation actions that can be taken. Given the limitations on word count, we are unable to go into great detail on any one of these actions. This comment has been conveyed to the developers of the sixth National Climate Assessment and the US Global Change Research Program for consideration in future assessments. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5.
Charles	Keeling	Whole Page	32. Mitigation		3				One or more references to climate change education could be appropriately added to chapter 32, p. 3: "Introduction".	We thank the reviewer for the comment. The chapter introduciton and text in KM 32.5 have been revised to include brief discussion of the role of education and outreach efforts. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.
Nick	Procopio	Figure	32. Mitigation		4				It is almost impossible to see the purple line for US territories. Consider removing this line or redoing the scale of the figure so that it is possible to see this line. Related, what does US territories mean in this context? It looks like this is almost the same as the total line, so clearly this isn't the emissions from US territories like Guam.	We thank the reviewer for the comment. Emissions from US territories are not categorized by sector but are included for completeness. We have added an explanatory note to the caption.
Nick	Procopio	Text Region	32. Mitigation		5	5	9	9	This line refers to the year 1900. Figure 32.2 lower on the page refers to 1990 and that seems to be a more likely reference year. However, it could be the case that the text is in fact referring to 1900. Whatever is in the report should be consistent with the cited reference, Feng, Davis et al., 2015.	We thank the reviewer for the comment. Reference to 1900 was an error, and the text has been revised to correct it.
Cathy	Day	Figure	32. Mitigation		6	6	7	12	The figure caption refers to ‚Äúlower emitting natural gas,‚Äù does this take into account the methane leakages during extraction, processing, and transport (especially pipelines)?	The figure shows only CO2 emissions related to electriciy generation, which is noted in both the title and caption.
Cathy	Day	Text Region	32. Mitigation		9	10	12	2	Annual agricultural GHGs for the US are estimated to have increased slightly from 536 Mt CO2-eq in 1990 to 577 Mt CO2-eq in 2020. The goal of the Agriculture Resilience Act (ARA) is to reduce this to zero in the next two decades, which would take the net annual land-related sequestration from -164 to more than -700 million metric tons. It seems appropriate that this report acknowledge this ARA goal and perhaps comment on the feasibility of such a goal and what it would take to attain it.	We thank the reviewer for the suggestion, and have added a reference to the ARA and its goals in KM 32.5. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.
Nick	Procopio	Figure	32. Mitigation		9				If one glances at this figure, it looks like six bars going down over time, and takes a little more thought to realize that this is actually three graphs in one, comparing 1994 and 2018. It might be helpful to provide some visual separation among the three categories. Perhaps having Electricity-related, then fuel combustion, then manufacturing processes would help to break this up visually and lower the chances of misinterpretation.	We thank the reviewer for the helpful suggestion, which has been incorporated into the figure.
John	Fleming	Text Region	32. Mitigation		11	11	20	21	Biomass is listed as a renewable resource that could contribute to emissions reductions, but this ignores the high lifecycle CO2 emissions associated with using biomass. For instance, using woody biomass (often the assumed form when the blanket term ‚Äúbiomass‚Äù is employed) as a feedstock for fuel or energy production emits high lifecycle emissions of CO2 and other air pollutants that harm the climate and communities. Gasifying trees and other woody biomass releases virtually all their stored carbon, worsening the climate crisis and ending trees‚Äô future carbon sequestration, creating a ‚Äúcarbon debt‚Äù (Sterman et al., Does wood bioenergy help or harm the climate?, 78 Bulletin of the Atomic Scientists 128 (2022). Biomass gasification also has substantial upstream emissions from cutting the biomass, extracting cut materials, trucking biomass often long distances, drying and chipping, and storage in wood chip piles which releases significant methane emissions (Roder et al., How certain are greenhouse gas reductions from bioenergy? Life cycle assessment and uncertainty analysis of wood pellet-to-electricity supply chains from forest residues, 79 Biomass and Bioenergy 50 (2015)) Even if cut trees are allowed to regrow, numerous studies show it may take many decades to more than a century, if ever, to capture the carbon that was released and pay back the carbon debt (Hudiburg et al., Regional carbon dioxide implications of forest bioenergy production, 1 Nature Climate Change 419 (2011); Law & Harmon, Forest sector carbon management, measurement and verification, and discussion of policy related to climate change, 2 Carbon Management 73 (2014); Holtsmark, The outcome is in the assumptions: Analyzing the effects on atmospheric CO2 levels of increased use of bioenergy from forest biomass, 5 Global Change Biology Bioenergy 467 (2012); Mitchell et al., Carbon debt and carbon sequestration parity in forest bioenergy production, 4 Global Change Biology Bioenergy 818 (2012); Schulze et al., Large-scale bioenergy from additional harvest of forest biomass is neither sustainable nor greenhouse gas neutral, 4 Global Change Biology Bioenergy 611 (2012); Sterman et al., Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy, 13 Envt‚Äôl Rsch. Letters 015007 (2018)). Research also shows that burning forest ‚Äúresidue,‚Äù or ‚Äúwaste,‚Äùreferring to biomass that would otherwise be disposed of,‚Äù similarly leads to a net increase of carbon emissions in the atmosphere for decades (Laganiere et al., Range and uncertainties in	We appreciate the comment and agree that there are important practical and context-specific considerations as to whether bioenergy is or is not beneficial to the climate. Unfortunately, space is limited and the authors have had to make difficult decisions about what information to include.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
John	Fleming	Text Region	32. Mitigation		11	11	20	22	Carbon capture and storage (CCS)-equipped fossil-fired generators are stated as a low-emitting, dispatchable energy resource, but this statement fails to consider the evidence of CCS being an ineffective mitigation measure that does little to address fossil fuel emissions. CCS is a supposed climate solution championed by polluting industries,Âîsuch as the biomass and fossil fuel industries,Âîto enable business-as-usual operations, all while diverting resources from the needed transition to clean, cheaper renewable energy. After billions of dollars of investment and decades of development, CCS projects around the world have consistently failed to meet their GHG emission reduction promises. A recent analysis by the Institute for Energy Economic and Financial Analysis (IEEFA) found that 10 of 13 flagship CCS projects, comprising 90% of the total capture capacity in the sample, failed or are underperforming in their CO2 capture efficiencies, mostly by large margins (IEEFA, The Carbon Capture Crux: Lessons Learned (September 2022), https://ieefa.org/resources/carbon-capture-crux-lessons-learned). For example, based on real-world data, the Boundary Dam CCS project in the power sector, the Chevron Gorgon CCS project in the gas processing sector, and the Illinois Industrial CCS project in the ethanol production sector are under-performing their designed CO2 capture rates by ~50% on average (Id. at Appendix 1). Another study estimated that NRG,Âôs Petra Nova CCS project in Texas, the only U.S. fossil-fueled power plant to operate with CCS equipment, vastly underperformed. Although Petra Nova promised a 90% carbon capture rate, in practice it achieved only a 55% CO2 capture rate from the carbon capture equipment on its pulverized coal boiler (Jacobson, Mark Z, The health and climate impacts of carbon capture and direct air capture, 12 Energy Envt. Sci. 3567 (2019), https://doi.org/10.1039/C9EE02709B). This project was shut down indefinitely in 2020 when it became uneconomic, after costing $1 billion and receiving $190 million from the federal government. These real-world failures of CCS projects do not even consider the lifecycle emissions of CCS projects. CCS operations are energy-intensive because they require large amounts of energy to capture, compress, transport, and inject carbon underground, called the ‚Äúenergy penalty.‚Äù For example, power plants using CCS generate an estimated 15% to 25% more energy to produce the same amount of power than	We thank the commenter for this perspective. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy or technology recommendations. We report on technologies and mitigation options that have been studied and might theoretically help to mitigate GHG emissions.
Nick	Procopio	Text Region	32. Mitigation		14	14	10	19	In the discussion of fuels, is there a reason that biofuels is not used as a category here? Is this not what is being discussed? In particular line 15 where ¬ìlow carbon fuels" are mentioned.	We appreciate the question and have revised the text to define "low-carbon fuels."
John	Fleming	Whole Page	32. Mitigation		14				In discussing the potential for electrifying medium- and heavy-duty vehicles, there is recent literature that emphasizes a greater potential in doing so than indicated by the text at present. Specifically, several studies now discuss how rapid advances in battery technology, including increases in the energy density and declining prices, have made battery electric technology a feasible and cost-effective option to meet most regional and long-haul trucking needs, as confirmed by studies by the National Renewable Energy Laboratory and Lawrence Berkeley National Laboratory. In the U.S., most heavy-duty trucks are not driven long distances, with about 70% of heavy-duty trucks operating within a 100-mile range and only about 10% requiring an operating range of 500 miles or more. Studies have found that the charging needs and charging times for electric heavy-duty trucks, including long-haul trucks, can be met without impairing operations or the economics of freight movement (Borlaug et al., Heavy-duty truck electrification and the impacts of depot charging on electricity distribution systems, 6 Nature Energy 673 (2021); Phadke et al., Why Regional and Long-Haul Trucks are Primed for Electrification Now, Lawrence Berkeley National Laboratory (2021); Muratori and Borlaug, Perspectives on Charging Medium and Heavy-Duty Electric Vehicles, National Renewable Energy Laboratory (2021); Tong et al., Energy consumption and charging load profiles from long-haul truck electrification in the United States, 1 Environmental Research Infrastructure and Sustainability (2021)). The text should reflect the viability of electrifying the vast majority of medium- and heavy-duty fleets.	We appreciate the comment. The authors believe our summary of the prospects for electricying medium- and -heavy duty vehicles is consistent with the suggested references (several of which were co-authored by this chapter's authors). We have accordingly added some of the suggested references.
John	Fleming	Whole Page	32. Mitigation		15				In this section, there should be further acknowledgement of the technology already available to meet the needs of high temperature industrial heating applications. Established technologies for industry electrification are already available for decarbonization of high-temperature industrial processes. Electric heat pumps are a cost-effective option for decarbonizing industrial processes that require heat up to 400¬∞¬∞C (Madeddu et al., The CO2 reduction potential for the European industry via direct electrification of heat supply (power-to-heat), 15 Environmental Research Letters 124004 (2020); Zv9hlsdorf et al., Analysis of technologies and potentials for heat pump-based process heat supply above 150¬∞¬∞C, 2 Energy Convers. Manag. X 100011 (2019)). For high heat processes that require temperatures of 1000¬∞¬∞C or more, available, established power-to-heat technologies include electric arc furnaces, microwave and radio frequency heaters, induction furnaces, resistances furnaces, infrared heaters, and plasma heating (Madeddu et al., The CO2 reduction potential for the European industry via direct electrification of heat supply (power-to-heat), 15 Environmental Research Letters 124004 (2020)). Available power-to-heat technologies can cover all temperature levels needed in industrial production.	We appreciate the comment. The text acknowledges that options exist for electrifying most industrial energy demand and cites the Madeddu et al. paper. Unfortunately, space is limited and the authors have had to make difficult decisions about what information to include.
Nick	Procopio	Text Region	32. Mitigation		16	16	12	13	Might it be worth mentioning that some states, including NJ, have legislated food waste reduction goals?	We thank the reviewer for the comment. Such policies are discussed generally in KM 32.5 but space is limited and the author team has deliberated and prioritized the information to include.
Ariela	Zycherman	Text Region	32. Mitigation		16	16	15	28	This paragraph separates items solely by the type of animal or plant food vs. the agricultural practices that produce them. It would be a more helpful paragraph if it also discussed the difference in GHG based on the practices employed. It is important to consider whether shifting to a diet of plant-based foods produced by industrial agriculture practices would truly be better for mitigating climate change than eating a flexitarian diet from regenerative and local farmers. I am leaving this comment but I will say that the paragraphs that follow address some of the issues of concern to me.	We appreciate the comment, and agree that there are important dimensions of diets beyond the type of plant or animal source. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.
Cathy	Day	Text Region	32. Mitigation		17	17	15	20	The text here develops the nitrogen management topic, focusing on chemical inhibitors of microbial nitrogen transformations and precision management of soluble nitrogen. Entirely missing are the multiple research findings that on healthy, biologically active soils, the Economic Optimum Nitrogen Rate (EONR) can drop to zero, greatly reducing fertilizer bills and slashing both N2O emissions and nitrate leaching. Our two memos offered via the Technical Inputs email in April 2022 provided the literature references documenting this opportunity. We am concerned that the chemical inhibitors would upset the soil microbiome in subtle ways, a possibility that is overlooked in a document which also seems to overlook the central role of the soil microbiome itself. By avoiding synthetics including nitrification inhibitors, organic production protects the soil microbiome and its functions including efficient nitrogen cycling.	We appreciate the comment. The text mentions improving soil health and optimizing nitrogen applications ahead of inhibitors, but unfortunately limited space precludes deeper discussion.
Cathy	Day	Whole Page	32. Mitigation		17				Under "Improve Management of Croplands and Pasture," the first paragraph nicely summarizes priority components such as soil health, nitrogen management, and perennials. It then adds a vague item, ‚Äúavoiding methane emissions,Âü without any specifics regarding livestock operations. It would be helpful to link this paragraph with some specific such as: oOrganic production (once again): perhaps refer to USDA National Organic Program and perhaps also alternative certifications like Certified Naturally Grown (less $$$). oThe four NRCS soil health principles ‚Äì keep soil covered, maintain living root, diversify the system, and minimize soil disturbance ‚Äì both physical and chemical. The evidence on highly managed pastures with livestock grazing suggests that careful livestock and pasture management may result in reduced methane emissions. oAgroecology (with reference to Chapter 11 where this topic is nicely developed).	We thank the reviewer for the suggestion, and have added a reference to Chapter 11 where we raise agroforestry. We do also mention that there are feasible options for reducing agricultural (livestock and rice) sources of methane emissions with a reference to Fig. 5.6. Unfortunately, limited space precludes deeper discussion.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Melissa	Shapiro	Text Region	32. Mitigation		18		9	17	The chapter authors acknowledge the role of ‚Äúpublic acceptance,‚Äù in the advancement of mitigation options, but should recognize the importance of ‚Äúcommunity consultation.,‚Äù The adoption of various energy sources and technologies in net-zero emissions energy systems must depend upon the acceptance not just of ‚Äúthe public,‚Äù but of the local communities that will be most affected by the prescribed transition. The chapter authors should acknowledge local community consultation and acceptance, and even risk assessments, as necessary conditions of carbon management solutions.	We thank the reviewer for the comment. The chapter text in KM 32.4 briefly discusses the importance of engagement with community groups and stakeholders in the planning process generally. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.
Matthew	Eisenson	Text Region	32. Mitigation		18	18	9	17	The title of Key Message 32.3 correctly notes that additional climate mitigation options, including carbon capture and removal, need to be explored. The body of text does not address this point, however. Instead, the text emphasizes the uncertainty of technological progress, public acceptance, and other future developments with respect to carbon capture and removal. The text should note the urgent need for research into these issues, particularly given the growing scientific consensus that carbon management, and specifically carbon dioxide removal (CDR), will need to be deployed to stabilize Earth‚Äôs climate. According to the IPCC, ‚Äúdeployment of CDR to counterbalance hard-to-abate residual emissions is unavoidable if net zero . . . emissions are to be achieved.,‚Äù Jim Skea et al., Climate Change 2022: Mitigation of Climate Change. Working Group III Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change SPM-27 (Intergovernmental Panel on Climate Change, 2022), https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SPM.pdf. The following is possible language for inclusion: Because carbon management is necessary to achieve net-zero emissions, technological, scientific, policy, and legal research is needed to reduce these uncertainties.	We appreciate the comment. The authors believe that the need for both CDR and further research of CDR options is addressed in Box 32.2. Space limitations preclude more discussion.
John	Fleming	Text Region	32. Mitigation		19	20	36	2	It is important to note research that contends that methane reforming with carbon capture, utilization and storage (CCUS), or ‚Äúblue,‚Äù hydrogen, is not a low CO2 alternative. A 2021 study found that the total emissions from producing blue hydrogen were only 9% to 12% less than gray hydrogen, or 135 to 139 g CO2eq per MJ compared with 153 g CO2eq per MJ, making blue hydrogen hardly ‚Äúlow emissions.‚Äù The lower emissions from blue hydrogen compared with gray hydrogen are partially offset by higher fugitive methane emissions (Howarth and Jacobson, How green is blue hydrogen?, 9 Energy Science & Engineering 1676 (2021)). Further this paper notes that blue hydrogen use as a strategy for decarbonization only works to the extent it is possible to store carbon dioxide long term indefinitely into the future without leakage back into the atmosphere. In this regard, the report should make clear that, either in the referenced section or elsewhere, of the options for hydrogen production, green hydrogen, that is hydrogen produced using clean, renewable solar and wind energy, is the superior option in the context of decarbonization.	We appreciate the comment. The revised text calls out the issue of life cycle GHG emissions for blue hydrogen and cites relevant literature including Howarth & Jacobson. Limited space precludes deeper discussion.
John	Fleming	Text Region	32. Mitigation		20	20	31	32	The sentence, ‚Äú[A]t low concentrations hydrogen can be safely injected into natural gas pipelines and uses in conventional home appliances,‚Äù should come with the caveat that the use of hydrogen in such a context is unwarranted given the availability of electric appliances. By opting for electric appliances, the risks of transporting hydrogen and using it in homes is avoided.	We appreciate the comment. Electrification of heat demands in homes is thoroughly covered in the text. Unfortunately, the suggested caveat reflects a value judgment as to the benefits and risks of electrification versus hydrogen combustion. The chapter notes numerous potential drawbacks of hydrogen combustion but leaves it to readers to draw their own conclusions.
John	Fleming	Whole Page	32. Mitigation		20				In discussing hydrogen, it should be noted how hydrogen combustion comes associated with criteria pollutants, namely NOx, PM2.5, and O3, whereas the use of hydrogen in fuel cells does not. Using hydrogen in combustion risks perpetuating NOx emissions that already plague disadvantaged communities as some researchers have found that burning pure hydrogen could release more than six times as much NOx as burning methane (Salih and Pƒ±narba¤üƒ±, Investigations on Performance and Emission Characteristics of an Industrial Low Swirl Burner While Burning Natural Gas, Methane, Hydrogen Enriched Natural Gas and Hydrogen as Fuels, 43 Int‚Äôl J. of Hydrogen Energy 1994 (2018)). The focus of the National Climate Assessment is, of course, climate effects, but the compounded effects of criteria pollutants of alternative fuels should also be noted. Further, hydrogen is stated as potentially being able to help decarbonize aviation, but the remaining unknowns in this regard should be discussed. Even if hydrogen is produced using clean, renewable energy, its use as a fuel still yields emissions,‚Äîwater vapor in the case of hydrogen fuel cells, and both water vapor and nitrogen oxides in the case of hydrogen combustion. Water vapor from conventional jet fuel combustion leads to contrails, which are responsible for over half of the radiative forcing associated with aviation (Kv§rcher, Formation and radiative forcing of contrail cirrus, 9 Nature Communications 1824 (2018)). Nitrogen oxides meanwhile contribute to the formation of ozone, both a greenhouse gas and local air pollutant (Freeman et al., Trading off aircraft fuel burn and NOx emissions for optimal climate policy, 52 Envt‚Äôl Science & Tech. 2498 (2018)). The effects of hydrogen fuel on atmospheric chemistry relative to conventional jet fuel have yet to be fully determined, so it is not clear how the production of contrails or nitrogen oxides compare. Thus, before hydrogen production is committed to the aviation sector, the effects of hydrogen-associated emissions, both in the cases of hydrogen combustion and hydrogen fuel cells, on global warming and public health must be thoroughly understood.	We appreciate the comment. The revised text notes the issue of NOx emissions from hydrogen combustion, as well as the special challenges of aviation, and cites relevant literature. Limited space precludes deeper discussion.
Matthew	Eisenson	Text Region	32. Mitigation		21	23	7	9	This section needs additional information on public acceptance and political considerations. The introduction paragraph correctly identifies that "[t]he degree and form of CDR deployment . . . remain highly uncertain, though, and depend on technological readiness, economics, public acceptance, and political considerations (Box 32.2)." However, Box 32.2 focuses mostly on technological readiness and economics and devotes no text to public acceptance and political considerations. The authors should add text on political considerations that require more research. In particular, text should be added on the need for further research into the legal context for CDR, including which level of government is best suited to govern CDR, see, e.g., Korey Silverman-Roati et al., Removing Carbon Dioxide Through Seaweed Cultivation: Legal Challenges and Opportunities (2021), https://scholarship.law.columbia.edu/faculty_scholarship/2980/, whether / how existing laws may constrain and/or facilitate development of CDR, and new legal frameworks that might be needed. While some research has explored these and other legal issues, significant questions remain. See, e.g., Romany Webb, The Law of Enhanced Weathering for Carbon Dioxide Removal (2020), https://scholarship.law.columbia.edu/sabin_climate_change/46/; Korey Silverman-Roati et al., Removing Carbon Dioxide Through Ocean Fertilization: Legal Challenges and Opportunities (2022), https://scholarship.law.columbia.edu/faculty_scholarship/3637/; Romany M. Webb et. al., Removing Carbon Dioxide Through Artificial Upwelling and Downwelling: Legal Challenges and Opportunities (2022), https://scholarship.law.columbia.edu/faculty_scholarship/3337/. The authors should also add text on the need for better understanding of public acceptance of CDR, including the need for consultations with local communities, see, e.g., Jacob A.E. Nielsen, Community acceptance and social impacts of carbon capture, utilization and storage projects: A systematic meta-narrative literature review, 17 PLoS One (2022), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9345485/, and the impact social acceptance can have on the development of CDR technology. See, e.g., Emily Cox et al., Public perceptions of carbon dioxide removal in the United States and the United Kingdom, 10 Nature Climate Change 744 (2020), https://www.nature.com/articles/s41558-020-0823-z. Another missing public acceptance piece is the	We appreciate the comment. KM 32.4 covers the topic of public acceptance and other considerations generally, and the revised chapter notes that siting and land use may also be a problem for CCUS and CDR projects, and includes two of the suggested references. Space limitations unfortunately preclude more extensive discussion.
Melissa	Shapiro	Text Region	32. Mitigation		21		12	15	The chapter authors should amend the text to recognize the need for community consultation (especially of Indigenous communities who are entitled to free, prior, and informed consent) with respect to CDR technologies. The sentence could read as follows: ‚ÄúThe degree and form of CDR deployment, including the balance between industrial carbon capture and intentional enhancement of natural carbon sinks, remain highly uncertain, though, and depend on technological readiness, economics, local and Indigenous community consultation and engagement, public acceptance, and political considerations.,‚Äù	We thank the reviewer for the comment. The chapter text in KM 32.4 briefly discusses the importance of engagement with community groups and stakeholders in the planning process generally. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
John	Driscoll	Text Region	32. Mitigation		22	22	3	4	As soon as a simplified but credible ‚Äúadditionality‚Äù validation procedure for carbon sequestration techniques can be made part of the United Nations Clean Development Mechanism, that validation procedure must be deployed across the United States so reliable techniques can be funded or financed to scale up to greater volumes over many locations.	Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.
Matthew	Eisenson	Text Region	32. Mitigation		22	23	33	3	This paragraph should clarify the type of additional research that is needed in order to better understand and prioritize ocean-based CDR. The NASEM Research Strategy for Ocean-based Carbon Dioxide Removal and Sequestration,‚Äôs recommendations provide an excellent starting point. Scott C. Doney et al., A Research Strategy for Ocean-based Carbon Dioxide Removal and Sequestration (National Academy of Sciences, Engineering, and Medicine, 2022), https://nap.nationalacademies.org/read/26278/chapter/1. As the NASEM report notes, most current knowledge of ocean-based CDR comes from laboratory-scale studies, so in-ocean research is needed to better understand the techniques. Id. at 239. Prior studies indicate that, under existing law, some ocean CDR research projects may be subject to multiple overlapping or duplicative permit and other requirements. The time, cost, and complexity associated with navigating those requirements could hinder or entirely prevent some needed ocean CDR research. See, e.g., Korey Silverman-Roati et al., Removing Carbon Dioxide Through Seaweed Cultivation: Legal Challenges and Opportunities (2021), https://scholarship.law.columbia.edu/faculty_scholarship/2980/. Conversely, other ocean CDR research may not be adequately regulated under existing law, with prior studies identifying key gaps and shortcomings that could create opportunities for "rogue actors" to pursue projects that are not scientifically sound and/or present unacceptable risks to the environment or communities. Romany M. Webb et al., Removing Carbon Dioxide Through Ocean Alkalinity Enhancement: Legal Challenges and Opportunities (2021), https://scholarship.law.columbia.edu/faculty_scholarship/2739/; Korey Silverman-Roati et al., Removing Carbon Dioxide Through Ocean Fertilization: Legal Challenges and Opportunities (2022), https://scholarship.law.columbia.edu/faculty_scholarship/3637/. As the NASEM report notes, "[f]urther study is needed to identify and analyze the full range of potentially applicable laws, explore gaps in and barriers created by the application of those laws to ocean CDR, and evaluate possible alternative approaches to regulation." Scott C. Doney et al., A Research Strategy for Ocean-based Carbon Dioxide Removal and Sequestration at 243 (National Academy of Sciences, Engineering, and Medicine, 2022), https://nap.nationalacademies.org/read/26278/chapter/1.	We appreciate the comment. We reference the NASEM report in Box 32.2, and have revised the text to emphasize the need for field work and large-scale demonstration in particular, and also mention the need for legal and regulatory structures. Space limitations unfortunately preclude more extensive discussion.
Cathy	Day	Whole Page	32. Mitigation		22				Under the heading ‚Äú‚Key Message 32.3 Additional Options Need to Be Explored,‚Äù the text discusses ‚Äúbiological,‚Äù carbon dioxide reduction (CDR), citing afforestation/reforestation and bioenergy with carbon capture and storage (BECCS) as the two largest opportunities. These are two very different approaches with, based on current research, widely differing likely outcomes. Reforestation is likely to produce high rates of carbon sequestration, especially on degraded lands. However, the life cycle analysis of existing forms of bioenergy does not yet produce net zero emissions, nor anywhere near it, and carbon capture and storage is still in its infancy and its long-term efficacy is unproven. It makes little sense to cite the two in the same context. The text also cites carbon sequestration through improved management of cropland and grazing lands, though without any mention of the role of soil microbiomes or the potential for organic agriculture to protect and foster soil life. Failing to mention organic research under ‚Äúoptions to explore,‚Äù is a missed opportunity.	We thank the reviewer for the comments. The chapter highlights soil carbon in the context of nature-based CDR (Box 32.2). Consistent with the commenter's suggestions, the text also points out that the degree and form of CDR deployed remains highly uncertain and depends on technological readiness, economics, public acceptance, and political considerations. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.
Cathy	Day	Whole Page	32. Mitigation		22				The text here develops the land-related GHG reductions including improved cropland and grazing land management, but organic production is not mentioned. Since this section is about ‚Äòadditional options need to be explored,‚Äù this is a good place to point to the need for an increased investment in organic research.	We appreciate the comment. The text mentions improving nitrogen fertilizer management, but unfortunately limited space precludes deeper discussion.
Melissa	Shapiro	Text Region	32. Mitigation		23		1	3	The discussion on CDR cannot conclude without explicit discussion of community consultation and involvement, especially when the CDR may impact community access to local resources, traditional lands. Efforts to launch CDR without the use of transparent and participatory decision-making processes that engage local communities early and often have proven inflammatory and ultimately unsuccessful. Those developing carbon management solutions should recognize the rights owed to Indigenous peoples living in the affected regions, including free, prior and informed consent; this section of the chapter should also recognize the value of traditional knowledge and the benefits of co-production in advancing equitable and just climate solutions.	We thank the reviewer for the comment. The chapter text in KM 32.4 briefly discusses the importance of engagement with community groups and stakeholders in the planning process generally. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.
Cathy	Day	Text Region	32. Mitigation		24	24	16	25	The text discusses the ‚Äúnumber of options for reducing non-CO2 GHG emissions from agriculture whose potential remains uncertain.‚Äù Organic agriculture and research into advancing both productivity and environmental benefits thereof may fit in here. Organic agriculture need not necessarily be added in all the locations we point to in these comments, but here, on p. 18, or p. 22, a statement to the following effect would fit well and is well supported by research: o‚ÜíOrganic farming systems that prioritize integrated soil health management and protect the soil microbiome from chemical and other disturbances show great potential to enhance soil carbon sequestration and minimize concentrated N inputs while maintaining profitable yields, thereby minimizing N losses as N2O or leached nitrate. Additional research is needed to fine-tune biologically based nutrient management and fully realize the potential of organic systems to mitigate direct agricultural GHG emissions.‚Äù	We appreciate the comment. The text mentions improving nitrogen fertilizer management, but unfortunately limited space precludes deeper discussion.
Matthew	Eisenson	Text Region	32. Mitigation		26	27	14	5	The subsection on "Siting and Land Use" notes that "siting may prove a key obstacle for renewables-based net-zero emissions systems" (page 27, lines 3-4). The only recommendation you provide for overcoming these obstacles is "[e]ngagement with community groups and stakeholders early in the planning process" (page 27, lines 4-5). While engagement is vital and can, as noted in the draft report, "prevent project delays and cancellations," other steps may also need to be taken at the state and federal level to facilitate renewable energy siting. First, state legislatures can help to circumvent obstacles to siting renewable energy facilities by enacting legislation that includes one or more of the following features: (i) vesting state government entities rather than local governments with decision-making authority over siting decisions; (ii) vesting state government entities with authority to set aside unreasonable local restrictions; (iii) setting limits on the restrictions that local governments can impose on renewable energy facilities; and (iv) imposing statutory deadlines for government decision-makers to reach decisions throughout the permitting process. See Michael B. Gerrard & Edward McTiernan, New York‚Äôs New Statute on Siting Renewable Energy Facilities, 263(93) N.Y.L.J., MAY 14, 2020 (2020), https://scholarship.law.columbia.edu/faculty_scholarship/3026. Three examples of states where one or more of these mechanisms are in use or in legislation recently passed by legislatures are as follows: New York: In 2020, New York State adopted the Accelerated Renewable Energy Growth and Community Benefit Act, which created a new Office of Renewable Energy Siting (ORES) to "undertake a coordinated and timely review of proposed major renewable energy facilities to meet the state,‚Äôs renewable energy goals while ensuring the protection of the environment and consideration of all pertinent social, economic and environmental factors in the decision to permit such facilities as more specifically provided in this section." See N.Y. Executive Law section 94-c(1). Under the Act, when evaluating an application for a major renewable energy facility with a nameplate capacity of 20 megawatts (MW) or more, ORES is authorized to "elect not to apply, in whole or in part, any local law or ordinance" that is "unreasonably burdensome in view of the [Climate Leadership and Community Protection Act] targets	We thank the reviewer for the comment. We now mention the potential for changes in governance and administrative law to streamline the process of infrastructure siting and include the suggested reference. However, the National Climate Assessment is a scientific document that provides a basis for decision making, and we cannot not prescribe policy.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Matthew	Eisenson	Text Region	32. Mitigation		26	27	14	5	The subsection on "Siting and Land Use" identifies "competition for land between renewables and agriculture (Hall, Morgan et al. 2022)" as an obstacle to siting solar and wind energy (page 26, line 25, to page 27, line 1). While it is true that developers have encountered opposition to siting solar and wind projects on agricultural land, some additional context is needed. In particular, there is no discussion in this chapter of biofuels, such as corn ethanol, which use far more land than solar and wind energy, but deliver relatively low yield in terms of energy production and few, if any, climate change benefits. There is also no discussion of legislative efforts to exclude solar energy projects from agricultural land. Please consider noting that: (1) solar and wind energy projects use very little agricultural land compared to the production of biofuels; (2) photovoltaic (PV) solar delivers far more energy per acre than corn ethanol; (3) corn ethanol delivers few, if any, climate change benefits; (4) any competition between renewables and agricultural uses can be mitigated by deploying systems that produce energy and agricultural products on the same land; and (5) some state and local governments have taken legislative action to limit or exclude large-scale solar energy projects from some or all agricultural land within their respective jurisdictions. With respect to point (1), approximately 40 million acres of agricultural land is currently being used to grow corn for ethanol, an area the size of Florida. According to the U.S. Department of Agriculture (USDA), 90 million acres of agricultural land in the U.S. are used to grow corn, and 45% of that corn is used for ethanol production. See Claire Hutchins, Feedgrains at a Glance, USDA Economic Research Service (last updated October 3, 2022), https://www.ers.usda.gov/topics/crops/corn-and-other-feedgrains/feedgrains-sector-at-a-glance/. By comparison, solar installations on all types of land (both agricultural and non-agricultural) occupy only 0.5 million acres, while wind turbines occupy only 0.07 million acres. See Dave Merrill, "The U.S. Will Need a Lot of Land for a Zero-Carbon Economy," Bloomberg (last updated June 3, 2021), https://www.bloomberg.com/graphics/2021-energy-land-use-economy/. To achieve complete decarbonization of the grid and electrification of end uses, the U.S. Department of Energy estimates that approximately 10 million acres of land will be needed for solar PV by 2050, will [illegible]	We thank the reviewer for the comment, and have added a sentence noting the land requirements of bioenergy and the prospect for decreased competition with food production insofar as transportation is electrified.
Nick	Procopio	Text Region	32. Mitigation		29	29	8	10	It seems worth mentioning that, at least by some counts, more people are already employed in the solar sector than in coal. Likewise, further in this section it could be mentioned that even in some states that traditionally have high employment in fossil fuel industries, renewable industries are already large employers, such as wind in parts of Oklahoma.	We thank the reviewer for the comment and have revised the text of KM 32.4 to include the estimated number of U.S. jobs in fossil fuel production versus wind and solar.
Melissa	Shapiro	Text Region	32. Mitigation		30		11	26	Environmental justice and procedural justice are cross-cutting issues that implicate several mitigation issues and science and policy responses. While these principles are relevant the energy sector, social inequities and systemic discriminatory practices are pervasive and should be raised earlier in the chapter and discussed more broadly.	We thank the reviewer for the comment. We have expanded the introduction section of the chapter and now raise principles of equity and justice in that section.
Cathy	Day	Text Region	32. Mitigation		31	31	11	13	Regarding the intensified heat island effect in poor neighborhoods from lack of trees: this is a reason to emphasize urban tree plantings and agroforestry-style urban farms and gardens. While this and the other chapters touch briefly on agroforestry and urban issues, greater emphasis could be given to urban re-greening and tree planting.	We appreciate the comment. Unfortunately limited space precludes deeper discussion of urban re-greening in our chapter.
Nick	Procopio	Text Region	32. Mitigation		33	36	5	16	A lot of mitigation strategies are discussed, and at what scale they have been adopted in the US. This is great. However, it might be more telling to offer some measurement of what portion/percentage of America is covered by these policies. States vary a lot in population, and thus discussing what percentage of America is covered under these policies would be instructive. This is true even if it is a ¬iballpark" measure like ¬i40 states, containing over XY% of all Americans".	We thank the reviewer for the comment. We discuss the spatial distribution of policies in KM 32.5 but the detailed data we would need to assess the population covered by different policies is not available.
Nick	Procopio	Text Region	32. Mitigation		33	33	14	14	The use of ¬ithe Nation" here seems awkward. Referring to the USA has not been consistently done in this manner in this chapter.	We thank the reviewer for the comment and have revised the text to refer to the US and not 'the nation.'
David	Saunders	Text Region	32. Mitigation		35	35	10	11	NCA COMMENT: Renewable Energy Certificates (RECs) Location NCA5_32_Mitigation_3OD Figure 32.21. Adoption Rate of Various Forms of Policy Instruments and Climate Action Page 32-35 Line 10 Comment ‚Äì Please add this text to line 10 Although Renewable Energy Certificates (RECs) are widely utilized as ‚Äúproof‚Äù of GHG mitigation, controversy as to their veracity exists. References Peltier, L. (2022, September 16). Retail Energy‚Äôs Greenwashing: How fictional renewable energy certificates became ‚Äú100% renewable‚Äù electricity. https://issuu.com/greenlaurel7/docs/retail_energy_greenwashing Gillenwater, M. (2008). Redefining RECs‚ÄîPart 1: Untangling attributes and offsets. Energy Policy. https://doi.org/10.1016/j.enpol.2008.02.036. Gillenwater, M. (2008b). Redefining RECs‚ÄîPart 2: Untangling certificates and emission markets. Energy Policy. https://doi.org/10.1016/j.enpol.2008.02.019 Brander, M., Gillenwater, M., & Ascui, F. (2018). Creative accounting: A critical perspective on the market-based method for reporting purchased electricity (scope 2) emissions. Energy Policy, 112, 29‚Äì33. https://doi.org/10.1016/j.enpol.2017.09.051 Gillenwater, M., Lu, X., & Fischlein, M. (2014). Additionality of wind energy investments in the U.S. voluntary green power market. Renewable Energy, 63, 452‚Äì457. https://doi.org/10.1016/j.renene.2013.10.003 ‚ÄÉ Discussion THE PROBLEM WITH RECS Does this situation sound familiar?	Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.
Melissa	Shapiro	Traceable Account	32. Mitigation		39		16	26	Other disturbances that have increased in frequency above their natural baseline due to warming are also not fully represented in all inventories and estimates. Wildfire in unmanaged lands/natural & semi-natural ecosystems can emit considerable amounts of CO2, as well as CH4 and other GHGs. These [CO2] emissions are not accounted for in estimates of net land sink/source strength. While wildfire CO2 emissions are to some extent compensated for by vegetation recovery, an increasing number of fires, shorter fire return intervals and ‚Äì in boreal and tundra regions ‚Äì more prolonged or deeper burn of organic matter below ground, all point towards a progressive weakening of the net land sink with an intensifying fire regime.	We appreciate the comment. The chapter text has been revised to mention the possibility of future changes in land related sorces and sinks, as well as the need for monitoring and inclusion of unmanaged lands. Unfortunately space is limited and the authors have had to make difficult choices about what information to include.
Melissa	Shapiro	Traceable Account	32. Mitigation		39		27	33	Emissions from the land sector are a comparatively large source of uncertainty, and reducing that uncertainty is important for assessing progress towards net zero. As warming continues, the magnitude of emissions from land is likely to increase due to increasing disturbance, particularly from wildfires and permafrost thaw. This means that, though at the moment, "these emissions are less important to overall trend" (p. 32-40, (l) 4), their importance will only increase over time. More comprehensive monitoring and modelling effort is needed to reduce uncertainty with respect to how emissions from land are already being affected and to better project changes in the future. It is also important to note that while increasing disturbance will affect both managed and unmanaged land, some processes (e.g. permafrost thaw) will both disproportionately affect unmanaged lands and have large consequences for land-related emissions overall. It is therefore critical that major sources/sinks on unmanaged lands are not excluded from this accounting.	The chapter text has been revised to mention the possibility of future changes in land related sorces and sinks, as well as the need for monitoring and inclusion of unmanaged lands.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Cathy	Day	Text Region	32. Mitigation		41	41	16	19	Several solutions deserve additional attention here. We suggest the section be expanded as follows (new language starts and ends with underscore): o‚Äúln general, there is limited research that quantitatively assesses a greater number of emerging energy technologies and land management options, including especially work that incorporates the non-cost factors discussed in Key Message 32.4. ____Additional research is needed to explore and develop the full potential of advanced agroecological systems such as organic farming, agroforestry, and crop-livestock integrated silvopasture to mitigate net GHG footprint of the US agriculture and food system while making it more equitable, and to build agricultural, community, and societal resilience to climate change.‚Äù____	We appreciate the suggestion. The text addresses several related topics, but space is limited and the author team has deliberated and prioritized the information to include.
Johan	Lopez	Whole Chapter	32. Mitigation						New York, November 28th, 2022. Dr. Allison Crimmins, NCA Director Dear Dr. Allison Crimmins, First, I would like to congratulate you and your team for your hard work in preparing this assessment. This document will not only lay the groundwork for future work, but it also serves as a sounding board regarding the urgency of our government to take prompt action in tackling climate change effects. As Prime Minister Mia Mottley of Barbados told us at COP 26 Last year, ‚ÄúA 2-degree Celsius rise in global temperature would be a ‚Äòdeath sentence,‚Äô for the island and coastal communities1. We understand that the coastal communities in the U.S. are particularly vulnerable to Climate Change Impacts due to their size, location, and exposure to natural hazards. I wanted to respectfully share with you some comments and concerns that I have regarding your assessment. This with the intention of enriching the content presented and scaling up the potential solutions that you and your team have provided. Unfortunately, despite these arrangements and commitments, we live in a more precarious situation than 50 years ago. A serious planetary crisis of climate change, nature loss, and pollution is threatening our life support system, and the U.S. is not exempt from such reality. Our current economic development paradigm drives environmental degradation. Production models for GDP growth are driving environmental degradation, undermining sustainable development. Our unsustainable patterns of consumption and production are causing climate change and biodiversity loss. More than one million species face extinction. The rate of indiscriminate extraction and exploitation of natural resources has tripled in the last 70 years, and the linear economic model is externalizing negative impacts which are denuding the planet and destroying the fabric of life. While I celebrate the findings and recommendations you make in the Adaption Chapter; I believe that the tone and key messages of urgency are imperative to drawn the attention of the reader. Quoting from the document:	We thank the commenter for the comments and kind words. Most of these are directed at adaptation efforts (chap. 31), but we have included some new text regarding pending SEC regulations and corporate reporting of risks and emissions in KM 32.5. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.
Rashawn	Merchant	Whole Chapter	32. Mitigation						The management and adaptation of climate change have understandably grown into a complex issue that spans every aspect of American society. As the National Climate suggests, this complexity stems from the fact that as the harm of climate change continues, there needs to be an increase in the attention and investments needed to prepare for the impacts. It‚Äôs important to note these impacts affect individuals and communities differently, and this assessment does an excellent job of highlighting these differences. Throughout these comments, there will be explained examples of how the assessment accomplishes this, and what improvements should be made so that readers can gain a better understanding of not only the scientific connection to the managing and adapting of climate but the societal connection as well. The paper clearly defines what adaptation is. Describing it as the actions taken to reduce risk from today,‚Äôs climate change conditions and preparation for future impacts allows people to have a foundational understanding of the information that will be provided to them. This is significant because not all people are informed on the inner workings of climate language. An assessment offered to the federal government should be one that is accessible to all people within the country. This means we can not assume people know what these terms are as most are still a part of a niche category of jargon. Moreso, the only assumption we should make referring to federal information is that people have zero climate knowledge at all. At some points, however, some of the broader languages at the beginning of the paper could‚Äôve been specified. While this may sound like a contradiction, it is possible to use specific details without being overly complex and still understandable. When referencing locations and groups, there should be specifications as to what places and people are included in these groups. As America is a vastly diverse place in regards to the East, West, South, and Central regions. These are regions in which climate change impacts vary from flooding, drought, and extreme heat all in unique ways. The American people should have a reference in terms of what areas relate to them to establish a better connection. The same concept applies to the usage of groups. America has long been the melting pot of the world and with 100s of racial, cultural, and ethnic backgrounds people should have referenced the circumstances in which their group applies. Climate impacts subjectively affect everyone. But there	We thank the reviewer for the comment, and have made efforts to include both broad and specific information about equity and justice as related to mitigation in our chapter. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.
Tom	Dower	Whole Chapter	32. Mitigation						The mitigation chapter includes well-known technologies and approaches to reducing energy-related emissions from various sectors, including electrification (with simultaneous power sector decarbonization), energy efficiency, and a few other options. However, one important form of carbon management is missing, namely carbon utilization, otherwise known as carbon conversion or carbon recycling. This is an important mitigation tool for both hard-to-decarbonize industries as well as a long-term transition to sustainable sources of carbon for carbon-containing chemicals, fuels and products which are today produced via fossil resources. There are carbon conversion technologies commercially available today which can immediately reduce emissions and create new, more sustainable supply chains for hard-to-abate sectors. For example, capture of carbon oxides, including carbon monoxide, prior to combustion is an example of mitigation through carbon utilization rather than first emitting CO2 and then subsequently having to capture those emissions via natural or mechanical CDR. This type of carbon management is almost entirely missing from the mitigation chapter, except for one oblique reference to CCUS within the context of Hydrogen production. Inclusion of this important carbon management pathway has several benefits including transitioning hard-to-decarbonize sectors; creating a circular economy; reducing emissions immediately,Äîwith compounding atmospheric benefits; reducing the need for atmospheric carbon dioxide removal (obtained at much lower concentrations than can be avoided now); and buying time until future technologies and related infrastructure can be developed and scaled.	We thank the reviewer for the comment, and have made efforts to include both broad and specific information about equity and justice in our chapter. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.
Glenn	Branch	Whole Chapter	32. Mitigation						This chapter would benefit from the addition of a discussion of education and outreach efforts with regard to climate change, which are foundational to mitigation efforts. In order to make the best decisions about mitigation, policymakers and voters need to grasp the scientific and social issues involved in meeting the challenges posed by climate change, and what confers them with that grasp is education. The point is acknowledged piecemeal previously in this draft report (e.g., ch. 11, p. 25; ch. 13, pp. 12-14; ch. 15, p. 21), but it would be appropriate to discuss it clearly and in detail here. Overall, it would be best for the report to contain a separate unit especially devoted to discussing the current state and future needs of education and outreach efforts on climate change.	We thank the reviewer for the comment. The chapter introduction and text in KM 32.5 have been revised to briefly discuss the role of education and outreach efforts--which are different but complementary to providing useful and actionable insights to decision makers. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.
John	Olson	Whole Chapter	32. Mitigation						The strength of this chapter is the way it presents the consequences of various mitigation strategies. It is missing the social and political processes that are needed to establish those strategies, such as engaging stakeholders, gaining societal consensus, and pursuing community, industrial and political leaders. There should be a chapter on these educational, social and political strategies. For the long term, it will be important to involve youth education and cultural sectors. An additional chapter could address this need.	We thank the reviewer for the comment. The chapter introduciton and text in KM 32.5 have been revised to include brief discussion of the role of education and outreach efforts. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jeremy	THORNER	Whole Chapter	32. Mitigation						Climate change education is a critical component of any plan for responding to and making every attempt to mitigate global warming and climate change. Formal education in these subjects is the best way to prepare future generations to face and be equipped with the necessary knowledge and practical tools to address the challenges posed by global warming and climate change. For this reason, I think it would improve the impact of the NCA5 Report to highlight the need for robust climate change education by adding an entire (new) chapter dedicated to discussing the need for formal climate change education, its goals, and how best to improve formal State science standards and implement formal coursework in this area, especially in secondary science education because a majority of Americans receive the bulk of their science education in that context. If you agree that the report would benefit from the addition of a unit (whether a chapter, or a section of a chapter, or something else) devoted to discussing climate change education and outreach specifically, offer the suggestion as a comment on the whole document.	We thank the reviewer for the comment. The chapter introduciton and text in KM 32.5 have been revised to include brief discussion of the role of education and outreach efforts. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.
Emma	Conrad-Rooney	Whole Chapter	32. Mitigation						All key messages should be revised to make sure they follow the Risk-Based Framework	We thank the reviewer for the comment. The chapter authors have applied the risk-based framework to the extent practicable, but our chapter is focused on mitigation responses to reduce risks of climate impacts detailed in the rest of the report.
Elizabeth	Wilkening	Whole Chapter	32. Mitigation						Mitigation should also include climate change education so that individuals can understand what is needed and how they can contribute. It should include education of all ages, formal and informal.	We thank the reviewer for the comment. The chapter introduciton and text in KM 32.5 have been revised to include brief discussion of the role of education and outreach efforts. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.
Melissa	Shapiro	Whole Chapter	32. Mitigation						Considerations of justice and equity are specifically raised in narrow contexts (for example, ‚Äúenergy equity and environmental justice‚Äù; however, these are cross-cutting principles that must be used to frame the discussion and which should be integrated throughout the chapter.	We thank the reviewer for the comment. We have expanded the introduction section of the chapter and now raise the broad applicability of principles of equity and justice in that section.
Citlali	Nieves Lira	Whole Chapter	32. Mitigation						I think one of the main takeaways for me in this chapter is the need to reduce greenhouse gases emissions with a heavier emphasis in the agricultural, commercial and industry fronts. Getting to net zero will have to be something everyone on the planet needs to contribute to, and although an individual does not have the power to change a company or stop and control how agriculture is managed we can push our consumer power into better option, into cleaner cars and into holding accountability for politicians. Another main take away from this chapter (perhaps it resonated with me as someone who is studying to become an environmental chemist) is how much money and resources we should allocate into research, whether it is to find a solution to the plethora of problems that are discussed in this paper, or to create a cleaner and greener battery to power cars, we will only advance and get this answer through research https://enveurope.springeropen.com/articles/10.1186/s12302-020-00419-1 Links to an external site.. It will be an extremely monumental task to try to cool the planet down, but we have to try and we have to remember that once a glacier melts or a species goes extinct we cannot recover it or restore it, we can only preserve what we currently have.	We greatly appreciate the reviewer's comment about the chapter and hope that the content is useful.
Daria	Singer	Whole Chapter	32. Mitigation						It was a pleasant surprise to find many different examples of mitigation tactics from the worldwide scale all the way down to the individual level, something that is sorely missing in many other 'we need to cut greenhouse gas emissions now' articles and news stories. It was also pleasing to find examples of not only possibilities, but examples of plans that had been enacted and worked! There is something refreshing about a paper on emission mitigation strategies that is both hopeful and realistic. The authors did a good job of presenting what the problem was, examples of how to solve it, examples of the problem-solving in action, and then kept in mind possible consequences to their solutions both good and bad. While reading, a few questions arose that didn't seem to be answered in the text: Electricity from nuclear powerplants were briefly mentioned along with hydroelectric power. Could nuclear power be considered a viable source, and is have there been enough improvements in nuclear waste disposal to make nuclear energy an option along with renewable energy sources like solar and wind energy? Granted, the source of uranium may need to change from ore to seawater (Conca, 2016), and existing nuclear power plants may need to be updated, but aside from that the research (IEA, 2019) indicates that nuclear power creates far fewer carbon emissions than fossil fuel energy plants. A little later in the paper, the authors mentioned that the manufacturing of goods is by far the biggest contributor to greenhouse gas emissions in the industrial sector. Though it wasn't mentioned specifically, the manufacturing of "fast fashion", cheap clothing made quickly by companies to make money off of the current fashion trend (which inevitably changes by the end of a given week), is one of the top contributors to pollution. Aside from the clothing being made from low-quality synthetic fabric that doesn't break down when it is discarded, "fast fashion" also produces 20% of the world's wastewater and 35% of the microplastics found in the ocean (Le, 2022). The manufacturers are also commonly located in countries that don't have very high work and pay standards, or wastewater treatment standards. This means that the vast number of people making these garments being underpaid and overworked (UNEP, 2022), and the wastewater is dumped into the nearest body of water without any of the toxic dyes being removed. If the authors were to reference fast fashion, it would also fit nicely into	We thank the reviewer for the comments. We include nuclear fission as a potential source of low-carbon energy in a number of places, but unfortunately space is limited and the author team has deliberated and prioritized the information to include. Similarly, apparel is not a major source of US manufacturing emissions; although consumption in the US is related to substantial extra-territorial emissions, those are beyond the scope of this chapter.
Joseph	Sollod	Whole Chapter	32. Mitigation						This chapter should include discussion on the important role of building codes in climate mitigation, consistent with the language that is presented in the Built Environment chapter section Key Message 12.3. Urban Climate Mitigation and Adaptation Opportunities. These comments are pertinent to both sections Established Opportunities to Reduce Energy-Related Emissions on pages 10-11 and Key Message 32.5. Governments, Organizations, and Individuals Can Act to Reduce Emissions on page 33. Building codes and standards provide a common language and requirements for the design, construction, and operation of buildings aimed at supporting the building industry‚Äôs construction of safe, resilient, and sustainable structures. They have long served as the main tool of governments in setting agreed-upon norms. Adoption and enforcement of up-to-date, modern codes can drive progress in reducing energy use and greenhouse gas (GHG) reductions. Specifically, energy codes are an important policy tool to drive climate mitigation, which provide the foundation to any effort to drive new buildings towards zero energy and zero carbon and set requirements for how renovations to existing buildings should be undertaken. Energy codes are highly effective in reducing energy use and GHG emissions while enhancing their resilience, which is critical to mitigate the impacts of climate change. The U.S. Department of Energy (DOE) evaluates improvements in the International Energy Conservation Code (IECC), a nationally recognized model energy code, once a new edition is released every three years. Since 2006 the residential provisions of the IECC have delivered about a 40% improvement in energy savings. Improvements in the residential and commercial provisions of the IECC since 2009 will provide over 350 million metric tons (MMT) of CO2e savings for residential buildings and 340 MMT for commercial buildings, totaling nearly 700 MMT of savings. The residential provisions in the 2021 edition of the IECC provide a 9.4% improvement in energy use and an 8.7% reduction in carbon emissions over the 2018 edition. The commercial provisions in the 2021 IECC provide site energy savings of 12.1% and a 10.2% GHG emissions savings for commercial buildings relative to the 2018 IECC. The 2021 IECC also includes an appendix for achievement of zero energy buildings. According to DOE, from 2010 to 2040, if consistently implemented and regularly updated, the model	We thank the reviewer for the comment. The revised chapter mentions building codes and benchmarking ordinances in KM 32.5 with a cross-reference to the key message in chapter 12.
Missy	Holzer	Whole Chapter	32. Mitigation						I realize this chapter focuses on the reduction of emissions; however, overlooked supporters of these reductions are those in education and educational systems. Consider addressing the roles of schools and those in schools to promote the reduction in emissions. Students are passionate about our future as they know it is theirs and they want it to be sustainable. We should support them!	We thank the reviewer for the comment. The chapter text in KM 32.5 has been revised to include briefly discuss the role of education and outreach efforts. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Melissa	Shapiro	Whole Chapter	32. Mitigation						The chapter notes that ‚ÄòGHG emissions that occur over large areas and are associated with complex interacting processes such as land-related emissions,Äô are a significant source of uncertainty in national assessments. We welcome the recognition of the need to reduce uncertainty re. land sector emissions through improved monitoring and modeling; advancing monitoring, in particular, is important, as there are many remote regions, such as the permafrost region, where land-related emissions are notable and have the potential to take up a significant portion of the carbon budget. Modeling can help to depict a more accurate picture of future emissions, but only if the models are aligned with and informed with robust monitoring efforts.	We thank the reviewer for their perspective. Relevant to the comment, the chapter text has been revised to also mention the possibility of future changes in land related sorces and sinks, as well as the need for monitoring and inclusion of unmanaged lands.
Melissa	Shapiro	Whole Chapter	32. Mitigation						Recognizing the chapter authors,Äô acknowledgement in the Traceable Accounts, we nevertheless urge the chapter authors to stress that the inventories and estimates featured in this chapter used to assess land-related emissions and sink strength,Äiwhile regarded as ‚Äúbest available,Äù science in many contexts,Äi are not comprehensive. Most notably, the full spectrum of emissions from permafrost thaw processes are not captured in these inventories. The entire permafrost region stores roughly 1.4 trillion tons of organic carbon,Äîor four times the amount of carbon that humans have released since the Industrial Revolution and roughly twice as much carbon as is currently in the Earth‚Äôs atmosphere (See Hugelius, G., Strauss, J., Zubrzycki, S., Harden, J. W., Schuur, E. a. G., Ping, C.-L., Schirrmeister, L., Grosse, G., Michaelson, G. J., Koven, C. D., O‚ÄôDonnell, J. A., Elberling, B., Mishra, U., Camill, P., Yu, Z., Palmtag, J., and Kuhry, P. (2014). Estimated stocks of circumpolar permafrost carbon with quantified uncertainty ranges and identified data gaps. Biogeosciences, 11(23), 6573‚Äì6593. https://doi.org/10.5194/ bg-11-6573-2014; Schuur, E., McGuire, A., Schv¶del, C. Grosse, G., Harden, J.W., Hayes, D.J., Hugelius, G., Koven, C.D., Kuhry, P. Lawrence, D.M., Natali, S.M., Olefeldt, D., Romanovsky, V.E., Schaefer, K., Turetsky, M.R., Treat, C.C. & Vonk, J.E., (2015). Climate change and the permafrost carbon feedback. Nature 520, 171‚Äì179. https://doi.org/10.1038/nature1433). Researchers are currently working to measure (via monitoring and modeling) the amount of greenhouse gas that is and may be released as permafrost thaws and this carbon is released. There is considerable confidence that these emissions will become much more substantial over the next few decades. (See, e.g. (https://www.pnas.org/doi/10.1073/pnas.1618567114). As permafrost thaws, as well as other disturbances such as wildfire, continue to accelerate, the importance of this phenomenon to overall trends in US GHG emissions will increase. While these processes continue to have considerable levels of uncertainty associated with them, there is some confidence that ‚Äòi globally - they have implications for the trajectory required to meet the Paris Agreement goals. It is therefore essential that attempts are made to improve both monitoring and reporting of emissions associated with these processes at a national level.	We appreciate the comment. The chapter text has been revised to mention the possibility of future changes in land related sorces and sinks, as well as the need for monitoring and inclusion of unmanaged lands. Unfortunately space is limited and the authors have had to make difficult choices about what information to include.
Don	Haas	Whole Chapter	32. Mitigation						Chapter 32 is the second of two ‚Äúresponse chapters.‚Äù These chapters are perhaps the strongest candidates of the existing chapters for substantive attention to climate and energy education. The chapter opens with this passage: ‚ÄúStabilizing Earth‚Äôs climate would require net-zero carbon dioxide (CO2) emissions and a decrease in net non-CO2 forcing (or that residual non-CO2 forcing is offset by removal of greenhouse gases from the atmosphere) (IPCC 2021b).‚Äù (p. 3, lines 2-4). If humans are to reach this goal, it requires that a broad segment of the population learns what needs to be done to achieve and how to take those actions. To mitigate, we must educate. That is more likely to succeed if substantial attention to education is given within the chapter. For the most part, it is not. Engaging youth in climate communication, for example, has promise to educate parents effectively, and daughter are especially effective at educating parents (Lawson et al., 2019) and can provoke institutional changes in energy use (Bandura & Cherry, 2020; Cherry, n.d.). While K-12 education is a logical piece of this, it should not be the primary focus. Where K-12 education is attended to, a component of that should engage youth in working on mitigation, and engage youth in engaging their families and communities. Engaging youth in climate communication, for example, has promise to educate parents effectively, and daughters are especially effective at educating parents (Lawson et al., 2019) and youth can provoke institutional changes in energy use (Bandura & Cherry, 2020; Cherry, n.d.). There is considerably more that could be incorporated into the chapter to bring attention to the role formal and informal educational systems could play in climate mitigation than is addressed in my comments. I would be happy to discuss this with the writing committee. While I know and have known for years that emissions from electric power generation in the U.S. have dropped substantially since the aughts, somehow it continues to surprise me every time I see it again. That simultaneously brings joy and elicits wonder at why it is not common knowledge that, ‚ÄúUS emissions from electricity generation are roughly 40% below 2005 levels,Äù (p. 6, line 4). That most Americans do not know this is perhaps a failure of our efforts at climate and energy education and ultimately add to the difficulty of mitigation efforts. It is simultaneously a potential mark of success that	We thank the reviewer for the comment. The chapter introduciton and text in KM 32.5 have been revised to include brief discussion of the role of education and outreach efforts. Unfortunately, space is limited and the author team has deliberated and prioritized the information to include.
Reid	Sherman	Text Region	Appendix 1: Process		3	3	17	17	Caption under 450+: Eliminate "a of" or reword to read " a team of" or similar.	We have revised this sentence to correct the error.
Daniel	Feldman	Text Region	Appendix 3: Scenarios and Datasets		4		10		Replace ‚ÄúAnalogues,Äù with ‚ÄúAnalogs,Äù as described in Pierce et al, 2014 (https://doi.org/10.1175/JHM-D-14-0082.1).	Thank you for the comment to clarify the phrasing used in the draft from "Analogues" to "Analogs". We have made the requested change to align the wording with Pierce et al., 2014.
Kayla	McCauley	Text Region	Appendix 4: Indicators		1	1	4	10	Indicators reflect changes over time and perhaps, perturbations in a system but are neither sensitive nor specific and in the absence of other data cannot be used to ascribe etiology.	Agree. The indicators used here all have a relationship to climate but are not meant to ascribe etiology. Multiple lines of evidence are necessary for assessing global change and the causes and effects of climate change. We have revised the description of indicators in the introduction to reflect this.
Kayla	McCauley	Text Region	Appendix 4: Indicators		2	2	6	6	Is the information on projections of climatic factors in the NCA - like changing extremes in temperature, precipitation in the future - not considered indicators?	That is correct. As described in the introduction and definition of indicators used here, indicators in the context of this NCA appendix are based on observations and measured data. Projected changes in climate are provided elsewhere in the report and often referred to as impacts.
Kayla	McCauley	Text Region	Appendix 4: Indicators		2	2	9	25	This is an important declarative statement, but the intent gets lost in subsequent text. These indicators are adjuncts to be added to other data in order to determine the nature of changes that may be occurring to an outcome of interest.	We have revised this sentence to clarify the intent. Also, we are unsure what exactly is meant by "other data", but we have added a sentence in the second paragraph of the introduction highlighting the utility of indicators when combined with other data, such as demographic and socioeconomic information.
Kayla	McCauley	Text Region	Appendix 4: Indicators		2	2	9	25	"Indicators" can tell us that the environment is changing over time but they cannot tell us why nor in the context of health can they tell of the impact of that change in the absence of other bio-indicators or biomarkers reflecting specific aspects of human biology. That said in the absence of the inclusion of indicators, current efforts at health surveillance are missing a potentially significant component of the public health scenario leading to potentially spurious conclusions.	The authors acknowledge that indicators related to human health need to include more than just health outcome indicators. Exposure, vulnerabilities, and adaptive capacity are all factors that influence health outcomes and the severity of impacts. The authors have added new content about the inclusion of indicators in national surveillance system data collection and analysis processes in the Knowledge Gaps and New Approaches section. It is beyond the scope of this introduction to discuss attribution and the components of the public health scenario. We made this clarification with a new sentence in the introduction: "Attribution and causation are discussed in other chapters throughout the report (e.g., Chs, 2, 3, 15)."
Kayla	McCauley	Text Region	Appendix 4: Indicators		2	2	10	10	an array of indicators is hardly ever, if ever, comprehensive in providing insight. Indicators are always limited in their ability to convey insight. Would qualify and at least say "more comprehensive" of something like "an array of indicators can start to represent a more comprehensive view of the interconenctions among factors in a warming world" or such. Array is also a peculiar word here. An alternative point from an array or limited set of indicators would be that taken as a whole (a matrix indicators?) a broad set of indicators across many different manifestations of climate change and its impacts provides a national snapshot of both the severity of the problem and the effectiveness of interventions on a more comprehensive scale. THat is I think what this sentence is trying to say, but it can be made clearer.	Thank you for this comment. We have edited this sentence to use the phrase "more comprehensive", to avoid use of the word "array", and to mention the interconnections between factors. This sentence is intended to be a high level overview of how a collection of indicators provides more information than each indicator individually. Specifics related to the severity of the problem are highlighted throughout the rest of the Appendix. Indicators related to the effectiveness of mitigation or interventions are an emerging area of research and current knowledge gap - we mention the need for effective adaptation indicators in the "Knowledge Gaps and New Approaches" section. We reference the Mitigation and Adaptation chapters for more information the type of information that is being tracked related to these efforts.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Kayla	McCauley	Text Region	Appendix 4: Indicators		2	2	18	18	The time period does not match: 1992-2021 vs. 1901-1960? Also, the panels on the left do not have any information to compare with.	The time periods are not intended to match; it has been the standard since NCA3 (for historical changes) to calculate the change for certain variables using data for the most recent 30 years, relative to a reference period spanning the first part of the 20th century. 1992-2021 was chosen to represent the more recent period or "present day" as this is consistent with the World Meteorological Organization's recommended use of 30-year periods for climate statistics. The motivation for using the 1901-1960 reference period is to illustrate climate changes occurring as a result of the recent acceleration in greenhouse gas concentrations. The beginning date of 1901 was chosen because earlier historical observations for the U.S. are less reliable and more sparse. Anthropogenic forcing exhibits a slow rise during the early part of the 20th century but then accelerates after 1960, which was the reason for choosing 1960 as the ending date of the reference period. Thus, these maps highlight changes in climate during the period of rapid increase in anthropogenic forcing. The reviewer is correct in that the panels did not contain data for the third-order draft version of this figure. Unfortunately, an important note was inadvertently left out of the caption, which stated: "Maps showing actual data for the four scales are currently in development." Data have now been added to the figure, but we apologize for any confusion.
Kayla	McCauley	Figure	Appendix 4: Indicators		2				How are the last two lines of the caption relevant to the Figure A4.1?	Unfortunately, an important note was inadvertently left out of the caption, which stated: "Maps showing actual data for the four scales are currently in development." These two sentences related to data and maps which have now been added to the figure. We apologize for any confusion.
Kayla	McCauley	Text Region	Appendix 4: Indicators		3	3	13	14	It is not clear as to what is meant by 'track trends and impacts' in this context. Is the intent to state that developing/tracking intermediate factors along a causal pathway helps track progress on strategies intended to reduce the adverse impact(s) arising from the climate hazards? For example, an indicator on energy burden in families can explain changes in adverse health outcomes related to extreme heat.	We have edited this sentence to be in the context of health and revised 'track trends and impacts' to be more specific to 'track trends in exposure and prevalence of health outcomes.' We recognize there is a gap in not having indicators of adaptation and strategies intended to reduce the adverse impacts arising from climate hazards in the Knowledge Gaps and New Approaches section.
Kayla	McCauley	Text Region	Appendix 4: Indicators		3	3	13	15	This sentence is uncited but is at least consistent with the point of this article by Liu et al. https://link.springer.com/article/10.1007/s10584-021-03125-w As written the sentence is hard to follow and not focused. The point of sets of indicators along pathways of exposure is first of all somewhat health specific. Second, it allows insight into changes in potential exposure or hazard, changes in exposures, and changes in outcomes. Because these are multi-step and complex causal chains, sets of indicators along the causal change allow inference about the extent to which changes in climate and earth systems are affecting human populations, and allows evaluation of interventions to stop exposures or prevent disease given exposures. This can be made much clearer.	We have added the citation. The revised text specifies this statement is in the context of health. We have also updated 'track trends and impacts' to be more specific to 'track trends in exposure and prevalence in health outcomes.' We added text to state sets of indicators in a health context can be useful to 'provide insights into the extent to which changes in climate affect people and help identify opportunities for public health actions to reduce or prevent exposures and adverse health effects.' We recognize there is a gap in not having indicators of adaptation and strategies intended to reduce the adverse impacts arising from climate hazards in the Knowledge Gaps and New Approaches section.
Kayla	McCauley	Text Region	Appendix 4: Indicators		4	4	10	10	indicators relevant to multiple regions and sectors' needs additional explanation for exclusion of relevant indicators such as economic and social measures that affect all regions and sectors. This statement does not currently explain why the specific indicators described in more detail below were selected.	Unfortunately due to space limitations it is not possible to include indicators of economic and social measures across all topics, however, we do include some socioeconomic indicators (e.g., Billion Dollar Disasters). We have revised this sentence to explain that this appendix presents *examples* of important indicators focusing on cross-cutting topics relevant to multiple regions and sectors. We have also revised the text associated with each indicator to highlight its value and utility. These specific indicators were selected because they: (a) have value in supporting other NCA5 chapters, (b) are from high-quality federal data sources that can be regularly updated, and (c) are of value to decision makers across multiple regions and sectors and a variety of geographies. These elements are mentioned in the introductory text.
Kayla	McCauley	Figure	Appendix 4: Indicators		4				The title/caption of the figure is misleading. Many climate-related risks don't differ across the United States (heat, flooding, etc.). The title and use of a subset of relevant icons suggests that risk differ much more than they do, and in fact, national scale indicators of risk are critical. This figure supports the previous figure showing different scales by highlighting the regional scale, but it doesn't add useful insight into national or local scale differences in risks. Suggest rethinking the need or purpose of this figure and changing the title.	We have renamed the title of the figure to "Observed regional changes can be represented by indicators" to remove the suggestion that risks differ across the country. We more clearly referenced the figure (A4.2) in the accompanying text as showing only regional information.
Kayla	McCauley	Text Region	Appendix 4: Indicators		5	5	3	3	This line highlights Key Message 2.2, but the text matches Key Message 2.1 almost word-for-word.	We thank the reviewer for pointing out this error. The reference has been changed to say KM 2.1.
Kayla	McCauley	Text Region	Appendix 4: Indicators		5	5	6	9	Reference Fig. 2.1	Agree we have added Fig 2.1 as a reference.
Kayla	McCauley	Whole Page	Appendix 4: Indicators		5				Seems like the items delineated in Section A4.2. Atmospheric Indicators could be recaste a bit. Much of the text describing these indicators I imagine can be found elsewhere in the report (i.e., are these indicators define elsewhere in the report and if so can't the reader be referred to the relevant sections?). could these sections on the individual indicators then focus on how they have been applied to date to address environmental impacts on specific health/societal outcomes, thereby highlighting their utility re public health assessment? Perhaps a referenced table of indicators x application (infrastructure, food systems, health etc.)?	Thank you for this comment. We have improved the text in the introduction to better describe the purpose of the appendix, including how we are providing examples of key indicators related to each topic. The Appendix exists to support the NCA5 chapters, and these specific indicators are not shown or defined elsewhere in the report, but are referenced within other chapters. Unfortunately, due to space limitations we cannot go into detail about how these individual indicators can be used to address environmental and societal impacts, however, we have also added a sentence stating the importance of atmospheric indicators and how they form the basis for assessing trends and impacts and key risks (as noted in the IPCC WG2 2022 report) among all sectors.
Kayla	McCauley	Whole Page	Appendix 4: Indicators		5				The sections are inconsistent in terms of whether/how they present the utility or use of specific indicators. For example, the section on "drought" is an esoteric presentation of the indicators but does not present examples of how those indicators might be used to assess impact on food systems. Have these indicators been used to assess impact on plant, animal/marine foods systems? I believe they have and it would be valuable to show the reader the value of applying these indicators.	We thank the commenter for this suggestion. We have made edits to the text in order to be consistent with the information presented across each category of indicators. Each section starts with a discussion of the importance of indicators on the topic, presents or refers to examples of indicators, and describes the selected indicator. Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples, we do not discuss in depth the applications and uses of these indicators.
Kayla	McCauley	Text Region	Appendix 4: Indicators		6	6	11	12	The reference to Key Message 15.1 seems less appropriate than one to Key Message 3.12.	We thank the commenter for this suggestion. We feel that both Key Message 15.1 (Climate change is harming human health) and 3.12 (Changes in extreme events) are relevant to this sentence. We edited the text and included both key messages as citations.
Kayla	McCauley	Whole Page	Appendix 4: Indicators		6				This page references several different key temperature impacts that all feel like they should have figures presented in the appendix but none do. Urban heat island is shown which demonstrates how exacerbation of extreme heat can manifest inter- and intra-city, as well as how it changes with time, but the majority of the Temperature and Extreme Heat subsection is related to the changes to magnitude and frequency of extremes in dry- and wet-bulb temperatures (by proxy through your citations), so I feel like it's a missed opportunity to not have an indicator for any of those aspects of temperature change.	We thank the reviewer for the comment. While we are not able to add a new figure to this section due to constraints, we have added various indicators to Figure A4.1 to highlight how different temperature-based indicators may be useful for stakeholders at various geographic scales: global (annual average temperature), national (summer nighttime minimum temperature), regional (southwestern US; cooling degree days), and local (Maricopa County, Arizona; number of days > 110°F) scales. The data were unfortunately not included in the 3rd order review draft but was described in that caption. They have been included now and we have referenced the figure in this section.
Kayla	McCauley	Text Region	Appendix 4: Indicators		7	7	10	17	Similar to a previous comment, this subsection presents several indicators but none get a figure showing their changes. Probably a casualty of word limit, but I thnk it's worth including if possible.	Thank you. Word count is indeed the reason additional figures could not be included here, in addition to the fact that various precipitation indicators are included in several other chapters (e.g., Figure 2.4 in the climate trends chapter). While we did not add a figure/caption, we did expand the text to reference precipitation impacts to agriculture, hydropower, and sensitive ecosystems, connecting this text to the respective NCA5 chapters and key messages.
Kayla	McCauley	Figure	Appendix 4: Indicators		8				There is no disaster event record in 1987? No record or no disaster event?	Yes, that is correct, no events exceeding $1 billion occurred in 1987. We revised the text to state this, along with noting that the two most recent years - 2020 and 2021 - have the most events in the record.
Kayla	McCauley	Text Region	Appendix 4: Indicators		10	10	18	18	Seems appropriate to include a reference to Key Message 4.2 as well.	We thank the commenter for this suggestion. We have changed the citation to reference Chapter 4 as a whole rather than listing all three key messages individually.
Kayla	McCauley	Text Region	Appendix 4: Indicators		11	11	11	11	Hyperlink embedded in text	Thanks, we have removed the extraneous hyperlink in question.
Kayla	McCauley	Text Region	Appendix 4: Indicators		11	11	11	11	Unsure if this link should be referred to; potentially should be moved to references	We thank the commenter for this suggestion and removed the hyperlink and added a reference at the end of the paragraph.
Kayla	McCauley	Text Region	Appendix 4: Indicators		12	13	17	5	I think it highlighting the changes in precipitation and evapotranspiration presented in other chapters (Figures 2.4 and 4.9, respectively) might help show the important interplay between the two in determining drought conditions.	Agree. We have added more context to this section of the Appendix and have added reference to Figure 2.4.
Kayla	McCauley	Figure	Appendix 4: Indicators		13	13		14	Figure is unclear what trend is being used to compute these values, i.e. is it the average monthly 5-year SPEI for each climate division? Yearly? Either way, I'm not convinced some of this isn't a case of endpoint bias. The trend is most certainly real, as Figure 2.4 suggests, but the values would suggest the water budget has increased by almost 3 standard deviations in some climate divisions over the past century, which seems extreme. I would double-check how the trend is computed to ensure this is accurate, or if a linear trend is appropriate.	Trends for each climate division are calculated using a linear regression - ordinary least squares - to generate a slope which is then used to calculate total change for the period of record (120 years). The five-year SPEI values are based on a July-to-June time span (e.g., the 2019 value considers SPEI from July 2014 to June 2019). The authors feel the 5-year SPEI is appropriate is an appropriate metric for climate. A multi-year drought index is less affected by interannual variability (Abatzoglou et al., 2017; Koch et al., 2012). Nationally, the 5-year SPEI (and other time intervals e.g., 1-year SPEI) trends compare reasonably well to other drought metrics that assess long-term trends in drought (e.g., PDSI). The authors plan to reference Figure 2.4 (precipitation trends) and other metrics of drought because we acknowledge a single indicator does not provide a full, conclusive assessment of hydrologic and drought conditions.
Kayla	McCauley	Figure	Appendix 4: Indicators		15				What does in mean in parts (c) and (d) to have 0.1 events per year? Is this number of events divided by a 30-year period?	0.1 events per year is the annual frequency in that given year. An annual frequency of 0.1 is equivalent to a 10% chance of the event occurring that year. We have added this explanation to the figure caption. Note that this is often referred to as the 10-year return period, however, the Army Corps of Engineers recommend that we do not use that language as people may think that a 10-year event occurs only once every 10 years, when in fact it is a probability of occurrence in any given year.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Kayla	McCauley	Text Region	Appendix 4: Indicators		16	17	11	11	Marine species seem to be mis-caste here. Changes in species number or location is a bio-indicator suggesting perturbations in the system however they are not causative and the etiology is complex. While environmental/climatic change is clearly contributing to these changes the point is that indicators of climatic changes should be included in analysis to determine causation of changes in ocean species not vice versa. This is not clearly stated in the section.	The authors have revised the first sentence in this section to clarify that warming oceans has contributed to shifts in the geographic distribution of marine species vs. the other way around. These shifts in geographic distributions (e.g., poleward shifts) along with other well-documented changes such as species composition and phenology are in part responses to changes in temperature. The marine species data used for this indicator are useful because they have been collected and compiled consistently over time. Many marine species are sensitive to environmental cues such as temperature ranges and track well with thermal climate velocities (Pinksky et al. 2013). The authors also acknowledge that there are several other factors that can influence the abundance and geographic distribution of species such as large-scale fishing practices, ocean currents, changes in habitats, and species' ability to adapt. We have also revised the introduction of the Appendix to discuss causation and attribution which applies to all the indicators in the Appendix.
Kayla	McCauley	Figure	Appendix 4: Indicators		16				I'm not sure I understand the connection between heat waves in the title of the figure and the units of the indicator, which is degree days. I think of a heat wave as a short-term event with extreme temperatures and degree days as an annual sum. These are related, but not exactly the same. Are these degree days just for short-term extreme events? This is not my area of expertise but seems like the title should be about annual average warming if the indicator is degree days, rather than number of short-term extreme events, which is what I think of as a heat wave.	We thank the reviewer for this comment. There are many different definitions of a heatwave. A heatwave in this instance is defined as an anomalously warm event lasting for five or more days, with temperatures warmer than the 90th percentile based on a 30-year historical baseline period (Hobday et al., 2016). This indicator is a unique metric which measures each individual heatwave in terms of its cumulative intensity. This cumulative intensity is determined by heatwave intensity multiplied by heatwave duration, and therefore the units are degree days. The indicator has been updated for the 4OD to be a measure of annual cumulative intensity (instead of average cumulative intensity) - this is hopefully more intuitive and alleviates some confusion. A brief definition of a heatwave has been added to the caption, with additional detail available via the metadata viewer.
Kayla	McCauley	Text Region	Appendix 4: Indicators		18	18	2	2	The effects of climate change on land system services have been discussed in Chapter 6 Land Cover and Land Use Change. These include intensity and frequency of extreme rain, droughts, fires (high 8 confidence), and floods. The change can increase risk for infrastructure, and agricultural production, forests and biodiversity, and human health. Suggest adding a citation for Chapter 6 KM 6.1 here.	We thank the commenter for this suggestion and cited KM 6.1 in the sentence.
Kayla	McCauley	Text Region	Appendix 4: Indicators		18	18	6	13	The section on seasonal changes and the intersection with social/cultural systems is great but wouldn't such impact apply to other indicators as well. What about the intersection of seasonal changes with weather indicators (rainfall shift, temp shifts etc)?	Agree. Changes in temperature and precipitation patterns are in part driving changes in seasonality. We state this explicitly in lines 8 and 9 ("The timing, duration, and variability of many seasonal events are changing in response to changing temperature and rainfall patterns"). Due to the breadth of the topic of seasonality and the page limit for the chapter, we focused on this set of specific examples to illustrate the point. We have added references to the Climate Trends chapter which includes some seasonal changes in temperature and precipitation (e.g., Figure 2.4).
Kayla	McCauley	Text Region	Appendix 4: Indicators		19	20	7	2	Could include a pointer to the air quality chapter and importance of increasing wildland fire smoke causing increased air quality-related human health risk.	We thank the commenter for this suggestion and cited KM 14.2 (Protecting People from Wildfire Smoke) in the first sentence.
Kayla	McCauley	Text Region	Appendix 4: Indicators		19	19	8	9	The chapter 6 also includes a KM for land system residence effected by climate change and wildfire. Suggest citing Chapter 6 KM 6.2 here.	We thank the commenter for this suggestion and we have now added a reference to KM 6.2 in the sentence.
Kayla	McCauley	Figure	Appendix 4: Indicators		19	19		6	The arrows indicating changes in seasonality are all of uniform length, making them visually disconnected from the label values. Some of the seasonal processes indicate lengthening but may have arrows in both directions, so it's not clear if it's a uniform lengthening in both directions by the number specified, a uniform lengthening that adds up to the number specified, or if there's non-uniform lengthening.	We thank the commenter for this suggestion and we will modify the arrows and lines in the figure to improve representation of the seasonal processes and modify the caption accordingly; however, because of space limitations, the lines and arrows can only approximate the actual data values. Where possible, data values will be provided in text above each arrow.
Kayla	McCauley	Figure	Appendix 4: Indicators		20	20		3	The caption for Figure 14a seems to describe the body of 14b, and vice versa, I think. The title and labels in 14a do not seem to line up with the caption text, but I can't see the body of 14b to be sure that this is a problem in the text or my misunderstanding of what's being presented. I'm unfamiliar with WUI, so I think this figure as is would be hard to parse for others unfamiliar with it.	We thank the commenter for catching this error. The authors have now identified panels (a) and (b) correctly.
Kayla	McCauley	Text Region	Appendix 4: Indicators		21	21	1	14	The section on agricultural productivity does not reflect the reciprocal relationship between food systems and climate, i.e.., each affect and affected by the other. Efforts to address either sustainability or resilience must consider both sides of the coin. The section is also only limited to issues of production/supply which does not consider all the other ancillary impacts of this intersection on economics, culture, and health. The impact of climate on food systems is also not linear as there are a myriad of other factors mediated through climate change that impact on dietary patterns and consumer choice which then impact on production.	The chapter text has been revised to incorporate this perspective. The scope of this section was limited due to space limitations and an intentional focus on the most mature indicators in the realm (indicators of climate impacts on ag productivity rather than indicators related to ag consumption). We agree with the reviewer that a discussion of the complexity of the feedbacks between ag systems and climate systems provides critical context, and thus we added it in the preamble to A4.5 (Land and Ecosystems). In the ag / food subsection of A4.5, we clearly name the types of indicators needed for better management and policy for the complex system and state that the indicators involving production instead of consumption are the most mature at this time. We thank the reviewer and hope the revised content is useful.
Kayla	McCauley	Text Region	Appendix 4: Indicators		21	21	9	10	This sentence includes some of the Walsh report sections, but not all. Please include an example from Chapter 6 of the Walsh 2020 report; for example, the Chapter 6 topic TFP is discussed in Chapter 11, but not listed here.	We thank the reviewer for the comment. Walsh 2020 (USDA) is now cited in the sentence about total factor productivity.
Kayla	McCauley	Text Region	Appendix 4: Indicators		22	22	6	6	Add vector ecology to land use and human behavior as potential ways that changes in weather impact vector borne diseases.	We thank the reviewer for the comment and have added vector ecology to the sentence in question.
Kayla	McCauley	Whole Page	Appendix 4: Indicators		22				The section on helath indicators has several serious problems. First, there are a many differnet health indicators being used beyond the three mentioned, so this is a very partial list. In fact, these three are among the hardest to link to climate change, but this point is not made. Suggest a more comprehensive discussion and listing of health indicators, and then a justification for only mentioning these three. This is also linked to my comment on page 3. Each of these health outcomes has a complex set of upstream indicators, but there is no mention of this, and the discussion does not clearly state that in the cases of Lyme and WNV, climatic factors have not been shown to predict disease outbreaks. So this would be seen as misleading I think by infectious disease experts.	We appreciate the reviewer's for the comment and acknowledge the Appendix does not provide full or adequate coverage for any of the indicator categories. We have significantly revised text for the health section, expanding the discussion to include other health outcomes and explained our reasoning for selecting this set of (climate-sensitive) infectious disease indicators. Specifically we acknowledge that changes in climate variables and other factors influence exposure and vulnerability which ultimately determine impacts to human health and society. We rely on the other chapter (e.g., Human Health chapter) to provide additional context for these changes. Separately, we disagree that climatic factors can't be used to predict disease outbreaks or increased risk. Seasonal and subseasonal climate data and modeling are needed for early warning systems and provide forecasts on shorter timescales.
Kayla	McCauley	Whole Page	Appendix 4: Indicators		22				There are a myriad of other priority health outcomes other than vector borne diseases. (Perhaps the report could refer to those identified in such public health efforts as Healthy People 2020, Dietary Guidelines for Americans etc.). There is emerging evidence re the impact of various aspects of climate (e.g., heat stress, severe weather events, drought, etc.) on these outcomes.	We thank the reviewer for the comment. We are relatively limited due to space constraints but are able to address the point with some additional text in the first paragraph of the health section. We discuss other priority health outcomes identified in climate change public health reports such as the 2016 USGCRP Climate and Health Assessment.
Kayla	McCauley	Whole Page	Appendix 4: Indicators		22				Moreover, our ability to interpret data more effectively from the national surveillance systems will demand an integration of these indicators into the data collection and analysis. Perhaps this could be included in the section on gaps and research priorities. Re: health indicators; there is a notable absence of any mention of the intersection of climate, food systems, nutrition, and health. Malnutrition (over-/under- or the double burden) is a significant public health issue in and of itself, not to mention its role in susceptibility to and response to treatment for infections and non-communicable diseases, as well as health and development throughout the life course.	Regarding the first part of the comment, we now discuss in the Knowledge Gaps and New Approaches section the need to integrate indicators into existing national surveillance system data collection and analysis processes. Regarding the second half of the comment, we added malnutrition to the list of example health outcomes affected by climate change in the first paragraph of the Health Outcomes section.
Kayla	McCauley	Text Region	Appendix 4: Indicators		24	24	21	22	While I do think the figure on renewable energy is perfectly reasonable, this sentence on line 21 intrigued me -- "Indices that combine multiple variables have been developed to capture complex issues affecting communities that are overburdened (Figure 15.4)." The increase in renewable energy is more well-known than these novel indices, so could be useful to include a novel index here that captures the complex issues affecting overburdened communities.	We thank the reviewer for this comment. Unfortunately due to space limitations we were only able to include one figure in this section. We do appreciate the reviewer noting that indicators capturing complex issues affecting overburdened communities are of great importance. Examples of such indicators are shown elsewhere in NCA5 and we have added references to figures in Chapters 11 (Community Resilience Index) and 22 (Droughts and Black Farmers in the Southeast).
Kayla	McCauley	Figure	Appendix 4: Indicators		24	24		17	It's not a major thing but I was wondering why the right panel was described in the caption before the left panel.	We thank the reviewer for this comment. The caption has been expanded to describe the left panel before the right panel.
Kayla	McCauley	Text Region	Appendix 4: Indicators		25	25	10	11	The Keenan and Maxwell citation is specific to coastal regions, but the sentence in the text is much broader. Thus, this citation does not adequately support the information in the sentence. Please reword the sentence to be more specific, or add more citations.	Agree, although the Keenan and Maxwell paper focuses on designing resilience and adaptation indicators for coastal communities, we feel that the sentiment that it is difficult to incorporate consistent indicators of resilience and adaptation applies more broadly. We have, however, added an additional citation and edited the text to indicate that these references are examples of this concept.
Kayla	McCauley	Text Region	Appendix 4: Indicators		25	25	21	21	Include a sentence about economic impacts that cites https://www.whitehouse.gov/wp-content/uploads/2022/04/CEA_OMB_Climate_Macro_WP_2022-430pm.pdf	We are unsure how this comment relates to the identified paragraph which discusses data sharing and transparency. This appendix focuses on climate-related indicators, and discussion of climate impacts for specific sectors is out of scope here. The economic impacts of climate change are discussed extensively in the Economics chapter.
Kayla	McCauley	Text Region	Appendix 4: Indicators		25	25	31	31	Add a sentence explaining that the temporal and spatial resolution of indicator data must be fit for use in assessing compound events (Focus Box 1).	We thank the commenter for this suggestion. Data resolution is just one of many factors involved in selecting appropriate indicators for evaluating compound events, and due to space limitations we are not able to list them all. We have therefore added the sentence, "Indicators should also be developed using data appropriate to track how compound events are changing over time" and refer the reader to the Focus Box for more information.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	Jasinski	Text Region	Appendix 4: Indicators		26		14		Please add the following entry for obtaining NASA Indicators: NASA's NCA-LDAS Terrestrial Hydrology Annual Trends Data for Continental U.S. 1980-2015, Goddard Earth Sciences Data and Information Services Center (GES DISC) v 2.0. https://disc.gsfc.nasa.gov/datasets/NCALDAS_NOAH0125_Trends_2.0/summary	We thank the commenter for this suggestion, however, due to space limitations, the federal indicators listed in that section of the Appendix are limited to those with collections of indicators rather than individual datasets. As stated in the introduction, the Indicators Appendix also focuses on indicators based on observations and measurements (not reanalyses or model data), however, we have added a sentence stating the value of reanalysis data and included the Jasinski et al. 2019 reference. Please note that other NASA indicators are represented, as we include a link to the Vital Signs of the Planet website.
Michael	Jasinski	Text Region	Appendix 4: Indicators		27		38		Please add the citation: Jasinski, M.F., Borak, J.S., Kumar, S.V., Mocko, D.M., Peters-Lidard, C.D., Rodell, M., Rui, H., Beaudoing, H.K., Vollmer, B.E., Arsenault, K.R. and Li, B., 2019. NCA-LDAS: overview and analysis of hydrologic trends for the national climate assessment. Journal of hydrometeorology, 20(8), 1595-1617. http://doi.org/10.1175/JHM-D-17-0234.1	We thank the commenter for this suggestion. As stated in the introduction, the Indicators Appendix focuses on indicators based on observations and measurements (not reanalyses or model data), however, we have added a sentence stating the value of reanalysis data and included this reference.
Kayla	McCauley	Whole Chapter	Appendix 4: Indicators						The text suggests that the chapter's goal is to primarily support other chapters in NCA5, so I went in expecting the appendix to be a listing of indices in the NCA5 as a whole rather than a primer on what indicators are and how they can be used. That's not to say there's anything wrong with the latter, but I think some added text to highlight this difference might be helpful.	The purpose of the appendix is to highlight the utility and relevance of indicators while providing examples of key indicators that support the report overall. Indicators are a sustained assessment activity for USGCRP and this Appendix represents an attempt to better integrate indicators into the National Climate Assessment. We have clarified the introduction accordingly, and removed wording suggesting that the appendix's primary goal was to support other NCA5 chapters. Let's discuss. Unfortunately, space is limited, so we are not able to list all indicators in the report.
Kayla	McCauley	Whole Chapter	Appendix 4: Indicators						This is a related comment to my first, but, having checked the USGCRP Indicator Platform, I saw that many of the figures and details I was expecting/hoping to see in this appendix appear there. Because there is no way to fit the very large number of indicators available this document given the length constraints, it might be worth moving the mention of the Indicators Platform to the beginning of the section into the introduction. This would allow you to inform the reader that there is an actively updated database of indicators that this chapter draws from. It could help branch the gap between what different readers might expect of the appendixx's composition.	We thank the reviewer for this comment. We have edited the introduction text to more clearly outline the purpose of the appendix, and have moved the "Federal Indicator Resources" information (including reference to the USGCRP Indicator Platform) to a box within the "Importance of Indicators" section.
Kayla	McCauley	Whole Chapter	Appendix 4: Indicators						Can the list of indicators not presented in the chapter but in different stages of development be shared in chapter so the audience are aware of the breadth of work?	We appreciate this suggestion, but space is limited. We reference many indicators in the text, both from other NCA5 chapters and from external sources, but we do not have room to describe all of them. We do state that the indicators in NCA5 are a small subset of all indictors and that others are being developed by US Global Change Research Program (USGCRP) agencies, their partners, academic institutions, and state, and Indigenous communities. The Indicators Appendix itself contains both well-known metrics from existing indicator sets and indicators that are have been newly developed and not yet published elsewhere.
Kayla	McCauley	Whole Chapter	Appendix 4: Indicators						Overall, it would be useful to have some guide to the reader about what to expect in this appendix rather than the full report. It seems that the appendix is a summary of each indicator with pointers back to chapters where the data are used and explained in context.	We have edited the text of the introduction to more clearly outline the purpose of the appendix and the presentation of the selected indicators: "Indicators appear in every NCA, with each report offering new ways to evaluate observations. Only a small subset of all possible indicators makes it into each these reports. This appendix highlights the use and importance of indicators while providing examples of important indicators focusing on cross-cutting topics relevant to multiple regions and sectors."
Kayla	McCauley	Whole Chapter	Appendix 4: Indicators						No mention of paleo data	The purpose of the Indicators Appendix is to highlight the utility and importance of indicators while providing examples of indicators with a focus on recent observations. For this reason, as well as space constraints, paleo climate data and information are not mentioned here, but are discussed more fully in NCA5 Chapters 1-3 (e.g., ice core data showing atmospheric concentration of CO_2 over the last 800,000 years).
Kayla	McCauley	Whole Chapter	Appendix 4: Indicators						At the beginning of this chapter the reasoning for selection of only these certain specific indicators should be clearly stated. It should also be clearly stated that this selection of specific indicators was not biased, and that equity and inclusion were considered.	We have edited the text of the introduction to more clearly outline the purpose of the appendix and the presentation of the selected indicators. Unfortunately we cannot ensure a completely unbiased set of indicators as they were selected specifically to support NCA5 chapters. We did add text stating that these indicators cover a diverse range of regions, as well topics relevant to urban and rural populations and the natural environment. The selection of indicators was also in part based on presenting newly developed and novel work that Agencies are funding, operationalizing, and developing (e.g., Urban Heat Island Intensity).
Kayla	McCauley	Whole Chapter	Appendix 4: Indicators						Why not explain and use indicators such as https://climatedata.imf.org/ ? This decision needs to be explicitly justified at the beginning and end of this chapter, and the justification should state why this choice of certain indicators does not cause bias or issues with equity and inclusion.	We have presented several indicators or provided links to resources that are similar to the ones available from the IMF climate change dashboard. Based on the scope of the NCA, we have included indicators from federal indicator resources that focused on the US given this is a national climate assessment. We do include indicators that have characterize potential societal risk and impacts including one socio-economic indicator Billion Dollar Disasters. Unfortunately we cannot ensure a completely unbiased set of indicators as they were selected specifically to be representative of the categories of the Appendix and to support NCA5 chapters. We did add text stating that these indicators cover a diverse range of regions, as well as topics relevant to urban and rural populations and the natural environment.
Kayla	McCauley	Whole Chapter	Appendix 4: Indicators						The list of indicators is valuable but the information within each particularly with regard to their applications is uneven; not at all clear why one indicator might be valuable for one type of application rather than others. There is also nothing to indicate to the reader what, why and how some indicators might be integrated into ongoing analyses (e.g., research, surveillance, policy etc.)	We have made edits to the text in order to be consistent with the information presented across each category of indicators. Each section starts with a discussion of the importance of indicators on the topic, presents or refers to examples of indicators, and describes the selected indicator. Due to space constraints and because it is out of scope, we do not discuss in depth the applications and uses of these indicators. This is mentioned in the Knowledge Gaps and New Approaches section.
Kayla	McCauley	Whole Chapter	Appendix 4: Indicators						There needs to be a clearer distinction between outcomes and indicators of causation (e.g., changes in climate etc.)	It is beyond the scope of this introduction to discuss the relative role of climate in the changes observed from these indicators. However, we have added text in the health section to discuss the importance of indicators along causal chain from climate to health outcomes.
Rachel	Licker	Text Region	Focus Box 1: Compound Extreme Events		2	2	8	12	The first sentence of this paragraph reads awkwardly, is very long and complex, and should be edited for clarity. Suggest "Compound events refer to combinations of weather or climate events that result in more significant impacts to human, natural, and built systems than isolated events on their own. Compound events can also intersect with non-climate stressors like wars, pandemics, and other crises that complicate disaster response."	Revised - "Compound events refer to the broad class of events that result from a combination of climate drivers or hazards in a location or across multiple locations that have greater impacts than isolated hazards on ecosystems, human systems like infrastructure, water resources, and health, and interconnected networks such as supply chains, energy systems, transportation and global food systems (Zscheischler et al. 2020; Seneviratne et al. 2021; Kuhla et al. 2021; KM 18.1)."
Rachel	Licker	Text Region	Focus Box 1: Compound Extreme Events		2	2	13	29	The examples listed in each bullet point are full sentences on their own, so should start with a capital letter. (E.g., "Simultaneous marine heatwaves..."	Suggested revision incorporated
Rachel	Licker	Text Region	Focus Box 1: Compound Extreme Events		2	2	16	17	To make clear that this example is describing successive hazards, it should include mention of the fires that burned the landscapes. Something like "Following extensive wildfires in 2017, heavy rain falling on burned landscapes in 2018 resulted in debris flows and flooding that damaged ecosystems and infrastructure in Montecito, California."	Revised - "Temporally Compounding: Successive hazards in a location such as destructive wildfires in 2017 followed by heavy rainfall on burned lanscapes in January 2018 that resulted in mudslides and debris flows that damaged ecosystems and infrastructure (KMs 3.X, 5.2, and 6.1, 27.2). "
Rachel	Licker	Text Region	Focus Box 1: Compound Extreme Events		2	2	24	26	Sentence constructure here is confusing. Suggest editing for clarity to something like "Enabled by higher sea levels and elevated storm surge, heavy precipitation can cause more frequent and severe flooding in coastal communities." Also, though, all the other examples here refer to specific events while this bullet describes a general phenomenon. Suggest replacing this with a specific example of when and where this happened so that it's consistent with the other examples in this section.	Revised - Extreme events superimposed on long-term trends such as warming-driven higher sea levels, elevated storm surge, heavy precipitation, and/or changing storm seasonality causing more frequent and severe flooding during storms in coastal communities (KMs 4.2 and 9.1, Taherkhani et al. 2020; Sweet et al. 2022), as occurred during Hurricane Florence in the Southeast in 2018 (KM 22.1; Reid et al., 2020), Typhoon Surigae in Palau in 2021 (KM 30.1 and 30.2), and Typhoon Merbok in 2022 Alaska (KM 29.X; Fang et al., 2018).
Rachel	Licker	Text Region	Focus Box 1: Compound Extreme Events		2	2	31	32	Delete "between 2020 and 2021" here because a) The sentence already indicates the timeframe by referring to the pandemic; and b) the examples give the years anyway.	Removed
Rachel	Licker	Text Region	Focus Box 1: Compound Extreme Events		2	3	34	2	The example of co-occurring wildfires and Atlantic hurricanes in 2020 was just listed in the previous bullet list, so is very repetitive here. Suggest replacing one or the other instance so as to avoid redundant text.	Text in both places - bullet list of compound event types and recent events section has been revised to discuss the events of 2020 distinctly. 2020 had several spatially, temporally and mutlivariate compound events. Different examples and impacts are now discussed in these places to avoid too much overlap
Rachel	Licker	Text Region	Focus Box 1: Compound Extreme Events		2	3	34	10	There are so many examples packed into this bullet, that they start to blend together and the text fails to fully explore the implications--or even just the types--of compound events. For example, the first example involving wildfires in 2020 would be stronger if it referenced the health impacts and the exacerbation of COVID-19 deaths. Overall, this is such a complex list, involving many different types of events and compounding types, that it should be broken out into either many bullets or fully fleshed out (and better organized) text.	Text revised and edited to more clearly articulate the human health and ecosystem impacts of the events, including the increased COVID mortality from wildfire smoke.
Rachel	Licker	Text Region	Focus Box 1: Compound Extreme Events		3	3	22	22	It is unclear what "increase the frequency of several compound events" means. Please clarify whether this means different types of compound events, the number of events contributing to compound events, or something else. Perhaps this is meant to just say "compound events" rather than "several compound events"?	Revised to say "compound events"

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Rachel	Licker	Text Region	Focus Box 1: Compound Extreme Events		3	3	22	35	Missing from this paragraph is an exploration of how increases in the severity of hazards is likely to contribute to more frequent compound events. For example, more hurricanes are expected to reach Categories 4 and 5 with further global warming, and heatwaves are expected to become more frequent and more severe. Together, that increases the chances of dangerous heatwaves occurring in the wake of devastating hurricanes that knock out power and water.	Text is revised: Compound events are likely to become more frequent with continued warming (KM 2.3). Climate trends like higher temperatures, sea levels, and humidity are increasing the frequency and severity of climate hazards such as heat, heavy precipitation, and severe storms (Ch 1). This will increase the chances of 1) a sequence of hazards occurring within a short time span and 2) simultaneous independent events in a location or multiple locations
Rachel	Licker	Text Region	Focus Box 1: Compound Extreme Events		4	4	2	2	"Proximity to hazard-prone areas" doesn't sufficiently acknowledge the reasons why these groups of people are located where they are. Policies like redlining and the intentional siting of industrial facilities in and around communities of color are what have concentrated vulnerable groups in hazard-prone areas. Suggest incorporating some of these root causes into this sentence.	Revised as - "Low-income communities, communities of color, and Indigenous peoples experience high exposure and vulnerability to climate hazards due to their proximity to hazard-prone areas, infrastructure deficits, limited disaster-management and response resources, and poor governance that are legacies of colonialism, redlining, and other discriminatory policies (KMs 4.2, 16.2, 18.2, and 20.3; Simpson et al. 2021; NAACP 2021;)" -
Rachel	Licker	Text Region	Focus Box 1: Compound Extreme Events		4	4	6	7	The "social disparities" referred to here seem to be those relevant to the context of compound hazards. If that's the case, suggestion stating so explicitly, as in "can avoid exacerbating existing social disparities and those that arise during compound events."	Revised - "Transformative, socially-just adaptation approaches (KM 31.1), investment in emergency preparedness, and governance structures that account for the inequitable distribution of climate impacts can avoid further exacerbating such existing social disparities (KMs 12.4, 20.3, 31.1; Kruczkiewicz et al. 2021; Jerolleman 2019; van den Hurk 2023)."
Benita Lily	Cheng	Text Region	Focus Box 1: Compound Extreme Events		4		19		Add blue green infrastructure can reduce flooding, as green infrastructure typically manages stormwater from a water quality perspective, but blue green infrastructure manages flood waters particularly in compound risk scenarios with extreme weather events and increasing urban flooding due to impact of climate change on precipitation.	Added
Rachel	Licker	Text Region	Focus Box 1: Compound Extreme Events		5	5	3	5	Either the caption or a legend should indicate what the colors on the map represent (perhaps it's intuitive to a climate scientist that it's wildfire smoke, but it's less intuitive for non-scientific audiences).	Indicated on revised figure
Rachel	Licker	Figure	Focus Box 1: Compound Extreme Events	1	5				It would be helpful to have a key for the different hazards represented on this graphic. Some are obvious, but others are less so, including the one for atmospheric river, the group of people, and the lightning bolt. The text helps, but it takes some work to connect the icons to the text without a key or legend as a guide.	Will include this comment to TSU
Shaye	Wolf	Text Region	Focus Box 2: Western Wildfires		2	2	1	16	The chapter ‚ÄúFocus on Western Wildfires,‚Äù states that ‚Äúclimate change is leading to‚Ä¶ more severe wildfires,‚Äù and that ‚Äúand a great proportion of area [is] burning at high severity.‚Äù However, these statements are misleading and should corrected. Numerous studies have reported no significant trends in the proportion of forest area burned at high severity with the exception of specific, limited regions of the western US. Most recently, Picotte et al. (2016) found no trends in fire severity (Picotte, J.J. et al., 1984-2010 trends in fire burn severity and area for the coterminous US, 25 International Journal of Wildland Fire 413 (2016)). Keyser and Westerling (2017) found no significant trends in high severity fire occurrence in western US forests during 1984-2014, except for Colorado (Keyser, A. and A.L. Westerling, Climate drives inter-annual variability in probability of high severity fire occurrence in the western United States, 12 Environmental Research Letters 065003 (2017)). As correctly reported in the chapter on Forests (page 7-6), Parks and Abatzoglou (2020) assessed trends in the annual proportion of forest burned at high severity from 1985-2017 across four large fire-prone ecoregions in the western US, and found no trend across the western US as whole. On a regional basis, the study found no trend in three ecoregions and an increasing trend limited to the Southwest region (Parks, S. A., & Abatzoglou, J. T. (2020), Warmer and drier fire seasons contribute to increases in area burned at high severity in western US forests from 1985 to 2017, Geophysical Research Letters, 47, e2020GL089858. https://doi.org/10.1029/2020GL089858). Furthermore, in a separate study, Parks et al. (2016) projected that even in hotter and drier future forests, there will be a decrease or no change in high-severity fire effects in nearly every forested region of the western U.S. due to reductions in combustible understory vegetation over time (Parks, S.A. et al., How will climate change affect wildland fire severity in the western US? 11 Environmental Research Letters 035002 (2016)).	Thank you for noting these nuances. This is correct if only referencing the papers listed but more recent papers make clear that patterns or fire severity have increased beyond the Southwest but also for CA. Given that most of the most destructive fires are occurring in the southwest and CA we believe the language we have used to communicate this pattern is appropriate and founded in the findings of the papers cited. Please consider the results of increased porpportion of burned area at high severity in Williams et al. 2023. Williams, J. N., Safford, H. D., Enstice, N., Steel, Z. L., and Paulson, A. K.. 2023. " High-Severity Burned Area and Proportion Exceed Historic Conditions in Sierra Nevada, California, and Adjacent Ranges." Ecosphere 14(1): e4397. https://doi.org/10.1002/ecs2.4397
Don	Falk	Text Region	Focus Box 2: Western Wildfires		2	2	6	6	Add literature citation: "...benefited from regular fires for millennia (Ch. 28; Margolis et al. 2022)..." Margolis EQ, CH Guiterman, RD Chavardv®s, JD Coop, K Copes-Gerbitz, DA Dawe, DA Falk, et al. The North American tree-ring fire-scar network. Ecosphere 13(7), p.e4159. https://doi.org/10.1002/ecs2.4159	We thank the commenter for this suggestion and have added the suggested citation(s) to the chapter/CCB on Western wildfires.
Don	Falk	Text Region	Focus Box 2: Western Wildfires		2	2	8	8	Add literature citation: "...across the western United States (Kitzberger et al. 2017)." Kitzberger T, DA Falk, AL Westerling, and TW Swetnam. 2017. Direct and indirect climate controls predict heterogeneous early-mid 21st century wildfire burned area across western and boreal North America. PLoS One 12(12): e0188486. https://doi.org/10.1371/journal.pone.0188486	We thank the commenter for this suggestion and have added the suggested citation(s) to the chapter
Don	Falk	Text Region	Focus Box 2: Western Wildfires		2	2	15	16	Add literature citation: "...with long-term costs and consequences (Coop et al. 2020; Sullivan et al. 2022." Coop JD, SA Parks, CS Stevens-Rumann, S Crausbay, PE Higuera, MD Hurteau, A Tepley, E Whitman, T Assal, BM Collins, KT Davis, S Dobrowski, DA Falk, PJ Fornwalt, PZ Fulvf©, BJ Harvey, VR Kane, CE Littlefield, EQ Margolis, M North, M-A Parisien, S Prichard, KC Rodman. 2020. Wildfire-driven forest conversion in western North American landscapes. BioScience 70 (8): 659,Äi673. https://doi.org/10.1093/biosci/biaa061	We thank the commenter for this suggestion and have added the suggested citation(s) to the chapter
Chuxuan	Li	Figure	Focus Box 2: Western Wildfires		3	3	1	1	The order of the figure number in Figure 1 is reversed.	We thank the reviewer for the helpful suggestion and agree. The author team has developed what we believe will be a figure that better captures the dynamics outlined in the text with clear crosswalks to other chapters in the report that treat or reference western wildfires.
Emma	Conrad-Rooney	Figure	Focus Box 2: Western Wildfires		3				As a reader, it was confusing that the images go from f to a rather than a to f. Also, in the figure caption, it would be helpful to more clearly indicate which letter refers to which panel descriptions.	We thank the reviewer for the helpful suggestion and agree. The author team has developed what we believe will be a figure that better captures the dynamics outlined in the text with clear crosswalks to other chapters in the report that treat or reference western wildfires.
Rachel	Licker	Figure	Focus Box 2: Western Wildfires	1	3				In panel c, fire is referred to as "wildland fire" whereas throughout the rest of the figure, it's referred to as "wildfire." Can the terminology be made consistent?	Figure is being updated
Rachel	Licker	Figure	Focus Box 2: Western Wildfires	1	3				The ordering of the panels in this figure is confusing, as "a" panels are usually first (on top or left) in multipanel figures. Also, it's hard to see what's going on in the graphics because they're both detailed and small. Suggest zooming the graphics in to show smaller areas so that readers can see things like roads and farms more clearly.	Thank you for this comment - the author team agrees and has modified our figure to more clearly communicte the dynanics treated in the western wildfire crosscutting box.
Don	Falk	Text Region	Focus Box 2: Western Wildfires		4	4	5	5	Add citation: "...facilitate bark beetle infestations and massive tree die-off events (Ch. 7; O'Connor et al.)... O,ÄöConnor CD, AM Lynch, DA Falk, and TW Swetnam. 2015. Post-fire forest dynamics and climate variability affect spatial and temporal properties of spruce beetle outbreaks on a Sky Island mountain range. Forest Ecology and Management 336: 148-162. http://dx.doi.org/10.1016/j.foreco.2014.10.021	We appreciate the suggestion and have reviewed the source of information. However, the author team determined that the current reference is appropriate and adequate given the chapter's space limitations. Additonally, we are priotizing research that has been conducted since NAC4.
Rachel	Licker	Text Region	Focus Box 2: Western Wildfires		4	4	9	9	The phrasing "affect fire behavior and intensity that promote" doesn't read well here. Perhaps "Other climate-driven changes affect fire behavior and intensity, including by promoting rapid spread rates and increases in fire severity"?	We have updated the text to reflect the change suggested by the reviewer and agree this provides a clearer read. Thank you.
Don	Falk	Text Region	Focus Box 2: Western Wildfires		4	4	17	18	Add literature citation: "...meet shrublands and grasslands in low-elevation, arid ecotones (Falk et al.2022). Falk DA, PJ van Mantgem, JE Keeley, RM Gregg, CH Guiterman, AJ Tepley, DJN Young, and LA Marshall. 2022. Mechanisms of forest resilience. Forest Ecology & Management Tamm Review 515: 120129. https://doi.org/10.1016/j.foreco.2022.120129 .	We thank the commenter for this suggestion and have added the suggested citation(s) to the chapter
Reid	Sherman	Text Region	Focus Box 2: Western Wildfires		4	4	23	23	Consider including events such as the Marshall Fire in Colorado that had a unique series of events that also included high winds and low snow cover for fires extending beyond the normal "fire season".	Draft text has been revised/added to incorporate the suggestion/information raised by the reviewer comment. "Additionally, there are examples where large and destructive fires realized rapid rates of spread during high wind events fueled by antecedent events such as multiyear droughts and bark beetle induced tree mortality." We appreciate the suggestion and agree that this an important addtional for our chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Don	Falk	Text Region	Focus Box 2: Western Wildfires		4	4	24	25	Add literature citation: "...death, property 24 damage, and costly road closures (Ch. 6; Sidman et al. 2015; Kean et al. 2019). Sidman G, DP Guertin, DC Goodrich, D Thoma, DA Falk, and IS Burns. 2015. A coupled modeling approach to assess the impact of fuel treatments on post-wildfire runoff and erosion. International Journal of Wildland Fire. http://dx.doi.org/10.1071/WF14058	We appreciate the suggestion and have reviewed the source of information. However, the author team determined that the current reference is appropriate and adequate given the chapter's space limitations. Additionally, we are prioritizing research that has been conducted since NAC4.
Rachel	Licker	Text Region	Focus Box 2: Western Wildfires		5	5	13	15	This list of adaptation actions covers just three of the many adaptations that would need to be implmented to truly achieve community protection and ecosystem resilience. For example, there is no mention of protections from poor air quality (or how those would be achieved for lower-income resident); no mention of wildfire smoke protection standards for outdoor workers; no mention of how water supplies could be protected from the increased runoff and sedimentary/debris load that can result from wildfires; no mention of improving early warning systems for evacuations; no mention of funding sources for making some of these changes ahead of wildfire disasters...	Thank for this set of suggestions to expand the adaptation measures for community, individual human and critical infrastructure protection. We have greatly expanded this section of the chapter to cover specific applications, including early warning systems, evacuation route improvements and home hardening measures. We have also referenced the adaptation chapter (chapter 31) and the Energy chapter (chapter 12).
Gail	Overstreet	Whole Chapter	Focus Box 2: Western Wildfires						Our family lost our home and everything we owned in a very large Western Wildfire, along with thousands of other Californians. Thousands of people - from this single fire - were left profoundly traumatized both physically and mentally, and external mental health resources to address this widespread and chronic trauma were and are simply not available at scale. These trauma impacts go on to have a lasting broad and deep impact on both community and economic health. As far as solutions to addressing this vast health-resources gap, please consider assembling and widely publicizing a portal with self-led trauma-informed practices, such as proven and accessible stress-reducing breathing practices or trauma-reducing body movement practices. For example, the Insight Timer app is a free resource where such a channel could be offered, either by creating new relevant content or aggregating existing content from the wide array of relevant content in the Insight Timer community. Climate change education, to include physical and mental health resources, is critical for any plan that addresses mitigating and adapting to climate change since future generations will face - and need to be self-equipped with knowledge and practical skills to cope with - the challenges and events of climate change.	The author team greatly appreicates and sympathizes with the expereince of this reviewer. We also agree that western wildifres that impact and in some cases destroy communities carry significant mental health impacts that can be long lasting. We did include the term 'mental' when talking about public health in the 5th paragraph of this report but a detailed treatment related to specific applications to address mental healp is outside the scope of this report.
Gillian	St John	Whole Chapter	Focus Box 2: Western Wildfires						I read the "Western Wildfires" chapter. I thought it was a really interesting chapter and it had great information on wildfires and how they are becoming more frequent and severe with climate change. I agree with Brianna Solomon that it is very important to center Indigenous knowledge when it comes to climate change because they have been living in harmony with this land for thousands of years. I also think it is important to note that in California it is prisoners who make up 30% of the wildfire fighting crews. These prisoners are only paid 2$ to 5$ a day and an additional 1$ or 2$ an hour when they are on the front lines fighting fires. This has saved millions in tax dollars by putting prisoners lives on the front lines of climate change, which is extremely unethical and a problem. The inmates should be paid what they deserve for the work they are doing and additionally when they get out of prison they should be able to continue the work they were trained for if they desire. Statistics from: Lowe, Jaime. ‚ÄúWhat Does California Owe Its Incarcerated Firefighters?,‚Äù The Atlantic, Atlantic Media Company, 27 July 2021, https://www.theatlantic.com/politics/archive/2021/07/california-inmate-firefighters/619567/ Links to an external site..	The points the commenter raises are beyond the scope of this chapter and we have not revised the text due to space considerations reserved for more pointed issues directly related to the role of climate change and western wildfires.
Najeeb	Marun	Whole Chapter	Focus Box 2: Western Wildfires						I decided to read the Western Wildfires chapter. Human influence and climate change since the beginning of the 20th century is causing significant increase in the extent and frequency of wildfires across the United States. Low and moderate severity fires can have important effects. However, the severity of the fires has been very catastrophic and destructive, which have significant environmental, health, and social impacts. Therefore, this chapter goes into detail about the effects that these fires have on infrastructure, health, the environment, and more. However, despite the detailed explanation of the effects of these wildfires, the chapter fails to purpose a good solution on how to address these destructive wildfires on both a business and individual level. To give credit to the chapter, the authors mention that reducing fuels and lowering forest stand density reduces the severity and impact of climate-mediated wildfires, but I believe that simply proposing to "reduce fossil fuels" as a solution is a weak argument because it doesn't address how to reduce fossil fuels. There are many countries today that depend on fossil fuels for their economic prosperity, and so we need a solution that addresses how to reduce fossil fuels while also maintaining the economies of these countries. I found an article that addresses this issue and gives a fairly good starting point to reduce fossil fuels emissions. The article Links to an external site., proposes a fairly decent starting point to reducing fossil fuel emissions on a business and individual basis that can complement this chapter quite well.	Thank you for this comment. It seems however the reader is confused by the term 'fuels'. In this context we are referring to forest fuels that burn during fires - these are things including trees, shrubs and other living and dead vegetation. Fuels does not refer to fossil fuels. We have added the term 'forest' before fuels to reduce this confusion.
Gabrielle	Chen	Whole Chapter	Focus Box 2: Western Wildfires						While this paper succeeds in presenting the causes, concerns, and possible solutions to these disasters, I do not feel as though it truly captured the severity of the effects. When briefly looking over the other three chapters, I was met with 59-70 pages each; all of which contained a wide array of graphs, statistics, and other detailed figures that supported the contents of the chapters. The chapter on western wildfires, having only 7 pages (two of which only consisted of references), paled in comparison. Besides one graphic, this chapter had very little to illustrate the severity and effect these fires have on people and their environment. I feel as though this chapter could benefit greatly with the addition of graphical information and specific statistics to support the given statements. An example of this can be seen on page four where the author writes, "Across the west, the size of forest fires and the maximum elevation of wildfires have increased due to warming temperatures, decreased summer precipitation, and drier conditions." As a reader of this paper, as well as someone who has lived through the destruction of these fires, the first question that comes to mind is, "Well, how much has the size and elevation increased, and how will these continue to increase?" and the second being, "How do these increases correlate to temperature, precipitation, and dry conditions?" This would be an ideal opportunity to add a statistic or graph illustrating the increase in fire size and elevation in response to rising temperatures, decreasing precipitation levels, and drier conditions.	Mention that the focus boxes are meant to be an entirely different scale and format than the main chapters. Also could reference the the direct and indirect economic impacts described in Chapter 19 (Economics) to help illustrate the severity of wildfires on people / society. In case it's helpful: Table 19.1. contains Example US Economic Impacts of Climate Extremes and Climate Change
Rachel	Licker	Whole Chapter	Focus Box 2: Western Wildfires						Missing from this chapter is a mention or discussion of population growth within the wildland-urban interface. While "development patterns" are mentioned in the introduction, that's in the context of contributions to increases in fire size and severity rather than increased population exposure to wildfire.	Thank you for this comment we have added a reference to Chapter 12 (built environment), which states "buildings across the western United States are already 1,255% more exposed to extreme wildfires compared to historic trends (Ager et al. 2021)." And we have also modified the text in this chapter to communicate that population sizes have increased in the wildland urban interface which has led to those living there being more vulnerble to wildfire impacts.
Juanita	Constible	Text Region	Focus Box 3: COVID-19		2	2	1	2	The 75 percent statistic comes from the cited paper, which used the 2015-2016 National Farmworker Survey. The 2019-2020 survey, which does not include farmworkers with H-2A visas, is careful to point out that many of the foreign born workers surveyed identify more with a country of origin than with Hispanic or Latino ethnicities. In other words, it is probably better not to use the word Latinx in this context. Furthermore, the latest survey found that about 70 percent of hired farmworkers were foreign born, and that only 15 percent were migrants.	Thank you for this detailed response to the inclusion of this paper. We have carefully restated these comments to make sure they align appropriately with paper that was cited.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Nicholas	Poggioli	Whole Chapter	Focus Box 4: Risks to Supply Chains						The draft conceptualizes supply chains as beginning with sourcing raw materials and ending with delivery of a product or service to the customer. This is a specific type of supply chain: a linear supply chain. I encourage the authors to add risks to circular supply chains to the chapter. A circular supply chain represents the continuous flow of materials through production and consumption systems. "Raw" materials are not the only source of material. "Reused" or "repurposed" materials collected from consumers can substitute or complement raw materials that have not been used before. Example: the production of polyester now includes new "raw" plastic made from petroleum and also reused plastic material like plastic bottles. A focus on only a linear supply chain would not be able to address risks to a circular supply chain. A circular supply chain has more stages than a linear change. Lines 36-37 describe the stages of a linear supply chain. A circular supply chain has at least two additional stages: collection from consumers and reuse by producers. I encourage the authors to incorporate circular supply chains in this chapter. Some resources to build upon include: Circle Economy. (2022). The Circularity Gap Report 2022 (pp. 1,Âí64). Circle Economy. https://www.circularity-gap.world/2022 https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview https://www.wsj.com/articles/soda-brands-are-about-to-get-possessive-of-their-trash-11657623940	Many thanks for this comment. The chapter authors have revised the text to incorporate this suggestion regarding circular supply chains and a reference added to distinguish between linear and circular supply chains.
Mark	Haver	Text Region	Focus Box 5: Blue Carbon		2	2	30	33	The deep-sea may be one of the planet's most significant carbon sinks, but just as the storage potential of kelp forests, freshwater wetlands, and phytoplankton is uncertain, the same is true of the deep-sea. It's really important to mention the deep-sea here. Here are some studies to reference: https://www.frontiersin.org/articles/10.3389/fclim.2021.710546/full https://www.science.org/doi/10.1126/sciadv.aao6588	We appreciate this suggestion and have added the citations and added a reference to the deep sea.
Mark	Haver	Whole Page	Focus Box 5: Blue Carbon		2				Lines 2 - 8 explain blue carbon well, so get rid of line 10. Lines 13 - 17 are hard to follow if you're not a scientist. Here is a recommended reword: Blue carbon ecosystems (BCEs) are coastal ecosystems, such as mangroves, wetlands, and seagrasses. BCEs store most of their carbon belowground in ocean sediments. Even though these BCE sediments cover less than 0.5% of the ocean floor (Bouillon et al. 2008; Lo Iacono et al. 2008), BCEs are estimated to store a volume of up to 50% of carbon that is stored in terrestrial vegetation (Figure F5.1).	We appreciate this suggestion and revised the text accordingly.
Emma	Conrad-Rooney	Text Region	Focus Box 5: Blue Carbon		4	4	2	2	At the end of the sentence "Sea level rise...threats to BCE," I would recommend citing Chapter 9, the coastal chapter.	Thank you for your comment and review. A cross chapter reference to Chapter 09: Coasts, has been added.
Mark	Haver	Whole Chapter	Focus Box 5: Blue Carbon						This chapter may be difficult for an average citizen to read. Simplifying language will allow everyday people to understand what blue carbon is, and how well it sequesters carbon, more easily.	We appreciate your response. We have sought to reduce jargon and define the terms to make it more accessible.
norman	holy		Whole Document						You should include conclusions based upon our climate has appeared previously - the mid-Pliocene, in which at the same CO2 content and temperature rise, the was no ice at either pole. The Smithsonian did a tv program (Polar Extremes on NOVA). Thus we would have more than 100 feet oj ocean rise, but don't because we are pumping so much CO2 into the atmosphere that polar melt can't keep up	Thank you for the comment. While some information on paleoclimate can be found in chapters 2 and 3, the scope of NCA5 does not include a detailed assessment of the Pliocene. Please see section 12.3 in Volume 1 of the fourth National Climate Assessment (climate science special report) for information on mid-Pliocene sea level rise
Andy	Bochman		Whole Document						Whole Document comment: In our now massively interconnected world with so-called "smart meters," "smart cities," "the Cloud," etc., not much works without reliable communications. Not power, not water, not transportation, not finance, not healthcare, and not government. In its 2021 report (GAO-22-104462) the GAO called out data operations centers (data centers for short) as an essential core network component. US and global data centers have failed recently from extreme heat events, the frequency and intensity of which are projected to only increase. I believe NCA5 is remiss in offering almost no mention of data center or other communications sector climate risks or candidate adaptation measures. And believe it would be a more helpful document were it to do so, either in a chapter dedicated to communications, or since this comment is arriving quite late in the process, as an addendum to be published after the full report is released. Else communications matters should at least be addressed more fulsomely in the energy and adaptation chapters, at a minimum.	Chapter 18 includes a special text box on risks to Data Centers
Benita Lily	Cheng		Whole Document						The term "green infrastructure" is used throughout the document to refer to non-grey infrastructure that can mitigate stormwater as well as floodwater. However, green infrastructure oftentimes does not have the ability to manage the extent of flooding that occurs with large precipitation events. Cities such as Washington, DC and New York City for example, have begun looking at blue green infrastructure as a means of addressing large amounts of flood water. Blue green infrastructure, similar to green infrastructure, has the ability to manage flood water while also providing co-benefits to neighborhoods. This comment is to propose using the term blue green infrastructure rather than just green infrastructure when discussing addressing urban flood water management.	Many of the concerns the commenter raised are desribed across mulitple chapter, including flooding from extreme precipitation and insufficiency of existing infrastructure to manage stormwater. The NCA5 glossary includes the term Green Infrastructure and includes descriptions of floodwater management and examples of how native vegetation and wetlands are considered green infrastructure. Because the NCA chapters do not use the term blue green infrastructure and it is less common in the underlying cited literature, the term has not been added to the glossary.
Benita Lily	Cheng		Whole Document						In discussions of funding, it would be helpful to include green banks, and green revolving funds/revolving loan funds such as Connecticut, Rhode Island, and New York have set up -- particularly in light of the Inflation Reduction Act and its creation of the Greenhouse Gas Reduction Fund which grants the EPA $20 billion to establish a national green bank, and an additional $7 billion specifically for state, local, and tribal governments,Âô own clean power investments.	Please see KM31.5 for information on ddaptation flnancing and economics, including examples of financing isntruments and challenges to tracking finance flows.
Jesse	Freeman		Whole Document						Comment	This comment does not appear to raise a question or suggest a revision.
Jesse	Freeman		Whole Document						this comment	This comment does not appear to raise a question or suggest a revision.
Monte	Dale		Whole Document						Your efforts to combat climate change are truly commendable, but there is a bigger picture that you need to focus your attention on. Modern Cosmology is wrong about galaxy evolution. All the stars in all the spiral galaxies are not orbiting their centers, they are all spiraling INTO their centers. Global Warming is a direct result of increasing proximity to the center of the Milky Way. The polar ice caps have been shrinking for 55 million years, not 11,700 years. Once they disappear, the oceans and air will quickly become inhospitable to all Life. The Moon and Mars are not viable options - they lack water and atmosphere. Mankind must make a conscious evolutionary step, and begin Low Earth Orbital Genesis - or LEOGen - raising future generations of humans in microgravity. It is estimated that humanity is 100,000 generations old. It may take another 100,000 generations of humans in microgravity before our race is physiologically fit to take to the stars. But blaming Mankind for a natural phenomenon is counterproductive. Billions of dollars have been wasted on the Big Bang, Dark Matter, black holes and carbon sequestration. We only have a slim chance of survival, but Mankind has shown that where there is hope, there is promise. My website has details: Galacticfurnacetheory.com.	This comment is inconsistent with the current state of the science on this topic. We suggest the commenter refer to chapters 2 and 3, and to volume I of the fourth National Climate Assessment (the 2017 climate science special report) for information on paleoclimate and the causes of climate change.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Ning	ding		Whole Document						Humans are now unequivocally implicated in triggering global climate change, and the impacts on human and natural systems will be severe, far reaching, and affect the most physically and economically vulnerable people around the world disproportionately. Society can respond to these threats through two distinct strategies: adaptation and mitigation. This report is the government‚Äôs draft policy strategies for both mitigation and adaptation, based on the government's expert assessment of the impact of climate change projections. The great thing is that the report takes the status of whole country and every state into consideration when they assess the climate change and make the policy and with the reference with it, so they formulate different policies according to different situations in different regions with equality and efficiency. In the section 2, this report introduces the background of climate change with severity and how climate change has environmental and social impacts on the whole United States. The negative impacts have been converted into risks and further analyzed in section 3. Through evaluating confidence and likelihood, NCA5 has adopted the terms used in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report and other specific terms to convey information about the degree of scientific confidence and certainty associated with important findings, observations and projections accurately. From the impact of climate change, the article is sorted out according to the logical relationship, divided into national scope and regional scope spatially under different scenarios, so that the content is clearer and easier to implement. But one thing I think could be modified is that the order of introduction. Compared to describe how we address climate change first followed by the impacts of climate change is not fairly reasonable and logical. It would be better to depict how we experience climate change and the risk it brings about before talking about current status of response to climate change so that we could analyze the problem with specific background. Based on the background and current condition, we could describe the right medicine and propose the targeted solution with guidance and get awareness of the direction we headed and the method we move forward. In section 1, the emphasis has been laid on innovation of clean energy technique, which has propelled	We thank the reviewer for the comment. The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Discussion of policy options is beyond its defined scope.
Alix	Dazin		Whole Document						Dear Dr Crimmins, Thank you for the opportunity to provide suggestions during the development of the Fifth National Climate Assessment (NCA5) in order to strengthen the draft and improve its ability to reach broad audiences and inform new and continuing adaptation responses to climate change. This letter will focus on Chapter 31 of the draft, which covers the important topic of adaptation. Overall, the draft chapter is easy to follow and logically structured around key messages. It frames the discussion around the topic of adaptation. The chapter accurately presents strong and broad science, with findings documented in a consistent, transparent, and credible way. The assessment of confidence and likelihood is communicated effectively. The chapter references an impressive number of articles and studies from peer-reviewed scientific literature to back up its claims. It also includes examples that align with key messages in the supporting text and figures. As a result of the science-based approach, chapter 31 manages to be relevant for policy and decision-making, while also meeting the needs of state and local governments and communities without prescribing specific policy interventions or advocating for a particular viewpoint. The chapter is also compliant with the Global Change Research Act (GCRA) and other applicable laws and policies, making it authoritative, timely, and transparent. It provides resources for readers wishing to explore any particular topic in more detail. The chapter introduction effectively presents the key messages. It explains why each key message is important and how they link together. The fact that the length of the key messages is mostly consistent across the chapter is appreciated (except KM 31.5.). It is interesting to see how the key messages have changed compared to the equivalent chapter on adaptation in the Fourth National Climate Assessment (NCA4). These changes reflect the fact that scientific research continues to advance understanding of climate change impacts and effective adaptation measures. In particular, the inclusion of key messages related to transformative adaptation and equity is very welcome. The term ‚Äòequity‚Äô features three times more frequently throughout the chapter than in the equivalent chapter in NCA4. The inclusion and emphasis of the concepts of adaptation fairness, environmental justice and intersectionality is also positive.	We greatly appreciate the reviewer's comment about the report/chapter and hope that the content is useful. These comments ahve been passed along to the adaptation chapter and other chapters for consideration.
Jesse	LeVesconte		Whole Document						Regarding the overall structure and effectiveness of the document, the NCA5 makes excellent progress in incorporating two key processes: Environmental/Climate Justice and Transformative Action throughout the report, especially in the sections 31.1 Transformative Adaptation and 31.2. Adaptation and Equity. However, there is a need for more candidly honest and critical engagement in these areas, to accurately reflect the unprecedented scale and urgency of the climate emergency. A touchstone to guide these necessary changes is the UN IPCC AR6, which explicitly names intertwined colonialism, neoliberalism, and capitalism as key drivers of the climate emergency, related impacts, and vulnerability ‚Äì and does so with regard to adaptation specifically: 1. ‚Äòit can be difficult for adaptation actions to target cities,‚Äô underlying,¬ elite influence over decision making or neoliberal planning logics that maintain and reproduce inequality (UN IPCC AR6, Section 6.4.6).‚Äô 2. ‚Äòvulnerability of ecosystems and people to climate change,¬ driven by,¬ historical and ongoing patterns of inequity such as colonialism, and governance (high confidence),‚Äô (UN IPCC AR6, Section SPM B.2). 3. ‚Äòthe vulnerability of these cultural uses to climate change is exacerbated by historical and ongoing processes of colonialism and capitalism, which dispossessed Indigenous Peoples and disrupted culturally significant multi-species relationships,‚Äô (UN IPCC AR6, Section 4.3.8). Therefore, in addition to revising the overall NCA5 report to highlight the active roles neoliberalism, capitalism, and colonialism play in obstructing adaption, please also make the following related changes: 1. Please reaffirm the need for transformational change with an additional text after the sentence in the Introduction lines 22-24. 2. This a minor rhetorical note: Please Strike the word ‚Äòthe,‚Äô in ‚Äòthe Five Adaptation Stages,‚Äô throughout Box 31.1. The concept is stronger without the universalizing and reductive use of ‚Äòthe.‚Äô 3. Box 31.1 Adaptation Stage 1: Awareness, would be more comprehensive if it included the following: - What is the level of awareness about the colonial and capitalist origins of the climate crisis and the barriers fossil fuel capitalists continue to put in the way of adaptation?	These individual suggestions have been sent to the various author teams for which they are relevant. Decisions on the appropriateness of these edits have been left up to the individual author teams to determine.
Rachel	Antidormi		Whole Document						1. There is mention of Indigenous peoples which is amazing, but I did not see a land acknowledgement in this report. I think it would be good to have an official land acknowledgement at the beginning of this report. 2. I feel as though it would be more helpful to include the chapters regarding direct human impact next to each other. The order of chapters 15-20 seems off. It would make sense to me as the reader that 15, 16, & 20 are located next to one another. Then fit 17, 18, & 19 into other areas that best relate. 3. This is a general comment. I am a graduate student and I am so grateful to all of you for writing this assessment and making a difference in our world. Thank you for sharing this and allowing public comment. It is amazing to be alive in a time where people are striving for change and dedicating so much time on research and reporting. Thank you!	We appreciate the suggestion about the land acknowledgement, and will provide the Federal Steering Committee with this note for their consideration. The decision to rearrange chapters, appendices, or Focus Boxes is made by the Federal Steering Committee based on comments received on the draft NCA5 prospectus (2020). At this stage of development, the Federal Steering Committee is not considering the addition of additional chapters, especially because such chapters would not have undergone the same rigor of agency, technical, and peer review as the existing chapters. This comment has been conveyed to the developers of the sixth National Climate Assessment and the US Global Change Research Program for consideration in future assessments. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Dave	White		Whole Document						link for college textbook https://ctruth.org/WhiteD RD pps2 12.16.22.pdf NCA5 report is based on the garbage science in The Intergovernmental Panel on Climate Change (IPCC) reports which are deliberate science fiction. Unless any scientist believes writing loosly referenced manuscripts and publishing them in a journal where the chief editor had a PhD in political science and then referencing them in the IPCC reports is science. That is not science. See chapter 13. Chapter 1. Carbon dioxide equilibrium. NetZeroCO2E = 8.6 billion tons of photosynthesis left in this world. Chapter 2. Greenhouse Gases. Methane is much less effective greenhouse gas. Water vapor is largest effect. Chapter 3. Astrophysical Warming of the Earth. Cooling in the south and warming in the north where 90% of people live. Chapter 4. Residence Time of Atmospheric Carbon Dioxide. It takes 150 years for anything we do with emissions of carbon dioxide to have an effect. Chapter 5. Statistical Analysis. Chapter 6. NOAA Mauna Loa data and fraud. Chapter 7. NiCE fix for Southeast USA Storms. Storms stopped in 2022. Ian is from South America and not from West Africa. Chapter 8. Global Sea Rise. 1.4 mm/yr. linear and not accelerating. No reliability in NOAA Satellites. Chapter 9. Photosynthesis Issues. Chapter 10. Atmospheric Carbon Dioxide Doesn‚Äôt Freeze in the Mesosphere. Chapter 11. NIST and photosynthesis experiment. Chapter 12. Ocean is not a Sink for Atmospheric Carbon Dioxide. Chapter 13. The Intergovernmental Panel on Climate Change (IPCC) reports are deliberate science fiction. Chapter 14. Videos to watch Chapter 15. Predatory Journals are a lie.	This comment is inconsistent with the author team's thorough assessment of the science.
Glenn	Branch		Whole Document						Although references to education and outreach are scattered unsystematically throughout the draft report, it would substantially benefit from the addition of a unit -- ideally a chapter, but possibly a chapter section, an appendix, a focus box, or something else -- especially devoted to discussing the current state and future needs of education and outreach efforts on climate change. The rationale for such a unit is clear. As the draft report repeatedly acknowledges (e.g., ch. 11, p. 25; ch. 13, pp. 12-14; ch. 15, p. 21), climate change education is a critical component of any plan for responding to climate change, since future generations will face, and thus need to be equipped with the requisite knowledge and knowhow to cope with, the challenges of climate change. While such a unit should discuss climate change education and outreach in both formal and informal learning environments, PreK to Gray, it would be appropriate for it to focus especially on secondary science education in the public schools, where a majority of Americans receive the bulk of their formal science education. Within that focus, it would be appropriate to review the body of evidence suggesting that the most effective way to improve the treatment of climate change in the public schools is to improve the treatment of climate change in the state science standards (acknowledged on ch. 26, p. 31) and ensure that pre-service and in-service educators are prepared to teach in accordance with the improved standards. It would also be appropriate to discuss what efforts have been made, and what further efforts could be made, by the federal government and its agencies to support effective climate change education and outreach in both formal and informal learning environments, especially with regard to secondary public school science education. In the absence of such a unit, the draft report's treatment of education and outreach could still be improved piecemeal, particularly by adding appropriate material to chs. 1, 15, 20, 31, and 32, and ensuring that chs. 21-30 all contain discussions of climate change education in their regions parallel to that of ch. 26. But a unified treatment would clearly be preferable.	The decision to add chapters, appendices, or Focus Boxes is made by the Federal Steering Committee based on comments received on the draft NCA5 prospectus (2020). At this stage of development, the Federal Steering Committee is not considering the addition of additional chapters, especially because such chapters would not have undergone the same rigor of agency, technical, and peer review as the existing chapters. This comment has been conveyed to the developers of the sixth National Climate Assessment and the US Global Change Research Program for consideration in future assessments. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Charles	Hunt		Whole Document						NCA5 Leadership does not seem to have taken taken appropriate steps to ensure that NCA Chapter Teams (as identified on the first page of each Chapter) utilized consistent sets of scenarios so that there was direct comparability between chapters. This issue should have already been identified by the Overview, Economics, Complex Systems, Social Systems, Adaptation, and Mitigation Chapter Teams. The difficulties in moving chapter to chapter with reasonable assurance that each chapter has been integrated through process and standards makes it difficult to impossible to rely on any one section as an authoritative source for policy formulation. Despite numerous strengths, this apparent lack of consistency is potentially a fatal flaw that needs to be addressed by NCA5 Leadership, and Chapter Leadership before publication.	Authors of NCA5 were given guidance to utilize the scenarios that their assessment of the scientific literature indicated made the most sense to use. They were not restricted to specific scenarios or encouraged to use any individual scenario over any other scenario. The Federal Steering Committee made an intentional choice to leave selections of scenarios to the individual author teams. While we acknowledge that this inherently introduces some inconsistentcy in presented scenarios across chapters, leadership determined that this freedom to authors to present the science as they felt best was a bigger priority that consistency across the various chapters.
Charles	Hunt		Whole Document						The tone throughout the document should be one of crisis that can be met and overcome. Too many places seem to celebrate initial efforts (even when they are not complete) and the tone creates the impression that all is well in hand, nothing more to worry about. Its a bit like reading much of the news from the beginning of WWII just before the fall of France. If the message is wrong, there is no way that the response by legislators, government executives, or the general public will be appropriate to the situation. US Citizens are going to have to make real changes in their lives (different heating, different ways to travel, etc). They will have to pay for the changes directly out of pocket (more expensive transportation, electricity, retrofitting their home heating and cooling, switching careers, etc.). Setting the wrong tone (or just as bad the right tone but only for those who are already deeply aware and engaged on the issues) will make many of the needed actions impossible. While this must not become a partisan political document, the message needs to fit the situation, and the situation is at least challenging.	The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. The tone of the report was prioritized to be clear and understandable to a general audience.
Mary	Hollowell		Whole Document						"Elevating homes" to the extent that will be necessary is not feasible (1-5, Southeast Region Action). Algal blooms that are mentioned multiple times are indeed a problem. The photos of environmental damage in this draft are not bad documents. The wind and solar project on 1-37 will not work. See Jeff Gibbs' documentary Planet of the Humans for documentation of solar array degradation. The wording of the following is unclear: "Amazon rainforest dieback" and "cloud decks that currently reflect sunlight." You might want to rephrase for clarity (2-29). Please clarify the term "ghost forest" (7-6).	A glossary to define important terms that are broadly used across the report is currently under development, with the intent of publishing it alongside the NCA5 upon publication. Individual terms such as the ones highlighted here have been defined by the authors within the chapters themselves.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jack	Schlotte		Whole Document						Education within our public schools is a vital component of transferring knowledge to the upcoming generations who will be the drivers of the critical changes needed to address climate change and its effects globally. This has become a political issue and this must be taken into account to properly and completely assess the actions that must be taken to lessen their unfortunate influences on education and implementation of the required solutions to climate change. Most people would agree that climate change education is a critical component of any plan for responding to climate change, since future generations will face, and thus need to be equipped with the requisite knowledge and technologies to cope with, the challenges of climate change. The most effective way to improve the treatment of climate change in the public schools is to improve the treatment of climate change in the state science standards and ensure that teachers are prepared to teach in accordance with the improved standards. Unfortunately these factors are being actively suppressed from primarily one political party, the Republicans, who have in their established party platform various subversive elements with the intent to restrict or stop all climate science education within our public schools across America. Their reasoning is complex and questionable, but must be brought to the attention of all of the 13 agencies and their personnel to overcome their detrimental effects nationwide. It is widely known that certain politicians, possibly with the motive to serve a limited constituent base, will act counter to the established goals and consensus knowledge of climate scientists, whether within America or from the I.P.C.C. (Intergovernmental Panel on Climate Change) Reports. A particularly impactful and widely known example of a politician's lack of knowledge and grandstanding against climate science was when James Inhofe (R), the Oklahoma Senator in Congress, brought a snowball in winter and threw it within the chamber floor as defiance of "Global Warming" and to bring unwarranted doubt to climate science. It is also widely known that his representing an oil-producing state that he is paid large amounts from oil and coal lobbyists. These conflicts of interest must be exposed and countered with valid science in order for these vital issues to be ameliorated in ways to benefit mankind. His and other's actions have set back the political discourse necessary to bring solutions not conflict to climate science education and the legislation and regulations needed to protect our population from the known negative effects on our	The authors, Federal Steering Committee, and the US Global Change Research Program agrees that educators and students are an important audience of NCA. NCA5 has been developed with these important audiences and their needs in mind. Development of the NCA is designed to result in a report that is authoritative, timely, relevant, and policy neutral; valued by authors and users; accessible to the widest possible audience; and fully compliant with the GCRA and other applicable laws and policies (see About NCA5 at https://www.globalchange.gov/nca5). To make the findings of the NCA useful and usable to educators and students, we have worked to make the NCA accessible to a broad range of audiences, both in the development of the content and the delivery of the final report materials on the website (see Appendix A1.3). Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside the development of NCA5.
K	Danowski		Whole Document						To Whom It May Concern: There are three basic points to climate change education: 1. Climate catastrophe education is a critical component of any plan for responding to our climate catastrophe. Future generations will face the worst effects and thus need to be equipped with the requisite knowledge and understanding to mitigate the major adverse outcomes of our climate catastrophe. 2. While climate catastrophe education is critical in both formal and informal learning environments, PreK to Grey, secondary science education in our public schools is particularly important, since a majority of Americans receive the bulk of their science education there. 3. The most effective way to improve the treatment of our climate catastrophe in public schools is to improve the treatment of said climate catastrophe in the state science standards and ensure that teachers are prepared to teach in accordance with the improved standards. Thank you.	The authors, Federal Steering Committee, and the US Global Change Research Program agrees that educators and students are an important audience of NCA. NCA5 has been developed with these important audiences and their needs in mind. Development of the NCA is designed to result in a report that is authoritative, timely, relevant, and policy neutral; valued by authors and users; accessible to the widest possible audience; and fully compliant with the GCRA and other applicable laws and policies (see About NCA5 at https://www.globalchange.gov/nca5). To make the findings of the NCA useful and usable to educators and students, we have worked to make the NCA accessible to a broad range of audiences, both in the development of the content and the delivery of the final report materials on the website (see Appendix A1.3). Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside the development of NCA5.
Elizabeth	Milliken		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Jimmie	Lunsford		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Sara	King		Whole Document						The National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. There is so much mis-information about climate change, we need strong science based evidence to make sure we do everything we need to do. Thank you.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Alan	MacLamroc		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Carol	Cook		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the climate risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. Thank you.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Paula	Shafransky		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Estrella	Risinger		Whole Document						Climate change is the defining issue in our world today, and climate literate students are necessary for our country to tackle the challenges to come. Knowing that climate change impacts are felt disproportionately by historically marginalized groups, particularly communities of color and low-income families, there is a critical need for an approach that is far-reaching and systemic. The report contains only a scattered and unsystematic discussion of the topic of climate change education, the essential basis for any future action on climate change. Climate change education is a critical component of any plan for responding to climate change since future generations will face, and thus need to be equipped with the requisite knowledge and know-how to cope with, the challenges of climate change. The most effective way to improve the treatment of climate change in public schools is to improve the treatment of climate change in the state education standards and ensure that teachers are prepared to teach in accordance with the improved standards. This requires an investment in both high-quality professional development as well as community-based partners. Please consider strengthening the report by incorporating climate education as a central and necessary strategy for addressing the climate crisis.	Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Carolyn Clark	Pierson		Whole Document						Aware of the pending, or perhaps even now occurring, climate collapse, as a member of Deep Adaptation, and a Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we are already facing, and to hopefully galvanize policymakers to take swift and strong action. Once the Fifth NCA has been released, the US Global Change Research Program should consider investing in public communications and outreach. Having access to the latest and best climate science would definitely be useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Emily	Platt		Whole Document						I have some general comments. As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. I live on the west coast where climate change-driven extreme weather has become the norm. It is imperative that the citizenry are well informed about climate change challenges and solutions.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Paul	Ward		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. We are running out of time. Strong motivation is needed to inspire quick, decisive actions.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Barbara	Shively		Whole Document						I am a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Caryn	Graves		Whole Document						As a climate advocate, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Michelle	Jorgensen		Whole Document						I am a huge proponent of doing what we all can to reduce climate change and I'm also a Union of Concerned Scientists supporter. I know that the National Climate Assessment (NCA) is a wonderful opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. People in general don't pay attention to much unless it is in front of their face,. That's why PR and outreach is so important. As a society, we don't have that much time to fix things. Let's do it now.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Richard	Stern		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Vikram	Sikand		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Gerald	Hallead		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Holly	Burgin		Whole Document						As a resident of California who as experienced years of drought, and most recently torrential rain that has caused destruction and casualties throughout the State, it is critical that NCA invest in communicating its findings clearly and accessibly to the US public. As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Natalie	Blasco		Whole Document						The National Climate Assessment (NCA) is a crucial opportunity to inform the public about the incredibly serious risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. Our lives and future depend on it.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Donna	Russell		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. Please keep in mind that there is a large portion of Americans that have low reading and comprehension, therefore it is imperative that climate science is also communicated in laymen's terms and at a lower level.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Probyn	Gregory		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Nicole	Prescott		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we as a country and the world face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. I believe documents like these can make a difference in advocacy, but the advocacy doesn,Âôt matter if action isn,Âôt taken.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Paul	Chapman		Whole Document						As a Yale alumnus, I have closely followed the work of the Yale Center for Climate Communication and know that it is vital to provide the general public clear, succinct information about the grave and growing nature of the climate crisis. Once the National Climate Assessment is complete, I urge you to secure sufficient resources to disseminate the report widely, and most important, frequently. I thank you for your vital work to help ensure the best environment for our children and grandchildren. Sincerely, Paul Chapman	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.

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John	Saccardi		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I respectfully ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. Thank you for the ability to comment.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Steve	Hersch		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Javier	Del Valle		Whole Document						Climate change is already having severe and worsening effects on the United States and its people. The National Climate Assessment is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. The USGCRP values reviews from climate activists like you. Public comments can help strengthen the science and content, and ensure this critical report is communicated clearly. The fifth NCA contains valuable information about observed and projected climate changes; their impact on human health, key sectors and regions of the country, and tribal and indigenous communities; and potential ways that our country can respond. Taken together, the various inputs to the NCA, and the NCA itself, will provide the best available, rigorously peer-reviewed science to help inform and guide the public and policymakers. As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
mae	basye		Whole Document						Climate change is already having severe and worsening effects on the global environmental scene. The National Climate Assessment is a crucial opportunity to inform the American public about the risks we face, and to galvanise policymakers to take swift and strong action. As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. The fifth NCA contains valuable information about observed and projected climate changes; their impact on human health, key sectors and regions of the country, and tribal and indigenous communities; and potential ways that our country can respond. Taken together, the various inputs to the NCA, and the NCA itself, will provide the best available, rigorously peer-reviewed science to help inform and guide the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Ervin	Kelman		Whole Document						As a private citizen, as well as a supporter of the Union of Concerned Scientists, my only comment is to strongly encourage the USGCRP - when the Fifth NCA is released - to expend the resources necessary to ensure that robust public communications and outreach is undertaken. Such would be a worthwhile approach to taking advantage of this quadrennial opportunity - at this crucial moment for our climate - to inform the public about the risks we face and to galvanize policymakers to take swift and strong action.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Jeffery	Garcia		Whole Document						As a citizen currently experiencing the effects of climate change in California's flooding and rain deluge and as a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Jeffery	Garcia		Whole Document						As a citizen currently experiencing the effects of climate change in California's flooding and rain deluge and as a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Laura	Lyons		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Virginia	Watson		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Glen	Young		Whole Document						As a concerned citizen and member of the Union of Concerned Scientists (UCS), I appreciate that the National Climate Assessment (NCA) is an opportunity to inform the public about the risks we face, and to encourage our policymakers to take urgent and strong action. I ask that, when this document is released, the US Global Change Research Program invest in public communications and outreach to ensure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Cheryl	Rigby		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I respectfully request that when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. Thank you for your consideration and for accepting my comments.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Dr. Mha Atma S	Khalsa		Whole Document						As a very concerned American citizen and taxpayer, I appreciate that the National Climate Assessmentis a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.

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Brian	Burt		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. The signs of, and impact of, climate change are already painfully evident every day. My children are cynical that we have the will to act. Please, let's show them that their future will be protected!	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Kevin	Walsh		Whole Document						The climate is of utmost importance. It is much more important than rich people or their profits.	This comment does not appear to raise a question or suggest a revision.
Jennifer	Valentine		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
AJ	Cho		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Marie	Wakefield		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Bretton	Little		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Chris	M		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. Thank you, Chris	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Croitiene	ganMoryn		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Katherine	Kohrman		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. This is so critical, that the release makes a big splash and is attention getting. Thank you.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Andrew	Phillips		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Robert	Renfro		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. Personal Note: My home state of Colorado has experienced unprecedented drought, heat and subsequent wildfires increasingly over the past 20 years. These climate events have been devstating to my state. The https://en.wikipedia.org/wiki/Marshall_Fire being the most recent example.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Victoria	Lea		Whole Document						It's crucial to make changes now; the public must know our current status and it must be accurate. As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
cara	artman		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
James	Champlin		Whole Document						Dear GlobalChange.gov, As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. Thank you, James Champlin	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.

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Christian	Stoltz		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. We are running out of time to ensure that this planet is safe and hospitable for generations to come. We cannot allow the avarice and disregard of the few outweigh the health, safety, and prosperity of the many. This action exists not only for humanity but for all living this inhabiting the earth; we are all passengers on this ship. When I was young, I wanted to go to school to study neuroscience and psychology; I thought that one day I would be a therapist or a professor. One day, however, I began to learn about insect decline, specifically in honey bee populations (although now I understand that honey bees are a bit less important than their native counterparts, which are declining at an even greater rate) and my world was changed. I went to school for entomology and eventually double-majored in plant science. I worked on projects and did research to better understand the natural world and its inhabitants. I cared more about the planet, the environment, and the climate; I always had but now I had scientific proof that something was wrong and only getting worse. The reason I share this is because public understanding is critical for change. There are so many people who don't fully understand the situation, willfully choose to misunderstand, or, even worse, misconstrue and mislead for their own gain. Public action and understanding begins with knowledge.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Hugh	Moore		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Christopher	Dunham		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Michael	Crowden		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Tony	Moureilles		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Amanda	Preston		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. At this point, most of the public knows that climate change is real. However, we need to do a better job of communicating exactly what that means for regular people and what we can do as a country to mitigate some of the most detrimental effects of the changes we're starting to see and expect to see in the future if we don't take bold action now. Thank you for your time and consideration.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Bari	Brookman		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. There has never been a more urgent and opportune time to fully communicate to the general public the importance of taking immediate and radical action to save life as we know it on this planet. Thank you.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Margaret	Barrett		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Tricia	Toliver		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. Thank you!	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Christine	Roane		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Rev. Gerald	Bishop		Whole Document						As a supporter of the Union for Concerned Scientists, I urge you to make sure that the NCA reflects sound science and is as accessible as possible not only to scientists and government agents but lawmakers and ordinary citizens as well. Climate change is an increasingly urgent problem that demands major changes -- even transformation -- in many areas of our society. We urgently need to respond forcefully, quickly and wisely to this danger.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Tedd	Ward Jr.		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Janice	Cooper		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.

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David	Gassman		Whole Document						As a climate advocate I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Art	Hanson		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I strongly urge that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. However, you MUST do MUCH more. We MUST keep ALL climate-changing fossil fuels IN THE GROUND! We MUST achieve 100% clean, renewable energy by 2030.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Richard	Stuckey		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. Richard J Stuckey 1931 N Fremont St Chicago, IL 60614	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Mike	Vanlandingham		Whole Document						As a climate advocate, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Paul	Meyers		Whole Document						I strongly believe that doing all we can for human health and safety, wildlife and the environment, and mitigating climate change are all very critical issues. Yes, the message below that I am sending you did come to me from an organization that I support, and it's also one whose information I trust. Please know that I have read it entirely, carefully, and that I agree with it fully, - in fact, I could NOT have said it better! As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Ronnie	Bolling		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Kathleen	Dolson		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Eric	Ericson		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Rhonda	Parsons		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Andrew	Ashburn		Whole Document						Before the release of the NCA5 3rd Order Draft, the U.S. Global Change Research Program must invest heavily in public outreach and communications to ensure that the latest science is made available immediately. People need to be made aware of the most up-to-date predictions of changes to Our Global Climate. The data that has been gathered throughout the last few years must be made rapidly available in an understandable and useful way. If we the people are not made aware of the most relevant information, how can we urge Our policy makers to advance necessary legislation to stave the worst avoidable consequences of Our extractive and combustive Global economy. Please engage the public with a concise and effective tool to help them take immediate action to inhibit the most life threatening effects of Global Climate Change at home and abroad.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
John	Olson		Whole Document						The document should address the human resistance to action about climate change. What actions are needed to address climate skeptics and political inaction? What are effective public education and advocacy strategies, in schools, communities, and the media? Include social scientists and education leaders in this study.	Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.
Wayne	Meulendyk		Whole Document						'Climate Change' appears to be the scapegoat for many of the water related problems that we are having. The root cause for many of the water related problems is the elephant in the room. That elephant is the overdraw of water from the Colorado River. This man-made catastrophe has set in motion a chain of events which has broken one hydrologic cycle and damaged others. Because the Colorado River no longer flows into its delta, the once fertile Delta is now a hot dry desert. This hot condition has damaged the North American monsoon water cycle. The heat in this area has established a temperature inversion which reduces the volume of moisture moved in the North American monsoon. Associated with the dry Delta is the dry Laguna salata, baja, Mexico.	This comment does not appear to raise a question or suggest a revision.
Wayne	Meulendyk		Whole Document						Laguna Salada, Baja, MX is the key to the broken water cycle created by the overdraw of water from the Colorado River. With the Colorado River being dry just after the Mexican border, water no longer fills Laguna Salada. Laguna Salada is the start point of a water cycle which goes from Laguna Salada, to Salton Sea, to Death Valley, to Great Salt Lake, to the headwaters of the Colorado River, to Laguna Salada. The water cycle is broken because Laguna Salada is dry. This began in 1939 with the Colorado River aqueduct transferring millions of gallons of fresh water out of the Colorado River watershed. This began the drying phase of Laguna Salata. Laguna Salada became dry in 1999. The mega drought started in 2000. The mega drought started as a drought. The first Domino of a domino drought.	This comment does not appear to raise a question or suggest a revision.

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Wayne	Meulendyk		Whole Document						So the megadrought began as a domino drought with the first domino being the drought in the Colorado River Delta. The Domino drought continued with droughts moving up through the Imperial Valley, Death Valley, Great Salt Lake, and Snake River. The the megadrought is responsible for the increased wildfire activity, for the decreased snowpack, and the reduction of water in the Colorado River. All of this as a result of the overdraw of fresh water from the Colorado River. Obviously the water being drawn from the Colorado River is being used for good purposes. The solution does not come from reducing the draw. Rather the solution is to repair the water cycle. This repair has three phases. The first phase is to refill Laguna Salada using ocean water. The second phase is to refill the Salton Sea to its historic level using ocean water flowing through Laguna Salada. The third phase is to pump water from the Salton Sea into Death Valley. Suggest pumping gallon per gallon the same as is removed from the Colorado River. The addition of the moisture in these places will restore the water cycle, even improve it. Natural processes will take the water from Death Valley and move it as fresh rainwater or snow into the headwaters of the Colorado River. Secondary benefits will occur within the Great basin as it is rehydrated through natural processes. This rehydration of the Great basin well benefit the indigenous people living there. The cost of the project installation can be billed to the Federal government. The management of the water transfer can be accomplished by the Reclamation Bureau. The cost of the transfer can be assessed as a tax on those drawing water from the Colorado River. The amount of the tax would be the cost of pumping one gallon into Death Valley for each one gallon they remove.	This comment does not appear to raise a question or suggest a revision.
Ruth	Fishkin		Whole Document						I have seen recent evidence that around 70% of the US population regard climate change as 'a serious problem'. That's something, but given that climate change IS the most serious global problem that modern human culture has ever faced, and is one requiring complex, intelligent and coordinated action, it's not enough. ALL Americans must have access to clear and accurate information about climate change, and this must happen now. Later on is likely to be too late. A too-late response to climate change will have consequences that don't bear thinking about. So please act to inform the public and decision-making bodies RIGHT NOW. As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Brett	Robert		Whole Document						I am glad to see that this document is honest and direct in its approach to climate change and the ways that it will affect all of us. I appreciate that the report looks at the effects of climate change in practical ways other than dollars and cents. This report does not have the bias toward the wealthy and powerful that we so often see in assessments such as this. It is high time that we look at these issues in this broader context so we can truly deal with the entire problem. We need the perspective that the National Climate Assessment (NCA) gives us to better understand and therefore better deal with the issues that we are facing now and in the future due to climate change. We need to follow the science and take action before it is too late. As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Andrew	Reich		Whole Document						The best science on climate is not useful unless it is communicated to the public effectively. As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Martin	Czigler		Whole Document						Congratulations on a very thorough assessment document. There is one addition that might improve the document a bit. In addition to the chapters on adaptation and mitigation, you may want to consider adding a chapter on how best to educate the public that needs to make the decisions on the actions to be taken in the future. A key part of such a chapter would be education of students, who (unlike people of my age) will have to try to live in our future world. To that end, strategies to help today's students become knowledgeable enough to make good decisions would be a positive contribution to this assessment. For example, the report could discuss strategies to improve the treatment of climate change in state science standards.	The decision to add chapters, appendices, or Focus Boxes is made by the Federal Steering Committee based on comments received on the draft NCA5 prospectus (2020). At this stage of development, the Federal Steering Committee is not considering the addition of additional chapters, especially because such chapters would not have undergone the same rigor of agency, technical, and peer review as the existing chapters. This comment has been conveyed to the developers of the sixth National Climate Assessment and the US Global Change Research Program for consideration in future assessments. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5.
Diane	Martinez		Whole Document						Throughout this document, it is important that readers understand that what is taking place right now is due to human-caused climate change. Although that message is stated directly in many places throughout the report, the construction of sentences tell readers another story. By using climate change as the subject of sentences (e.g., climate change causes…climate change impacts…), climate change is seen a separate entity, an entity that threatens humans and our way of life, but what we are experiencing is "human-caused climate change," and that is what should be emphasized. Instead of writing "Climate change causes…", terms like "human-caused climate change" or "human-driven climate change" should be used throughout the report in order to keep the fact that the effects humans are experiencing are, indeed, human caused. Without this constant reminder, readers distance themselves from "climate change," the enemy, the thing that threatens us, and they neither see nor take responsibility for human actions. If this committee wants people to make decisions that will reduce human-caused greenhouse gas emissions, then readers have to get the message that they are the ones responsible for causing climate change and they are the ones responsible for fixing the problems that have erupted because of it. Grammar matters. The subject that does the action in the sentence should be connected to the real-life subject that does the action and has caused climate change: humans.	We thank the reviewer for this comment, but the suggestion is outside the scope of the report. Authors are charged with being as accurate to the state of the science as possible. The focus is on clear communication, and we seek to inform. Pushing particular policies or interpretations of political choices is outside of the scope of the NCA.
Jeanine	Silversmith		Whole Document						In a recent paper in the Proceedings of the National Academy of Sciences, scientists picked climate education as one of six (6) key societal transformations needed to address the climate crisis. While education in a variety of settings and for all ages is important, K-12 education - especially secondary science education - is particularly important, since that is where most of us receive our science education. Each year, students graduate from high schools armed with the skills and knowledge about the climate that inform their actions, and the effects on the climate, positive or negative, of each of those students lasts beyond a lifetime. Those students need to be prepared to implement changes in professional and personal practices, to support and help develop new technology and policy, and to address the coming social and economic challenges and opportunities arising from a changing climate. It is thus essential that each of these graduates are climate literate. To do this, we must increase the prevalence of climate change concepts in state science standards and prepare our educators to teach these improved standards. I implore you to add a section to this document solely dedicated to climate change education and outreach.	The decision to add chapters, appendices, or Focus Boxes is made by the Federal Steering Committee based on comments received on the draft NCA5 prospectus (2020). At this stage of development, the Federal Steering Committee is not considering the addition of additional chapters, especially because such chapters would not have undergone the same rigor of agency, technical, and peer review as the existing chapters. This comment has been conveyed to the developers of the sixth National Climate Assessment and the US Global Change Research Program for consideration in future assessments. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5.

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Alex	Youngs		Whole Document						Thank you for providing the opportunity to comment on the NCA5 Third Order Draft. The National Climate Assessment (NCA) represents a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action, after decades of wilful ignorance. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Jensen	Fiskin		Whole Document						To start, I know it is customary to avoid usage of the first person when commenting but I feel my personal experience is key to the subject of my comment. Also, I'm not a scientist, so I apologize that my comment will not be on the content of the NCA, but rather its dissemination. I am a high school senior living in Palm Desert, California. I try to do everything I can to educate my school and community on climate change and the urgency of the crisis. I have worked with the Sierra Club developing energy policy and would like to think I'm well versed in the basic scientific literature of the climate crisis. In community presentations I frequently use some of the very same sources used in the NCA5. Considering my position, I am very grateful for the NCA5. Despite it being an intricate 1600 page report, it is organized very well and the tone remains academic, yet comprehensible. The information used is explained thoroughly and progress made in regards to accurate data is illustrated. A brief skim over this report can dispel any climate denialism or justification for delay in action. The content of this report, similar to the IPCC reports, is exactly what the American public needs to hear. We can understand the minutiae of the climate crisis, yet we have political leaders who have yet to even acknowledge its existence. We have a good majority of the public (at least in my own experience) that doesn't know the slightest when it comes to the drivers of things like fossil fuel expansion, energy efficiency measures, etc. There is a blatant disconnect between our scientific level of knowledge, and the public level of knowledge, that is far too wide to ignore. Many NGOs are working on this education, but this report offers a real opportunity to cement the gravity of the climate crisis in the minds of the American public, and light a real fire under us. Sadly, as you know, policy doesn't change in response to reports like this alone, even if it should. It takes a public outcry. And this is exactly what this report can help galvanize. So, I ask that when the Fifth NCA is released, the US Global Change Research Program invest heavily in public communications and outreach. Specifically, the "reduced uncertainty" and "improved attribution" must be emphasized so Americans can understand exactly why many of the extreme weather events across the country are happening. The makers of this report know the gravity of the climate crisis and the urgency required to mitigate it	Thank you for the comment and we hope the final report continues to be useful to you. The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Michael	Lowry		Whole Document						Climate change education is a critical component of any plan for responding to climate change, since future generations will face, and thus need to be equipped with the requisite knowledge and knowhow to cope with, the challenges of climate change. While climate change education is important in both formal and informal learning environments, PreK to Gray, secondary science education in the public schools is particularly important, since a majority of Americans receive the bulk of their science education there. The most effective way to improve the treatment of climate change in the public schools is to improve the treatment of climate change in the state science standards and ensure that teachers are prepared to teach in accordance with the improved standards.	Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Hildy	Meyers		Whole Document						Climate change is the single most important issue of our day. The National Climate Assessment provides a critical opportunity to inform people and show policymakers the importance of the immediate, comprehensive actions we must take for a livable future. The NCA is only useful if the public and policymakers are aware of the climate science in the report. Therefore, when the Fifth NCA is released, I urge the US Global Change Research Program to perform due diligence in widely disseminating and promoting the use of the NCA. Thank you.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Andra	Yeghoian		Whole Document						The response to climate change requires a cultural paradigm shift on a massive scale. Because K-12 schools have a major impact on societies culture, it is critical that K-12 schools be part of the broader initiative for change. There is no hope for solving the unprecedented challenges of Climate Change without K-12 schools being on board; therefore, K-12 schools should be a critical component of any plan for responding to climate change. Climate resilience in K-12 schools will include plans for climate literacy to be embedded into core subject areas (science, math, English language arts, and social studies), as well as support and plans for schools to adapt to the impacts of climate change and mitigate emissions that contribute to worsening global warming.	Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Andra	Yeghoian		Whole Document						Climate change education is explicitly discussed in ch. 26, pp. 31-32. It would be good to see it included in chapters 21-30, which separately discuss different regions of the country. In particular the Southwest.	Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954

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Katie	Navin		Whole Document						Climate change education is a critical component of any plan for responding to climate change since future generations will face, and thus need to be equipped with the requisite knowledge and know-how to cope with, the challenges of climate change. This should be a more prominent focus of the document as a whole. While climate change education is important in both formal and informal learning environments, PreK to Gray, secondary science education in public schools is particularly important, since a majority of Americans receive the bulk of their science education there. The most effective way to improve the treatment of climate change in public schools is to improve the treatment of climate change in the state science standards and ensure that teachers are prepared to teach in accordance with the improved standards.	Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Thomas	Knutson		Whole Document						"Climate change" vs. "human-caused climate change": The term "climate change" needs to be defined in terms of how it is used in the report. Does it mean just "human-caused climate change" or does it also include climate change from all sources (both natural and human caused). This can be addressed in the glossary, but once it is decided, the report needs to be consistent with that definition throughout.	The term climate change appears in the NCA5 glossary, which will be released when the final report is released. Additional edits have been made throughout the report, based on this comment and others, to clarify attribution. Please see the Overview and Chapter 2 for more information on human caused vs natural climate changes and their contributions to observed warming.
Jeremy	THORNER		Whole Document						The draft Fifth National Climate Assessment (NCA5) Report has multiple objectives, but one of them should clearly be how we can best get our nation mobilized to commence taking concrete steps to thwart further global warming. The best way to get our citizenry four-square behind such efforts is to make certain that our population is fully informed about the causes of global average temperature rise, the impact of the personal choices each person makes, the science behind both the causes and potential solutions (solar, wind, tidal, wave, geothermal, hydroelectric. etc.) to the problem, how to handle the rich nation-poor nation disparities, etc. Informing the public needs to be achieved on multiple fronts, but paramount among the mechanisms should be formal education about climate change appropriate for each grade level in our public and private schools. No Federal funds should be released to any school or school district that refuses to implement such formal pedagogical teaching about global warming and its impacts and the actions necessary to stave off disaster. In its current form, it seems to me that NCA5 Report contains only a smattering of non-coherent and poorly integrated consideration of the pressing need for climate change education in schools. Knowledge is power and is the essential basis for any future action on ameliorating climate change.	We thank the reviewer for this comment, but the suggestion is outside the scope of the report.
Diane	Gioe		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, understandable, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Charles	Keeling		Whole Document						The report would benefit from the addition of a unit (whether a chapter or sections of one or more chapters) devoted specifically to discussing climate change education and outreach.	The decision to add chapters, appendices, or Focus Boxes is made by the Federal Steering Committee based on comments received on the draft NCA5 prospectus (2020). At this stage of development, the Federal Steering Committee is not considering the addition of additional chapters, especially because such chapters would not have undergone the same rigor of agency, technical, and peer review as the existing chapters. This comment has been conveyed to the developers of the sixth National Climate Assessment and the US Global Change Research Program for consideration in future assessments. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5.
Charles	Keeling		Whole Document						The assessment should convey at least the following three basic messages with respect to climate change education: ‚ÄCClimate change education is a critical component of any plan for responding to climate change, since future generations will face, and thus need to be equipped with, the requisite knowledge and know-how to cope with the challenges of climate change. ‚ÄCWhile climate change education is important in both formal and informal learning environments, PreK to Gray, secondary science education in the public schools is particularly important, since a majority of Americans receive the bulk of their science education in that setting. ‚ÄCThe most effective way to improve the treatment of climate change in the public schools is to improve the treatment of climate change in the state science standards and ensure that teachers are prepared to teach in accordance with the improved standards.	Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Bill	Slowinski		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Zsuzsa	Palotas		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Myles	Robertson		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Alexandre	Guv©vel		Whole Document						The role of the US: I may have missed that but the major responsibility of the US with respect to climate change should be emphasized, and therefore the role the US has to play in fixing it. While countries like China may pollute more at the moment, historically, in terms of cumulated GHG emissions, the US is by far number 1 in terms of responsibility for climate change.	While chapters 1 and 2 note the role of the US in global historical emissions, this assessment is a technical report and does not include policy recommendations, in compliance with the congressional mandate . Detailed coverage of these topics is beyond the scope of this report.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Alexandre	GuvÍ©vel		Whole Document						Planetary boundaries: While tipping points are mentioned, I did not see any mentions of the 9 planetary boundaries (Stockholm Resilience Center), and that at least 4 of them have been crossed. They are important to mention since they should drive our response, instead of focusing solely on carbon emissions, which won't matter much when all boundaries are crossed. Another missing important resource is the Meadows Report, Limits to Growth (made in USA), which already warned (and even predicted) that our current system based on infinite growth, in a world of finite resources, was not sustainable. The Meadows Report pioneered Systems Thinking that is found for instance in the IPCC reports (e.g. different scenarii depending on our use of resources, CO2 emissions, positive feedback loops...). The discipline of Systems Thinking is also increasingly recognized as an important discipline to be taught to students (see Engineering for One Planet e.g.). This can help understand for instance how reinforcing feedback loops occur, and why we should really fear them (as the recent pandemic has reminded us).	Thank you for the resources. However, much of the content of these references are beyond the scope of the National Climate Assessment. Please see Chapter 17, key message 4, for coverage of international sustainable development
Alexandre	GuvÍ©vel		Whole Document						Solutions and education: Overall, the report is mostly focused on the (alarming) state of things, with very little left to solutions. This is surprising given that drastic concrete actions are urgently needed at all levels, and that we have known for a long time now that the state of things is indeed alarming when it comes to climate change. I think that there is too much focus on the reduction of emissions at the national scale and not enough on practical actionable actions at the individual scale. From my experience with high school and university students, explaining in great details how alarming the situation is without providing clear solutions and empowering students to do so can leave them distressed, and even demobilized. Since the solutions to climate change will be mostly implemented by the younger generations, this report should make sure to address them. Therefore, a subsection could be added about "Education" and/or "Empowering the youth". This report should call for a change in higher education curricula, which some universities are already undertaking on their own. This should start by ensuring climate literacy, since most college students have fundamental misconceptions about climate change (see Milovanovic et al. (2022), Senior engineering students in the USA carry misconceptions about climate change: Implications for engineering education. J. Clean. Prod.). This was recently confirmed by the UNESCO on a global scale (https://unesdoc.unesco.org/ark:/48223/pf0000383615). However, a unified, national response would be more efficient. For instance, while big universities may have the resources to change their curricula, smaller universities will need assistance in doing so. As I am part of this reflection in my university, I would be happy to provide more details regarding empowering the younger generation to face the challenges posed by climate change. Ideally, this reflection should operate on a national level and could be driven by the White House for instance. There are already groups of faculty and nonprofits teaming up to rethink how to teach engineering, for instance Engineering for One Planet. It is also the occasion to benefit from the advances that other countries, particularly in Europe, have made in this direction (I am for instance very familiar with the French system). As this report shows very well, it is truly the occasion to address at the same time interconnected systemic issues such as climate change and massive social inequalities. This will start through education (not necessarily only in universities)	Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Danielle	Hefferan		Whole Document						Hi there, My name is Danielle and I call northern MN home. A cold climate where climate change has been evident and is causing the need for adaptive and creative solutions. I am concerned about the lack of mention of climate change education throughout the draft. Climate change education is a critical component of any plan for responding to climate change, since future generations will face, and thus need to be equipped with the requisite knowledge and know how to cope with, the challenges of climate change. While climate change education is important in both formal and informal learning environments, PreK to Gray, secondary science education in the public schools is particularly important, since a majority of Americans receive the bulk of their science education there. The most effective way to improve the treatment of climate change in the public schools is to improve the treatment of climate change in the state science standards and ensure that teachers are prepared to teach in accordance with the improved standards. Thank you for taking my comments into consideration. Be well, Danielle	Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Roy	Clark		Whole Document						General Comment on NCA5 Third Order Draft, November 7, 2022 Roy Clark PhD President Ventura Photonics Thousand Oaks CA 91360 Please Note: This is the first part of a General Comment on the NCA5 Third Order Draft that was sent as an e mail attachment to review@usgcrp.gov from roy.clark@venturaphotonics.com on 1/24/23. The title of the file is RCVP01_GenComment_NCA5_TOD.pdf Figures and references are given in the e mail attachment. SUMMARY For NCA5, the USGCRP has blindly copied the global warming/climate change argument used by the UN Intergovernmental Panel on Climate Change (IPCC). The fundamental assumption is that the ‚Äòglobal mean surface air temperature,Âô (GSAT) can be explained by a series of contrived ‚Äòradiative forcings,Âô or changes in net average flux at the top of the atmosphere. NCA5 Figure 3.1c Global Surface Temperature Response shows the increase in GSAT attributed to various forcing agents. Such forcings are pseudoscientific nonsense. This also demonstrates that the USGCRP has no understanding of the energy transfer processes that determine the surface temperature. The entire NCA5 draft final report should be rejected and rewritten to show that there can be no ‚ÄòCO2 signal,Âô in the climate record. There is no need to mitigate a non-existent problem. The USGCRP also needs to explain to the President, to Congress and to the American People that it has been lying about climate change since it was founded in 1989/1990. The first step towards a realistic climate assessment is the quantitative thermal engineering analysis of the effects of an increase in the atmospheric concentration of so called ‚Äògreenhouse gases,Âô particularly CO2, on the earth,Âôs climate. This then provides the foundation for any actions that need to be taken	This comment is inconsistent with the author team's thorough assessment of the science.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Dave	White		Whole Document						NCA5 report is based on the garbage science in The Intergovernmental Panel on Climate Change (IPCC) reports which are deliberate science fiction. 11% EV's will Crash the grid. 6 California,Äôs power grid has already had rolling blackouts. This article says ‚ÄúCalifornia has pushed hard to switch to solar and wind power while closing older gas-burning plants, but that‚Äôs left it vulnerable in evenings when solar production fades. California Independent System Operator Chief Executive Officer Elliot Mainzer said Friday that consumer conservation to avoid outages may be needed for years.‚Äù https://www.nytimes.com/2022/09/01/us/california-heat-wave-flex-alert-ac-ev-charging.html Unless any scientist believes writing loosely referenced manuscripts and publishing them in a journal where the chief editor had a PhD in political science and then circular referencing them in the IPCC reports is science. That is not science. See chapter 13. Concensus. Https://cctruth.org/consensus.pdf See 4 pillars Chapter 1. Carbon dioxide equilibrium. NetZeroCO2E = 8.6 billion tons of photosynthesis left in this world. Chapter 2. Greenhouse Gases. Methane is much less effective greenhouse gas. Water vapor is largest effect. Chapter 4. Residence Time of Atmospheric Carbon Dioxide. It takes 150 years for anything we do with emissions of carbon dioxide to have an effect. Chapter 5. Statistical Analysis. Chapter 6. NOAA Mauna Loa data and fraud. Chapter 7. NiCE fix for Southeast USA Storms. Storms stopped in 2022. Ian is from South America and not from West Africa. Chapter 8. Global Sea Rise. 1.4 mm/yr. linear and not accelerating. No reliability in NOAA Satellites. Chapter 9. Photosynthesis Issues. Chapter 10. Atmospheric Carbon Dioxide Doesn‚Äôt Freeze in the Mesosphere. Chapter 11. NIST and photosynthesis experiment. Chapter 12. Ocean is not a Sink for Atmospheric Carbon Dioxide.	This comment is inconsistent with the author team's thorough assessment of the science.
Emma	Conrad-Rooney		Whole Document						The phrase Ÿ‹Ä‹üNature-based Solutions" should be added to the glossary. I propose the following definition from a White House Report to the National Climate Task Force (citation below). Here is their definition: "Nature-based solutions are actions to protect, sustainably manage, or restore natural or modified ecosystems to address societal challenges, simultaneously providing benefits for people and the environment" (page 11). Citation: White House Council on Environmental Quality, White House Office of Science and Technology Policy, White House Domestic Climate Policy Office, 2022. Opportunities for Accelerating Nature-Based Solutions: A Roadmap for Climate Progress, Thriving Nature, Equity, and Prosperity. Report to the National Climate Task Force. Washington, D.C.	A glossary is currently under development for NCA5 and terms like this are under consideration for inclusion.
Emma	Conrad-Rooney		Whole Document						There is very minimal coverage of topics related to the effect of fungi, bacteria, and microbes on ecosystems. Microbial and microscopic life, especially bacteria and fungi, play critical roles in supporting life on Earth. Microorganisms are extremely abundant--there is more than 40x the biomass of microorganisms on earth than that of animals (Bar-On et al. 2017)--and their functions have enormous impacts on every ecosystem. Fungi and bacteria are responsible for much of the movement of nutrients through ecosystems. They perform decomposition, through which dead matter is broken down, and nutrients in organic matter are transformed back into usable forms, recycling infinitely. Without decomposing microorganisms, our planet would be covered in dead matter and life on Earth would cease. Thus, the many factors that impact the composition and activity of decomposer microorganisms (such as climatic, edaphic, and biotic factors) should be of critical interest, especially as these factors, along with microbial diversity and distributions, are changing rapidly with global change. Fungi are also responsible for most of the nutrient transfer to vegetation. 80% of all plants and nearly every tree species on earth form associations with mycorrhizal fungi (Wang and Qiu 2006), which are responsible for providing nutrients from the soil to the plants in return for sugars from photosynthesis (Smith and Read 2008). Like soil decomposers, the composition and activity of mycorrhizal fungi are strongly dependent on factors that are changing rapidly with global change, which will affect plant productivity, soil carbon storage, and nutrient cycling. There seems to be a lack of expertise among the authors to address information about microbial communities and functions in ecosystems. We suggest adding information on these topics, perhaps by adding one or more technical contributors who have expertise in how fungi and bacteria impact ecosystems. Suggestions include Drs. Jennifer Bhatnagar at Boston University, Serita Frey at the University of New Hampshire, V. Bala Chaudhary at Dartmouth College, Ashish Malik at the University of Aberdeen, Mark Anthony at WSL Umweltforschung, and Peter Kennedy at the University of Minnesota. Citations: Bar-On, Y. M., R. Phillips, and R. Milo. 2018. The biomass distribution on Earth. Proceedings of the National Academy of Sciences 115:6506--6511. Smith, S. E., and D. J. Read. 2008. Mycorrhizal Symbiosis. Elsevier. Wang, B., and Y.-L. Qiu. 2006. Phylogenetic distribution and evolution of mycorrhizas in land plants. Mycorrhiza 16:299--363	This comment has been conveyed to the Ecosystems chapter and regional chapters and also to the National Nature Assessment development team. While we recognize this is an important topic, adding a new chapter, feature, or extensive coverage on this topic was not considered at this late stage of development, in part because of spatial constraints but especially because such content would not have undergone the same rigor of agency, technical, and peer review as the existing content. While coverage of fungi, bacteria, and microbes may be limited in NCA5, we appreciate that this is an area of growth for future assessments.
Helgaleena	H		Whole Document						The fifth NCA contains valuable information about observed and projected climate changes; their impact on human health, key sectors and regions of the country, and tribal and indigenous communities; and potential ways that our country can respond. Taken together, the various inputs to the NCA, and the NCA itself, will provide the best available, rigorously peer-reviewed science to help inform and guide the public and policymakers. As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to galvanize policymakers to take swift and strong action. I ask that, when the Fifth NCA is released, the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers. REPEAT: INVEST in public communications and outreach !!!	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.
Margaret	Phanes		Whole Document						As a climate advocate and Union of Concerned Scientists supporter, I know that the National Climate Assessment (NCA) is a crucial opportunity to inform the public about the risks we face, and to urge policymakers to take swift and strong action. When the Fifth NCA is released, I ask that the US Global Change Research Program invest in public communications and outreach to make sure that the latest and best climate science is available, accessible, and useful to the public and policymakers.	The release of the NCA5 is planned to include opportunities for public engagement and amplification of the report itself. We look forward to utilizing the NCA5 to help ensure that all decisionmakers at all levels of government and throughout the United States have the best science available to help them make more informed choices.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Katie	Boyd		Whole Document						Climate education is a very important part of enacting climate solutions - education is a critical component and foundation to support a broad societal response (e.g. Bowman & Morrison, 2021; Kwauk, 2020; Otto et al., 2020; UNESCO, 2020). For example, Research studies highlight that educating secondary students on climate change topics can result in a significant reduction of individual CO2 emissions (Cordero et al., 2020). Furthermore, educating youth has been shown to increase parent awareness and parents‚Äô level of climate concerns (Lawson et al., 2019). I would encourage you to add more references and information about recommending climate education throughout the US throughout this document. I have also provided a specific comment for one place where it is particularly relevant. References: Bowman, T. & Morrison, D. (Eds.). (2021). Empowering climate action in the United States. Part of Resetting Our Future Series. Changemaker Books. Cordero, E. C., Centeno, D., & Todd, A. M. (2020). The role of climate change education on individual lifetime carbon emissions. PloS one, 15(2), e0206266. Kwauk, C. (2020). Roadblocks to Quality Education in a Time of Climate Change. Brief. Center for Universal Education at The Brookings Institution. Lawson, D. F., Stevenson, K. T., Peterson, M. N., Carrier, S. J., L Strnad, R., & Seekamp, E. (2019). Children can foster climate change concern among their parents. Nature Climate Change, 9(6), 458-462. Otto, I. M., Donges, J. F., Cremades, R., Bhowmik, A., Hewitt, R. J., Lucht, W., ... & Schellnhuber, H. J. (2020). Social tipping dynamics for stabilizing Earth‚Äôs climate by 2050. Proceedings of the National Academy of Sciences, 117(5), 2354-2365. United Nations Educational, Scientific and Cultural Organization (UNESCO). (2020). Education for Sustainable Development: A Roadmap.	Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 ("Climate Education, Engagement, Workforce Development, and Training") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Joseph	Zajac		Whole Document						There was no US nor global network of monitoring stations to come up with preindustrial temperatures (1850‚Äì1900 average), no certified equipment calibration and unit certification.	Please see the Indicators appendix for information on historical observations, including methodology used for monitoring and the time periods available for different datasets.
Joseph	Zajac		Whole Document						include section in each chapter of dissenting options as none are included.	NCA authors are instructed to evaluate all available sources of information that meet Information Quality Act and Evidence Act requirements. The NCA5 has complied with all required laws, including those mandating specific standards of data quality and evidenciary support.
Joseph	Zajac		Whole Document						All models must specifically state the margin of error as the error increases over time. This is deliberately left out.	The NCA5 has complied with all required laws, including those mandating specific standards of data quality and evidenciary support. All figures, including those showing model projections, have extensive metadata records which will be made publicly available. These metadata records include information on models, datasets, methods, and uncertainty. Other uncertainties can be found in each Key Message's traceable accounts. Please see the process appendix on scenarios in future drafts for more information.
Joseph	Zajac		Whole Document						All models must show observations vs projections.	Where appropriate, observed data appears in figures with projections. Additional observational datasets are available in Appendix 4 (Indicators). Please also see appendix 3, which outlines the methods used, including the observational datasets used, in downscaled projections of temperature and precipitation.
Joseph	Zajac		Whole Document						Political correctness must be avoided.	We thank the reviewer for the comment. The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Discussion of political issues or policy options is beyond its defined scope.
Joseph	Zajac		Whole Document						The huge impact of tectonic plate shifting on sea level is overlooked. Even IPCC AR6 makes a mention.	We appreciate this comment and authors will consider whether this merits discussion in the report, as well as whether a scientific literature exists to support the inclusion of such topics.
Joseph	Zajac		Whole Document						The path of a single hurricane cannot accurately be projected out past 72 hours over a small area and the paper discusses long-term impacts and modeling decades out into the future to 2050 and 2100. No margin of error is cited in these projections.	This comment is inconsistent with the author team's thorough assessment of the science. This comment also conflates weather predictions with climate projections- please see Appendix 3 for more details on climate modeling. The format and structures used throughout the report to convey uncertainty is described in the Front Matter and descriptions of uncertainty for every Key Message can be found in that Key Message's traceable accounts section.
Joseph	Zajac		Whole Document						fails to state the obvious - no sun, no wind, no green power generated	The concept of intermittency is discussed in the Ch 32 references. Chapter 32 notes the difference between variable renewables and dispatchable or "firm" renewables and discusses energy storage technologies as well as improved transmission, which are essential components within future scenarios that include high uptake of wind and solar technologies. For example, Chapter 32 notes that under scenarios of high expansion of wind and solar, "expansion of energy storage allows heavier reliance on wind and solar."
Joseph	Zajac		Whole Document						fails to state that green power must be backed up by fossil fuel power	The concept of intermittency is discussed in the Ch 32 references. Chapter 32 notes the difference between variable renewables and dispatchable or "firm" renewables and discusses energy storage technologies as well as improved transmission, which are essential components within future scenarios that include high uptake of wind and solar technologies. For example, Chapter 32 notes that under scenarios of high expansion of wind and solar, "expansion of energy storage allows heavier reliance on wind and solar."
Joseph	Zajac		Whole Document						fails to state the unreliability of green power generation	The concept of intermittency is discussed in the Ch 32 references. Chapter 32 notes the difference between variable renewables and dispatchable or "firm" renewables and discusses energy storage technologies as well as improved transmission, which are essential components within future scenarios that include high uptake of wind and solar technologies. For example, Chapter 32 notes that under scenarios of high expansion of wind and solar, "expansion of energy storage allows heavier reliance on wind and solar."
Joseph	Zajac		Whole Document						document is filled with fearmongering and doom and gloom scenerios and claims when the planet is doing just fine.	This comment does not appear to raise a question or suggest a revision. The tone of the report was prioritized to be clear and understandable to a general audience.
Joseph	Zajac		Whole Document						references or inferences to wildfires as part of climate change are absurd. it is a fact that wildfires are a fraction of what they were decades ago. it is a fact that the overwhelming majority of wildfires are the direct result of government's failure to properly manage the land allowing fuel to accumulate. arsonists, homeless campfires, old utility wires, and fireworks from gender reveal parties started the biggest fires.	The report clearly notes that climate change is one driver, among other factors including human behavior and building patterns, that affects the observed increase in wildfires. While there are many factors that affect ignition of wildfires, climate change plays a significant role in the severity of wildfires once started, and the increasing size of land area burned. Please see Appendix 4, Indicators, and chapter 6, land use and land use change, for more information on observational datasets of wildfire metrics.
Joseph	Zajac		Whole Document						nothing appears to cover the COST of what is being discussed to do away with fossil fuels, go green, etc.	Consistent with its Congressional mandate, this assessment is a technical report and does not include evalutation, incldluing the costs, of different policy actions or recommendations. Detailed coverage of these topics is beyond the scope of this report. However, the Economics chapter does discuss the fact that the damages associated with climate change far outweigh the costs of response actions. Please also see the mitigation and adaptation chapters for more details on feasibility, tradeoffs, and limitations of mitgiation and adaptation actions, including the potential for distributional equity impacts and maladaptation.
Joseph	Zajac		Whole Document						nothing appears to cover the environmental damages and CO2 created in mining, production, and delivery of wind and solar power. There is no information explaining how much fossil fuel is used to mine, manufacture, transport, and install a solar panel and a wind turbine. on a mwhproduced basis, wind and solar consume far more critical materials such as copper, nickel, chromium, zinc, rare eaths, etc., than nuclear, NGCC, and coal-fired power plants. NEVER MENTIONED.	Minerals and metals critical for mitigation and renewable energy is covered in chapter 17, notably Figure 17.2. While this text does not go into extensive detail, it does describe the potential for the extraction and processing of minerals used in renewable energy infrastructure to heighten local ecological, political, and justice tensions. Additional information on the rapidly decreasing costs of renewable energy, such as wind and solar, and rapidly increasing capacity, can be found in the Overview and Chapter 32.
Joseph	Zajac		Whole Document						use of politically correct terms like "environmental justice issues" and "social injustices" do not belong in this document	The NCA5 has complied with all required laws, including those mandating specific standards of data quality and evidenciary support. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.
Joseph	Zajac		Whole Document						fails to acknowledge the failure of predictions and models from previous reports, and in IPCC reports	Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. Detailed coverage of these topics is beyond the scope of this report.
Joseph	Zajac		Whole Document						there are no references to what is the optimum state of the earth's climate, optimum temperature, optimum human population, and the optimum number of each species. why not?	Authors were provided this comment for consideration.
Joseph	Zajac		Whole Document						needs to cover the huge negative economic impact on rural areas from green state and federal government policies, cost to taxpayers, projected increase n national debt.	Authors were provided this comment for consideration.
Joseph	Zajac		Whole Document						not seeing any reference to basic government maintenance of infrastructure such as keeping storm drains clean to allow water to flow more efficiently which helps avoid flooding. proper maintence of federal & state land to avoid wildfires.	Authors were provided this comment for consideration.
Joseph	Zajac		Whole Document						fails to address the failure of government to provide for the those who have been marginalized and under-resourced, blaming climate change for the failure of government	Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. Detailed coverage of these topics is beyond the scope of this report.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Joseph	Zajac		Whole Document						there is a huge conflict of interest when the author's jobs are dependent upon supporting and promoting a green agenda. why is there no proportional diversity and inclusion of non-government and non-education sector representatives as authors?	Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. Detailed coverage of these topics is beyond the scope of this report.
Joseph	Zajac		Whole Document						no mention whatsoever that climate change is at the bottom of the list of issues for Americans, but federal and state governments are proceeding as a top priority and diverting funds from other areas of higher public importance	We thank the reviewer for this comment, but the suggestion is outside the scope of the report. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.
Joseph	Zajac		Whole Document						Show the past ERRORS in the old vs Advances in understanding the (fill in the blank)	Authors were provided this comment for consideration.
Joseph	Zajac		Whole Document						I am shocked at the poor quality and political correctness of this document. The authors should be ashamed to have their names associated with this bogus research.	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac		Whole Document						another report whose goal is to create victims , create social conflict, and divide people because of climate change. the authors should ashamed of themselves.	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac		Whole Document						there is no consistency in the topics/sections covered in each chapter outside of political correctness and conclusions without facts. The subsections in each chapter should be uniform. If a subsection does not apply, simply list the subsection and put Not Applicable. that way readers can easily compare the chapters.	The format and structure of the individual chapters was determined by the Federal Steering Committee overseeing the NCA. The FSC made a decision that authors would have the flexibility to design a chapter that was best structured - within that format - to communicate effectively with the target audience of their chapter. While that may reasonably come a cost of being able to easily compare chapters to each other, the FSC felt this trade off was worthwhile to ensure that individual chapters best communicated with the audiences interested in reading them.
Joseph	Zajac		Whole Document						Not mentioned: Money spent by the USA on green projects means hundreds of billions less money spent on social programs, border control, infrastructure, defense, and foreign aid. What country benefits the most from green spending, social unrest, open borders, crumbling infrastructure, weaker military, and less foreign influence? (CHINA)	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac		Whole Document						not mentioned: All solar and wind power on an electric grid must be backed up with an equal or great amount of fossil fuel power running on standby 100% of the time. This cost MUST be factored in with any green project.	The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Discussion of policy options is beyond its defined scope. Discussion of energy-related scientific topics will be included in multiple chapters throughout the report, including the Energy chapter, as well as various regional chapters, among others.
Joseph	Zajac		Whole Document						there needs to be a statement in EVERY CHAPTER saying that the authors do or do not have a conflict of interest related to the chapter's discussion. for example, state and Federal Forestry Service failed to properly maintain forestland and then claims wildfires are the result of climate change.	All auithors and contributors attested that they would abide by conflict of interest requirements in their onboarding process. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.
Joseph	Zajac		Whole Document						not mentioned: America's dependence on countries like China who control the supply of rare earths required for going green and that have a huge low cost production advantage over America, including using prison labor to manufacture solar panels.	Information on international consideration can be found in the International chapter. Please also see the box on risks to supply chains.
Joseph	Zajac		Whole Document						needs to specifically state that use of Chinese rare earth minerals to go green is a national security risk. This is in line with Biden administration goals to move away from dependence on China.	Information on international considerations, including national security, can be found in the International chapter. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. If authors determine a scientific basis exists for assessment of these topics, they will be considered for inclusion in the report.
Joseph	Zajac		Whole Document						not mentioned: China has a near monopoly on a group of 17 metals that are crucial to the development of everything from smart electronic devices to wind turbines. China controls nearly 80% of rare earths imports, according to data from the U.S. Geological Survey, while the U.S. claims just one rare earth mine and has no capability to process the minerals.	Information on international consideration can be found in the International chapter. Please also see the box on risks to supply chains.
Joseph	Zajac		Whole Document						not mentioned: the hidden costs of solar panels not factored into the purchase and Return on Investment, like increased property taxes, monthly connection fees, increased costs to non-solar panel owners from utilities to make up for lost revenue, etc. inability to sell the home at a later date because not everyone wants solar panels on their home. increased home value from the solar panels impacts property taxes in the neighborhood.	Information on mitigation and adaptation actions can be found in the Mitigation and Adaptation chapters. If authors determine a scientific basis exists for assessment of these topics, they will be considered for inclusion in the report.
Joseph	Zajac		Whole Document						not mentioned: governments cannot stop a hurricane, a tornado, a thunderstorm, or a blizzard from forming but somehow governments have the power through science to stop planetary warming at 1.5C with green taxes and projects.	This comment does not appear to raise a question or suggest a revision. Please see the chapter on Climate Trends and Mitigation for information about the choices that lead to different projected temperature increases
Joseph	Zajac		Whole Document						needs a disclaimer - fails to state conclusions are based upon peer reviewed papers that used flawed tempoerature and sea level data, whose results were not replicated by the authors, and that failure to replicate is a known issue in the scientific community.	We appreciate this comment and will consider the appropriate way to ensure clarity to readers on the sources of content within this report. Information about the report and about the report development process, including Information Quality, will be provided in Front Matter and process appendices in later drafts.
Joseph	Zajac		Whole Document						fails to state that was no global weather monitoring network in place in 1850 but data 170 years is cited	Please see the Indicators appendix for information on historical observations, including methodology used for monitoring and the time periods available for different datasets.
Joseph	Zajac		Whole Document						fails to state that old data (100+ years old) is subject to a huge margin error by today's measurement standards	The NCAS has complied with all required laws, including those mandating specific standards of data quality and evidenciary support.
Joseph	Zajac		Whole Document						fails to mention that while western countries including the USA move away from coal driving up energy prices, China continues to build hundreds of coal fired power plants. Coal Power Capacity Under Development by Country 2021 #1 China 246,864 GW - Source: Global Energy Monitor	Information on international issues may be found in the International chapter. Information on US emissions, including dources of emissions by fuel type, may be found in the Mitigation chapter. Consistent with its Congressional mandate, this report focuses on climate change topics within the United States, and does not engage with issues outside of the US unless they have direct impact on the US. However, authors were provided this comment for consideration.
Joseph	Zajac		Whole Document						fails to mention that in the US, environmentalists do not consider hydroelectric power green and block the building of new hydroelectric projects with lawsuits. the EU considers hydroelectric green.	We thank the reviewer for this comment, but the suggestion is outside the scope of the report.
Joseph	Zajac		Whole Document						not seeing the names of A-Team level players authoring this report. looks to be written to support a one-sided political agenda vs presenting verifiable facts.	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac		Whole Document						any author pushing climate change caused wildfires should resign from this report. references or inferences to wildfires as part of climate change are absurd. it is a fact that wildfires are a fraction of what they were decades ago. it is a fact that the overwhelming majority of wildfires are the direct result of government's failure to properly manage the land allowing fuel to accumulate. arsonists, homeless campfires, old utility wires, and fireworks from gender reveal parties started the biggest fires.	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac		Whole Document						"Climate change" is more a nebulous marketing term that has replaced global warming, than an accurate climatological definition. NOAA, NASA, the IPCC, and the USGCRP cannot agree on one definition of "climate change."	This comment is inconsistent with the author team's thorough assessment of the science.
Joseph	Zajac		Whole Document						no discussion on the COST of net-zero to consumers, increasing prices, increasing inflation, increasing the cost of energy, diverting funds away from needed areas, etc, all for an unnecessary goal. money diverted to net-zero/going green mean less money for defense, social programs, infrastructure.	Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. Please see the Economics, Adaptation, and Mitigation chapters for information on costs and benefits of climate impacts under different scenarios.
Joseph	Zajac		Whole Document						the paper seems to set the stage for promoting wealth transfer to various groups	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac		Whole Document						solar and wind turbine electricity generating numbers should be a reflection of the actual contribution of energy or reliability to a grid system, not the theoretical capacity to produce electricity. no nameplate ratings. the range for solar power is typically 12% to 18%. wind turbines perhaps 20% to 30% max.	We appreciate this comment and authors will consider whether this merits discussion in the report, as well as whether a scientific literature exists to support the inclusion of such topics.
Joseph	Zajac		Whole Document						no mention of the deadly impact of solar panels and wind turbines killing millions of bats and birds including endangered species such as eagles. no mention of offshore windfarms inpacting whales and marine life.	Authors were provided this comment for consideration.
Joseph	Zajac		Whole Document						no mention of using system adequacy contribution (in MWs) and annualized electric energy generation (in MWhs) in determining costs and ROI.	Authors were provided this comment for consideration.
Joseph	Zajac		Whole Document						no mention of the mandatory or contractual payments to solar and wind electricity providers when the panels and turbines are not generating for whatever reason. for example, the demand is low so the billing does not meet the contracted monthly minimum. bad weather reduces the number of hours of sunshine for the solar panels. high winds cause the wind turbines to be shut down, low winds fail to turn the blades.	Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. If authors determine a scientific basis exists for assessment of these topics, they will be considered for inclusion in the report.
Joseph	Zajac		Whole Document						the authors need to sign a personal liability statement for each chapter holding themselves personally liable for damages on decisions made by governments, businesses, and the public, based upon flawed information, modeling, recommendations, conclusions, etc., presented by the authors.	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac		Whole Document						chapter by chapter, needs a disclaimer - fails to state conclusions are based upon peer reviewed papers whose results were not replicated by the authors, and that failure to replicate is a known issue in the scientific community.	We appreciate this comment and will consider the appropriate way to ensure clarity to readers on the sources of content within this report. Information about the report and about the report development process, including Information Quality, are provided in Front Matter and process appendices.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Joseph	Zajac		Whole Document						no mention whatsoever that solar panels and wind turbines are not really recyclable, leaving toxic elements, chemicals, and components to pollute the environment.	Authors were provided this comment for consideration.
Joseph	Zajac		Whole Document						the negative environmental and business impact of onshore and offshore wind turbines needs to be discussed. for example, fisherman cannot trawl in the area of wind farms. ship navigation is potentially dangerous. fisherman must move further out into the ocean to fish driving up fuel costs which drives up the price of their catch to consumers. offshore windfarms negatively impact migration of large sea creatures such as whales, sharks, and manatees. sea bird migration is impacted by birds being chopped up in turbine blades. offshore windfarms do not lower the cost of electricity to consumers.	Authors were provided this comment for consideration.
Joseph	Zajac		Whole Document						there is no discussion on the enormous amount of electricity consumed and CO2 produced by the cryptocurrency industry.	Authors were provided this comment for consideration.
Joseph	Zajac		Whole Document						imagine that you have a real job where you are responsible for producing a report that impacts the lives of over 330 million people and influences tens of trillions of dollars in spending. when you reference information for a source such as a research paper, do you: 1. blindly accept the information and conclusions in the paper as being 100% correct; or 2. independently verify that the information and conclusions are correct because you know that a high percentage of scientific papers fail replication.	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac		Whole Document						not covered. onshore wind and PV solar have expected lifetimes of around 20 years. offshore wind installations may also have expected lifetimes of 20 years, though, at this point, no one knows their life expectancy. how well will they hold up against hurricanes? nuclear power plants operate for 80 years, while NGCC power plants operate for at least 40 years and coal-fired power plants operate for 60 years. therefore, wind and solar plants have to be built and then replaced THREE TIMES while the nuclear plant is built just once.	Authors were provided this comment for consideration.
Joseph	Zajac		Whole Document						never mentioned that wind and solar power generation are so inefficient that both require tremendous areas of land (or sea) to operate.	Authors were provided this comment for consideration.
Joseph	Zajac		Whole Document						not mentioned that solar farm developers typically have NOT provided an adequate escrow fund to finance the removal of the solar panels at the end of their useful life, for which there is no recycling of the panels.	Authors were provided this comment for consideration.
Joseph	Zajac		Whole Document						need a disclaimer for each chapter: the writings of the authors are not necessarily the accepted views and opinions of the entire scientific community. the information provided in this chapter is for general informational purposes only and not to be used for public planning purposes.	This suggestion and description of the purpose of the National Climate Assessment is incorrect and does not align with the Congressional Mandate as expressed in the Global Change Research Act of 1990. Furthermore, NCA5 has complied with all required laws, including those mandating specific standards of data quality and evidenciary support. As mandated, the assessment is written to help inform decision-makers, utility and natural resource managers, public health officials, emergency planners, and other stakeholders by providing a thorough examination of the effects of climate change on the United States, and thus is intended to be used for planning purposes. Please find more information about the report, including its mandate and purpose, in the Front Matter of future drafts.
Joseph	Zajac		Whole Document						report needs to acknowledge the limitations of climate models including: an incomplete understanding of the climate system, an imperfect ability to transform our knowledge into accurate mathematical equations, the limited power of computers, the models' inability to reproduce important atmospheric phenomena, and inaccurate representations of the complex natural interconnections.	We thank the reviewer for this comment. A thorough discussion of climate models will be included in the Earth Systems chapter. All figures, including those showing model projections, have extensive metadata records which will be made publicly available. These metadata records include information on models, datasets, methods, and uncertainty. Other uncertainties can be found in each Key Message's traceable accounts. Please see the process appendix on scenarios in future drafts for more information.
Joseph	Zajac		Whole Document						why would the USA want to promote an electric vehicle or transportation system that is costly, unreliable and based on minerals and metals which are mostly limited to environmentally negligent human rights abusers such as China, Russia, the Congo and the lithium triangle in South America?	Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. If authors determine a scientific basis exists for assessment of these topics, they will be considered for inclusion in the report.
Elizabeth	Wilkening		Whole Document						Chapters 21 - 30 needs to include Climate Change Education for Educators, Students and the public. It is mentioned briefly in Ch. 26, but all regions should have climate change education. States will still adopt their own education standards, but Federal incentives and programs can encourage and reward educators and schools for incorporating programs with local relevance. Other countries have national climate change education and it is time for the the USA to have it also.	Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 (""Climate Education, Engagement, Workforce Development, and Training"") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Elise	Trelegan		Whole Document						We're all aware that addressing climate change requires us to look at root causes - looking at NCA5 this is clear. However I was shocked to see that EDUCATION for climate action was completely missing from this report. The majority of people in our country engage in the public school system where we aspire to provide learning experiences that support the development of "whole" community members. Public school instruction is guided by state standards, most of which lack adequate learning around the causes and solutions of climate change. Without robust education for climate action, we're missing a huge opportunity and in fact doing a disservice to future generations. We must be working collaboratively with the education field to ensure that education for climate action is embedded into not just national and state science standards but also social studies (C3); and that teacher are provided with critical professional development so that they can support this student learning.	Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 (""Climate Education, Engagement, Workforce Development, and Training"") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
John	Christy		Whole Document						John R. Christy The University of Alabama in Huntsville 27 January 2023 Comments on NCA5 Third Order Draft (3OD) Basic issues At the present, this NCA report reads as a set of claims about the climate that are intended to support a political agenda. The general failure of the report is found in the following issues, examples of which will follow in the appropriate chapters 2 and 3. 1. Pervasive neglect of information that qualifies or contradicts the claims being made a.Selecting specific time periods which mislead regarding true variability 2.Overstatement of confidence in our understanding of the climate system a.Understatement of significant uncertainties with climate model results b.Neglect of information that demonstrates climate model failings c.Use of virtually impossible emission scenarios 3.Understatement or dismissal of the role of natural variability in climate variations 4.Sermonizing about policy directions Many of NCA5 claims are often unscientific, especially in the sense the 3OD does not provide information that mitigates or even contradicts the claims being made. Political documents don‚Äôt offer negative views to their claims but addressing such counter-claims is a bedrock of science. I realize my effort to influence the report is a fool‚Äôs errand as my review of the ZOD (which was based on reproducible, published information) was ignored. But I hope someone with an objective mind will read and understand the implications of this submission. If these issues aren‚Äôt addressed, this information will be made public in unknown ways and thus reduce any credibility that one might attach to the report. Since the entire report depends on two basic assertions; 1.Chapter 2: Climate is changing for the worse due to humans 2.Chapter 3: Models are reliable or creditable	This comment is inconsistent with the author team's thorough assessment of the science.
Marcy	Rockman		Whole Document						Recommend and request that throughout this report, human social systems are recognized and described as including culture and heritage, and/or that culture and heritage are included as additional categories of attention. Alternately, where it is not possible to include attention to culture and heritage, this gap should recognized. Attention to culture and heritage with respect to climate is difficult for the US government as federal agency roles do not address them with nearly the same rigor and specificity as areas such as natural resources, land management, economy, and funding and research for culture and heritage in relation to climate change similiarly lag behind (reference: Rockman and Hritz 2020, https://doi.org/10.1073/pnas.1914213117). My comments that follow for the NCA5 are directed to noting additional places where mentions of culture and heritage would be appropriate and to add potential references. My apologies these comments are not exhaustive.	NCA5 contains, for the first time, a chapter discussion social science and justice topics. As an assessment of literature on these topics, additional discussions on these topics are also present throughout the report, particularly in the regional chapters.
Kristen	Scopinich		Whole Document						Climate change education needs to be part of any plan that aims to address climate change impacts and solutions. An informed population will be ready to face the substantial challenges climate change poses and will be more likely to be able to equitably participate in climate change solutions that consider the perspectives of different constituents. Americans receive the bulk of their science knowledge as well as scientific habits of mind/way of thinking through their science education in secondary schools. If a climate literate populace is valued and seen as a important component of ensuring a broad-based understanding of climate change impacts and a desire to contribute to climate change solutions, we need make climate education standards in our public secondary schools an imperative in building science literacy, as critical as language and math literacy. State science standards (and associated professional development for teachers) that address climate change are the lever that will ensure teachers and communities have the support they need to bring meaningful climate change education to their students. This increases general climate literacy, and at the same time, prepare the next generation of citizens that will support climate action and contribute in new economies that will contribute to the mitigation and adaptation of climate impacts. Thank you for the opportunity to share my thoughts, on behalf of Mass Audubon. Mass Audubon is a statewide organization based in Massachusetts. Mass Audubon is the largest nature-based conservation organization in New England. With the help of our 160,000 members and supporters, we protect wildlife, conserve and restore resilient land, advocate for impactful environmental policies, offer nationally recognized education programs and nature experiences for over 700,000 adults and children at our wildlife sanctuaries and in communities across the state.	The authors, Federal Steering Committee, and the US Global Change Research Program agrees that educators and students are an important audience of NCA. NCA5 has been developed with these important audiences and their needs in mind. Development of the NCA is designed to result in a report that is authoritative, timely, relevant, and policy neutral; valued by authors and users; accessible to the widest possible audience; and fully compliant with the GCRA and other applicable laws and policies (see About NCA5 at https://www.globalchange.gov/nca5). To make the findings of the NCA useful and usable to educators and students, we have worked to make the NCA accessible to a broad range of audiences, both in the development of the content and the delivery of the final report materials on the website (see Appendix A1.3). Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside the development of NCA5.
Nadia	Gronkowski		Whole Document						The Early Years Climate Action Task Force (‚Äúthe Task Force,‚Äù) appreciates the opportunity to comment on the NCA5 Third Order Draft. Below we offer several considerations for representing the needs of infants and young children (prenatal-8) and their families in this critically important report: INCLUSION OF CHILDREN, CAREGIVERS, AND PREGNANT & LACTATING PEOPLE The Task Force applauds the NCA5 authors for including children consistently throughout as a population that will disproportionately bear the impacts of climate change. Including this framing in impacts that are often associated with children and families -- such as food insecurity, access to clean water, etc. -- and in less obvious or immediate effects of climate change -- such as conflict, energy insecurity, and pathogens ‚Äì will support climate and early childhood advocates in preparing for the many diverse needs of children and families in the years to come. Suggestions for Improvement: The Task Force encourages the authors to elevate the young children (prenatal to 8), their caregivers and families as a key population and a fundamental issue in Climate Science and Policy. There is extensive (and growing) evidence that this segment of the population is exceptionally vulnerable to climate disruptions, emergencies and disasters. Climate change not only endangers life in the early years, but lacking appropriate attention and support, the damage incurred in the early years carries over and accrues over the full lifespan of an individual. In this sense, climate policy and programs that are sensitive/centered on the early years are a great investment that provides support in the present and yields resilience over the long term. The Task Force also recommends naming ‚Äúinfants and children‚Äù throughout the report and generally increasing the information presented about the impacts of climate change and climate emergencies on our nation‚Äôs youngest citizens. The younger a child is, the more susceptible they are to many of the negative impacts of climate change, meaning that infants are at high risk; furthermore, infants have unique needs in the context of disaster preparedness and community resources that must be considered as the nation plans for climate resiliency. The Task Force appreciates the authors‚Äô many mentions of pregnant people, and encourages them to	Thank you for this comment and the extensive list of recommendations for improvement. This comment has been shared with all the author teams for consideration in their individual chapters, as well as with the federal steering committee. In particular, the authors appreciate the suggestions on how to better capture intersectional issues, such as children with disabilities. Chapter 15 in particular notes the disproportionate impacts on children. Please also see NCA4 and the 2016 Climate and Health Assessment, which described impacts on children and pregnant women and people with prexisting conditions or disabilities. Information has also been added to the text to better describe intergenerational equity concerns.
Juanita	Constible		Whole Document						Thank you for more closely examining how climate change magnifies existing vulnerabilities created by structural and institutional racism and other inequities than in previous versions of the NCA.	We greatly appreciate the reviewer's comment about the report/chapter and hope that the content is useful.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Don	Haas		Whole Document						My comments will focus on the need to give more attention to climate and energy education in the final draft. At first blush, it's stunning that there is virtually no attention to education in the Assessment. Of course it's worth noting that these reports are about how the climate is changing and not focused upon how to respond to climate change. That's true. However, climate education still warrants more attention for a few reasons: - The dearth of effective climate education is part of the reason we're in the state we are in. - The report does include "Response Chapters," Adaptation, Mitigation; Chs. 31 and 32. Among other things, these chapters claim to describe best practices and best practices must include attention to education in both formal (K-16) and informal education. Like in most federally funded science reports the report does not make policy recommendations. It should obvious that an essential part of a best practice response to climate change is education. - Further, the federal government funds substantial initiatives in climate and energy education, and it feels like a huge oversight to give these efforts no attention. The current draft has only passing and non-systematic attention to climate and energy education. A chapter or at least a chapter section is warranted to describe the central role of education in addressing climate change. Barring this there should be a prominent if brief discussion of why education initiatives are not included in the report and references to reports or other literature that addresses the need for quality climate and energy education. I won't go chapter by chapter here, but will note the first section of Chapter 1: Overview is titled "How We Are Addressing Climate Change." It has five subsections, none of which address education in more than a passing mention. Climate education is both part of how we are currently addressing climate change and is central to what we must do moving forward. I have also submitted individual chapter comments for some chapters. The word "education" appears on 80 pages of the 1,695 page document. The lion's share of those mentions are in citations. At least 14 of those mentions - 18% - are in citations of Journal of Physical	Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 (""Climate Education, Engagement, Workforce Development, and Training"") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
Jim	Titus		Whole Document						In most of the chapters I read, someone should carefully validate and fact-check the references cited. As I read this report, occasionally I would see an assertion that seemed dubious, citing a source that appears legitimate. In all of those cases, it was very hard to actually track down the fact cited because a long article was being cited for a detailed "fact" that appeared on a single page, if at all. And half the cases, I was unable to find asserted fact at all. I will not speculate on how that kept happening, but one thing is clear: No one is fact checking this report. It would be a mistake to assume that citizen reviewers will find all the errors. If NCA intends to take the accuracy of this report seriously, each chapter needs someone to check every citation to ensure that the document cited actually says what NCA claim it says. Ideally the authors would do that, but that may be expecting too much and often a third party with no stake in the claim does a better job. In addition, authors required to cite the actual page that supports a claim do a better job of ensuring that the citation is accurate. (This is probably not needed for citing a short paper whose entire point is the fact cited; the problem arises when longer papers or--worse yet--NCA and IPCC reports are cited for a single fact possibly mentioned in passing.	The NCA5 has complied with all required laws, including those mandating specific standards of data quality and evidenciary support. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.
Gabriel	Oppler		Whole Document						ECOLOGICAL CONNECTIVITY AS A KEY CLIMATE RESILIENCE STRATEGY: A SUBMISSION FROM THE CENTER FOR LARGE LANDSCAPE CONSERVATION The Center for Large Landscape Conservation (CLLC) appreciates the opportunity to provide input on the Fifth National Climate Assessment (NCA). We hope these comments provide useful guidance and resources specifically focused on emphasizing the importance and role of ecological connectivity in the text, given the mission of our organization. As the Secretariat for the International Union for Conservation of Nature - World Commission on Protected Areas Connectivity Conservation Specialist Group, CLLC (1) serves as the hub of a growing global movement to reverse the fragmentation of landscapes and seascapes and restore nature‚Äôs resilience to climate change. Together with our partners, we form a world-wide network of conservation professionals, scientists, and decision makers. We are therefore encouraged to see the draft NCA mention ecological connectivity. However, we recommend that the final draft elevate the maintenance, enhancement, and restoration of ecological connectivity across intact and fragmented environments as a critical climate resilience strategy that warrants greater attention and investment‚Äîa. Indeed, the Biden Administration has recognized that connectivity is essential to achieving its ‚Äú30 by 30‚Äù goals. According to the U.S. Department of the Interior, ‚ÄúPresident Biden has issued a call to action that we work together to conserve, connect, and restore 30 percent of our lands and waters by 2030 for the sake of our economy, our health, and our well-being,‚Äù (2). This commitment to collaborative conservation of wildlife habitat and corridors is echoed in state efforts as well, such as California‚Äôs 30x30 conservation, restoration, environmental mitigation, and climate adaptation goals (3). We herewith provide expertise on the critical role of ecological connectivity as a natural adaptation and mitigation strategy against climate change. Ecological connectivity is the unimpeded movement of organisms, species, and genes on a daily, seasonal, and/or annual basis and sustains ecological processes, such as nutrient and energy flows (4). Ideally, an ecological corridor is a clearly defined geographical space that is governed and managed over the long term to maintain or restore effective ecological connectivity (5). Ecological connectivity is central to the NCA because connecting habitats, landscapes, and seascapes is essential for conserving	Thank you for this comment and the extensive list of references. Authors recognize the importance of the topic of ecological connectivity and appreciate these recommendations. This comment has been shared with all the author teams for consideration in their individual chapters, as well as with the federal steering committee of the National Nature Assessment and NCA6, as there may be even more ways to improve coverage of this issue in upcoming assessments.
Gabriel	Oppler		Whole Document						ADDITIONAL COMMENTS FROM THE CENTER FOR LARGE LANDSCAPE CONSERVATION: JOINT STATEMENT AND RECOMMENDATIONS REGARDING CLIMATE-INFORMED WILDLIFE CROSSINGS Consensus Authors: Kimberly Andrews (University of Georgia) Renee Callahan (ARC Solutions) Patricia Cramer (Wildlife Connectivity Institute) Molly Cross (Wildlife Conservation Society) Norris Dodd (AZTEC Engineering Group) Jeff Gagnon (Arizona Game and Fish Department) Meade Krosby (Climate Impacts Group, University of Washington) Renee G. Seidler (Jackson Hole Wildlife Foundation) Justin Suraci (Conservation Science Partners) Ron Sutherland (Wildlands Network) Anna Wearn (Center for Large Landscape Conservation) Leslie Duncan* (The Pew Charitable Trusts) Julia Kintsch* (ECO-resolutions) Caitlin Littlefield* (Conservation Science Partners) Matt Skroch* (The Pew Charitable Trusts) *Consensus Organizers Author affiliations provided for identification purposes only. OUR VISION: We envision a modern, resilient transportation network that provides for ecological processes, accommodates climatic changes, and enables the safe and efficient movement of not only people and goods but also wildlife. THE CONTEXT: From migrating elk to breeding salamanders, from roaming cougars to sea-run salmon, wildlife	We thank the reviewer for the comment. The National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Discussion of policy options is beyond its defined scope.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Jeff	Peterson		Whole Document						The Coastal Flood Resilience Project (CFRP) is a coalition of national nonprofit organizations and individuals working for stronger national programs to prepare for coastal storm flooding and rising seas along the American coast. The Fifth National Climate Assessment will be an important milestone on the road toward building understanding of the complex and inter-related threats that a warming climate poses for the United States. The draft document makes a compelling case for expanding efforts to meet greenhouse gas reduction goals and for adapting to the changes that a warming climate will bring in ways that are effective and that recognize environmental justice challenges. The coastal effects elements of the draft National Climate Assessment present important new scientific understanding of the risks that rising sea level poses for the American coast drawing on the 2022 report of the Sea Level Rise and Coastal Flood Hazard and Tools Interagency Task Force. The draft document also includes useful information on the changing nature of coastal storms and the impacts of coastal storms and rising seas on communities and ecosystems. Although there are many strong aspects of the discussions of coastal effects in the draft document, there are areas that should be strengthened. In general, some key needed changes are: ‚ÄCHighlight Unprecedented Changes that Rising Sea Levels Will Bring to Coasts: Among the multiple significant impacts of a changing climate, rising sea level stands out as a massive challenge and will bring major, unprecedented changes to coastal areas far beyond what is generally understood today. The NCA5 can play a major role in helping shape the public understanding of the dramatic changes caused by sea level rise compounded by more intense and frequent storms. The draft document needs to make this point more forcefully in the Overview as well as the Coastal Effects chapter. ‚ÄCExplain that Relocation of Coastal Communities, Ecosystems, and Infrastructure is Inevitable: Although the NCA5 is not intended to be a national climate change adaptation plan, it can play an important role in identifying adaptation strategies that are both effective and cognizant of environmental justice issues. In the case of more severe storms and rising sea levels, relocation of communities, ecosystems, and major infrastructure to higher ground is inevitable. The science presented	This comment is inconsistent with the author team's thorough assessment of the science.
david	introcaso		Whole Document						January 27, 2022 To: U.S. Global Change Research Program (USGCRP) From: David Introcaso, Ph.D. (dmintr@gmail.com & 202.907.7426) Re: Comments: Fifth National Climate Assessment (NCA5) Please accept these comments concerning the NCA5 third order draft. These concern the ‚ÄúOceans,‚Äù ‚ÄúAir Quality,‚Äù and ‚ÄúHuman Health,‚Äù chapters. Overarching Comment The report uses the phrase ‚Äúclimate change.‚Äù Over the past several years this phrase has been increasingly abandoned. This is because, as for example The Guardian noted in 2019, the term is not ‚Äúscientifically precise.‚Äù The phrase climate change, The Guardian also argued ‚Äúsounds rather passive and gentle when what scientists are talking about is a catastrophe for humanity.‚Äù Instead, the phrase climate breakdown, climate crisis, climate disaster, climate emergency are now routinely used by among others the United Nations. The UN Secretary General has started using the phrase ‚Äúclimate carnage.‚Äù Chapter 10: ‚ÄúOceans‚Äù One of the most, if one the most, serious climate crisis problem is ocean warming or rising ocean heat content (OHC). Therefore, it passes understanding why this issue is not discussed. The one brief, vague mention of OHC at page 5, line 5 and 6, ‚ÄúThe deep ocean has already absorbed a vast quantity of carbon and heat,‚Äù is inaccurate and moreover far from sufficient. The word ‚Äúdeep‚Äù is inaccurate since OHC is measured from zero to 2,000 meters and ‚Äúocean‚Äù is inaccurate, it should be ‚Äúoceans,,‚Äù since warming as well as changes in salinity vary. ‚ÄúOceans,,‚Äù that cover 71% of the earth‚Äôs surface, absorb 93% of the heat energy trapped by greenhouse gas emissions. Concerning warming or OCH, in their just-published research in Advances in Atmospheric Sciences, Cheng, et al., again found OHC continues to increase at a beyond remarkable rate. (This article and their related 2022 article should be cited.) Cheng, et al. found that in 2022 oceans absorbed 11 zettajoules (a zetta joule = 1021 joules) of heat, equivalent to the energy of seven nuclear	Technical comments raised this comment have been passed along to the relevant author teams for their consideration. It is also worth noting that the National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Discussion of policy options is beyond its defined scope.
Alexandre	Guv©vel		Whole Document						Biodiversity and indigenous populations: The numerous mentions of the impact of climate change on biodiversity are very welcome, insofar as biodiversity is often discarded when focusing too much on CO2 emissions. The report should however be more explicit and speak of the undergoing human-caused sixth mass extinction (at least if we don't drastically change our ways of life). Striking numbers can be mentioned, such as "69% average decline in wildlife populations since 1970" (WWF). Perhaps this is not mentioned since these data are global and not restricted to the US. However, climate change is one of the most interconnected processes one can imagine so not mentioning global data would be hard to understand. The numerous mentions of the impact of climate change on indigenous populations, and the solutions they are bringing, are also greatly appreciated. A striking fact that can be mentioned in that regard is from WWF: "Although they comprise less than 5% of the world population, Indigenous peoples protect 80% of the Earth‚Äôs biodiversity in the forests, deserts, grasslands, and marine environments in which they have lived for centuries". With regard to my overall main comment, namely empowering the population with actionable solutions rather than discussing vague carbon neutrality targets, recognizing and empowering the indigenous populations' crucial role in stewarding most of biodiversity is paramount. Following their recognition, they should be empowered to implement their solutions. In all, examples of clear actionable and efficient solutions are empowering the indigenous populations and promoting a circular economy.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful. The assessment focuses on national impacts and so does not include extensive coverage of international impacts. The assessment does recognize the role of Indigenous Knowledge and the actions of Indigenous peoples as critical to climate action. Please see Chapter 16 on Tribes and Indigenous Peoples and the regional chapters for more information.
Kenneth	Haapala		Whole Document						Comments on the Fifth National Climate Assessment (Nov 7, 2022) The U.S. Global Change Research Program (USGCRP) By the Science and Environmental Policy Project (SEPP) January 27, 2023 Summary: Stated are some of the reasons why the Science and Environmental Policy Project (SEPP) considers the NCA5 inadequate for meeting the stated public purpose. In summary, the USGCRP fails in its mandate to understand, assess, predict, and respond to human-induced and natural processes of global change for the following reasons: 1.It ignores climate history, thus cannot separate natural from human-caused change. 2.It relies on global climate models that fail basic testing against physical evidence. 3.It ignores over 40 years of atmospheric temperature trends, that are supported by weather balloon observations and reanalysis data. 4.It ignores independent measurements of the greenhouse effect. 5.It ignores basic physics that applies to understanding the extent the earth is warming. ********** Thank you for the opportunity to comment on the Third Order Draft of the Fifth National Climate Assessment (NCA5, Nov 7, 2022) by the U.S. Global Change Research Program (USGCRP). USGCRP was established by Presidential initiative in 1989 and mandated by Congress in the Global Change Research Act (GCRA) of 1990. Its mandate is to develop and coordinate ‚Äúa comprehensive and integrated United States research program which will assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change.‚Äù [Boldface added] According to NCA5: ‚ÄúThe findings in this report are based on a comprehensive review and assessment of information sources determined to meet the standards and documentation required under the Information Quality Act and the Foundations for Evidence-Based Policymaking Act of 2018,‚Äù including scientific literature (e.g., peer-reviewed and gray literature, technical input reports) ‚Äù(p.0-6) Also, NCA5 states: ‚ÄúClimate modeling experts develop global climate projections for a range of	This comment is inconsistent with the author team's thorough assessment of the science.

First Name	Last Name	Comment Type	Chapter	Figure/Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Joseph	Henderson		Whole Document						The near-total omission of climate change education research from this document/review is distressing. It's basically an afterthought where in mentioned at all (save one paragraph buried in chapter 26). Further, there should be an entire chapter on educational institutions of all kind (e.g., K-12, higher education, informal, adult learning, work apprenticeships, etc.) given the fact that education is a social technology capable of bringing down carbon emissions, and educational institutions will be required to adapt and mitigate climate change conditions. And it's basically just wholly absent in this document. This is exasperating for a number of reasons: 1. Multiple federal agencies have long-standing climate change education initiatives. NASA, NOAA, NSF, etc. Around 2010 or so the National Academies hosted a bunch of formal workshops on climate change education. NSF funded the CCEP climate change education projects. None of this information is anywhere in this document. Why? 2. Shouldn't the US Dept. of Education have some say here too, even if only to articulate their constitutionally-limited role in the influence of state-level educational policy? Many states around the country are implementing climate change curriculum. Many are not. There's research on this! Seems important to describe that landscape. 3. Article 6 of the 1992 UNFCCC treaty requires national planning on climate change and education. Are we ever going to do this? Sincerely, Dr. Joseph A. Henderson, Paul Smith's College	Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 (""Climate Education, Engagement, Workforce Development, and Training"") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954
bruce	vogt		Whole Document						The assessment would be enhanced by a separate chapter on estuaries. While some estuaries are named for specific reasons in the document, they climate issues facing these areas is not captured. The solution is to add a chapter on estuaries that addresses the following issues. Estuaries are connecting rivers and coasts, provide key nursery and spawning habitat form many fish and shellfish, are experiencing significant impacts from SLR, acidification, hypoxia, hardening of shorelines, and loss of habitats such as oysters, SAV and marshes. These areas also represent large population centers and are key locations where adaptation and resilience measures can be identified and implemented. Lastly many estuaries such as Chesapeake Bay, San Francisco, Puget Sound and Gulf of Mexico have governance structures (collaborative state, federal, local and NGO partnerships) that can coordinate the development of common goals and actions to combat climate impacts and build resilience for the ecosystem and communities. Examples of such a program is the Chesapeake Bay Program https://www.chesapeakebay.net/ and Puget Sound Partnership https://www.psp.wa.gov/	Thank you for this suggestion. While the authors appreciate the importance of estuaries, the decision to add chapters, appendices, or Focus Boxes is made by the Federal Steering Committee based on comments received on the draft NCA5 prospectus (2020). At this stage of development, the Federal Steering Committee is not considering the addition of additional chapters, especially because such chapters would not have undergone the same rigor of agency, technical, and peer review as the existing chapters. This comment has been conveyed to the developers of the National Nature Assessment and the sixth National Climate Assessment for consideration in future US Global Change Research Program assessments.
Debra	Freeman		Whole Document						I am glad you are asking the questions of smart people. I am relieved a systems-level approach with actionable deliverables is even being discussed. Unfortunately, given the past time delays and future time sensitivities, I am concerned if there will be an undue burden on micro-entities (future fiscal effects and access through unbalanced arbitration avenues of redress), if there will be adequate macro-scale implementation and funding of necessary changes, and if the current national valuation of a statistical human life ($10 million) is sufficient if a fossil fuel plant can still be in planning to be built next to a school. I am thankful for the scientists and researchers, and concerned about the right-sizing of macro-economic determinants on micro-economic behavior.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful. Please see the chapter on Economics, which covers the social cost of carbon and, to some extent, the topics of finance and household level economic impacts. In accordance with the Congressional mandate, the National Climate Assessment does not evaluate different policy actions. However, the mitigation and adaptation chapters describe the tradeoffs and limitations of actions, including potential impacts on distributional equity.
Myron	Ebell		Whole Document						I.The Draft Report Does Not Comply with the Global Change Research Act A.25-Year and 100-Year Projections Are Missing. The Global Change Research Act („ÄúGCRA„Äù) of 1990 requires that not less frequently than every 4 years, the Federal Coordinating Council for Science, Engineering, and Technology, through the Committee on Earth and Environmental Sciences, shall prepare and submit to the President and the Congress an assessment which „Äúanalyzes current trends in global change, both human- induced and natural, and projects major trends for the subsequent 25 to 100 years,„Äù (emphasis added). The report does not include any projections for ~2050 or ~2125 of major trends for all of the types of global change discussed in the draft report and for which the U.S. Global Change Research Program was created. This is expressly required under the GCRA. Without this information, the report is of no utility to inform Congress and the President on appropriate future public policies. The failure to include these projections (and their associated uncertainty) calls into question what the USGCRP, despite over 30 years in existence and ample taxpayer funding, has to conclude from its efforts. The NCA5 must present clear probability-adjusted projections of global change metrics over the next 25 and 100 years, so that Congress, the President, and the public can receive an assessment that meets the purpose of the law and can inform future decision-making. B.Consideration of Scientific Uncertainty Is Missing The GCRA also requires that the assessment „Äúdiscusses the scientific uncertainties associated with [its] findings.„Äù The draft report fails to accurately and consistently describe the uncertainty of its findings. The draft report states „ÄúNCA5 calibrated uncertainty language follows standards developed for the Intergovernmental Panel on Climate Change Fifth Assessment Report„Äù, see Table 1. The current draft, however, abdicates its charge from Congress by obscuring uncertainty in standards developed by a third-party rather than its authors. The UN IPCC standards may include systemic bias in its confidence levels and findings because they assume, as the key variables, pre-determined and pre-selected future global energy use and emissions scenarios that have been widely deemed implausible and unrealistic by the	A text box has been added to Appendix 3 to describe impacts 100 years into the future, as mandated by the GCRA. This text explains that while we are mandated to report impacts 100 years in the future, most studies only project impacts to 2100, limiting the authors ability to assess impacts past 2100. One exception to this is sea level rise; chapter 2 and chapter 9 provide descriptions of impacts to 2150. The front matter of the report describes the format and structure of how uncertainty is characterized throghout the entire assessment, namely through the calibrated language defined in the front matter and in traceable accounts. Every Key Message of the report includes a traceable accounts section which outlines the evidence used to support the finding, descriptions of likelihood and confidence, and areas of uncertainty and research gaps. Information on the report structure and process for development can be found in Appendix 1. The commenter notes the GCRA language that informs the structure of the Subcommittee on Global Change Research, not the structure of the National Climate Assessment. The structure of the author teams and development of the assessment were conducted in compliance with the Information Quality Act, 2018 Evidence Act, and Federal Advisory Committee Act as approved by the Information Quality Officer and the NCA Administrative agency (NOAA general council). Appendix 2 outlines the process for compliance with the Information Quality Act and the OMB guidance on Highly Influential Scientific Assessments. Appendix 3 describes the models and scenarios used in the assessment, including how they have improved since the previous assessment and their limitations. A glossary is under development and will be released along with the final NCA5 report, which defines terms like risk and hazard.
Mari	Tye		Whole Document						While there are some incidental remarks in e.g. Chapters 1, 5, 13 about the negative impacts of climate change on built infrastructure there needs to be stronger comments throughout on the explicit role of design in ensuring resilient forward looking infrastructure. Chapter 12 does have a key message (12.3) that some codes, standards and policies address climate change, but this message could be stronger and call for unified minimum standards to be included. For instance Ch 1p 20 discusses how climate change exacerbates existing inequalities. There also needs to be a recognition of the role of minimum design standards in making homes, property and infrastructure better able to withstand extreme weather. Cheaper housing will be built to the lowest compliant standard, and at greater risk of damage to, or loss of, property putting the same groups already listed at greater risk of being relocated temporarily or permanently following events such as hurricanes. This same message needs to be included in 1-5.3 and 1-5.5; Ch 5 KM5.1 KM5.3; 13.3Ch 13 KM13.3 and as appropriate within each of the regional chapters.	Thank you for this comment. This has been passed on to authors of the assessment for consideration in their chapters. Text has been revised in Chapter 1 to better desribe the role of equitable access to safe housing. In accordance with the Congressional mandate, this assessment does not make policy recommendations; thus, recommendation on standards are beyond the scope of this assessment.
Jim	Titus		Whole Document						Throughout the report, chapters mischaracterize redlining as a policy that increased segregation, which is not correct. There were two admirable exceptions: Northeast correctly explained redlining and the effects. The Northwest chapter also seemed to define it correctly, though the sentence in which it mentioned redlining needs further editing.	Authors were provided this comment for consideration.
Jim	Titus		Whole Document						It would be helpful for all the regional chapters to provide more specific facts at the state level, including tables or maps that quantify impacts and location-specific expectations. It is important to do so because some federal agencies will create state-specific fact sheets about the impacts of climate change. To avoid the accusation of cherry picking, these agencies are often limited to using the facts presented by IPCC, NAS, and the National Assessment, which as a practical matter, usually means that NCA is the main source.	The format and structure of the individual chapters was determined by the Federal Steering Committee overseeing the NCA. The FSC made a decision that authors would have the flexibility to design a chapter that was best structured - within that format - to communicate effectively with the target audience of their chapter. While that may reasonably come a cost of being able to easily compare chapters to each other, the FSC felt this trade off was worthwhile to ensure that individual chapters best communicated with the audiences interested in reading them.

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Steve	Roth		Whole Document						This report seems to be a combination of sound science and woke ideology run amok. To a large extent the report seems to be attempting to catalogue (and occasionally explain) all the ways that greenhouse gases will affect people and the environment for the worse. But occasionally the report runs off the rails as if the goal is to also ensure certain constituencies that the climate scientists are on their team too. No doubt the genocide at our nation's founding as well as the vestiges of slavery will cause some people to be more affected by climate change than others. But this report seems to be looking under every bed to make sure that no such effect goes un-noticed, and in so doing, diverts attention from the real problem.	This comment is inconsistent with the author team's thorough assessment of the science.
Steve	Roth		Whole Document						This report seems to be written to appeal to the base of the Democratic Party. It looks like the organizers managed to engage a lot of people from "outside the beltway", but everyone who comments on policy or social studies seems to be from a distinctly Liberal slant. The report will be more useful if a few conservatives are brought into the process for each chapter other than the pure science portions of the report.	This comment is inconsistent with the author team's thorough assessment of the science. Please see Appendix 1 for more information on the development process, including the public call for nomination for authors.
Steph	Courtney		Whole Document						This occurred to me while reading the overview (climate justice section), but then I did a search of the entire report. Communication and education are NOT adequately represented as the critical components of reducing harm from climate change that they are. The only chapters that had sections discussing education (and only 1-2 paragraphs in most) were transportation, Indigenous Peoples, the Northeast, Southern Great Plains, and a bit in adaptation. In total, the word education was used as a strategy or asset relevant to solutions 28 times in the entire document. Possible negative impacts to education were mentioned 8 times, and low education as a factor in social vulnerability was mentioned 14 times. In contrast, the word "education" appeared in references and affiliations 50 times, by my count (50%). Still very low for a 1700 page document. I know many of us in the vibrant climate education world are submitting comments on this matter, but this quick and imperfect analysis shows all the room there is for improvement. Education, at all levels, formal and informal, is a game changer, especially for climate justice. Education is the key to democratic participation and self determination, or as Ch. 1 describes, procedural justice.	Education is mentioned throughout the assessment and within the cited references. Many chapters discuss the disproportionate impacts of climate change on individuals with lower educational access. How people know and think about climate change (epistemology) is the topic of KM20.1. Education in the sense of workforce training is discussed in Chapter 13 and Figure 13.5. Mandates to support Indigenous people's health, economic vitality, education, environmental quality, and cultural continuance can be found in Chapter 16. An example of a climate education related law in Maine is referenced in Chapter 21. Education as an important element of response to climate change (mitigation and adaptation) is discussed in Chapters 11, 16, 21, 23, 24, 26, 27, 28, 31, 32, and cited references within. Climate literacy and curriculum is discussed in KM26.5. Impacts of climate change on education is discussed in chapters 17, 19, 24, and 27. Additional supplemental materials, including an updated Climate Literacy Guide, and other communication and outreach materials are being developed by the US Global Change Research Program alongside of the development of NCA5. For interested readers, we direct them to the U.S. Biennial Report, a required submission to the UN Framework Convention on Climate Change. The most recent report covers a similar time period for that which is assessed here in NCA5. Specifically, Chapter 9 (""""Climate Education, Engagement, Workforce Development, and Training""""") provides an excellent nation-wide summary. The report can be freely accessed here: https://unfccc.int/documents/307954"
Rachel	Licker		Whole Document					Suggest replacing "American(s)" with "person/people in the United States" to be inclusive to non-US citizens living in the US	Authors were provided this comment for consideration. Revisions have been made to Chapter 1 to ensure intentional and inclusive language use.	