Fifth National Climate Assessment
Public Comment Period for Annotated Outline (Zero Order Draft)

The U.S. Global Change Research Program (USGCRP) released the Zero Order Draft (annotated outline) of the Fifth National Climate Assessment (NCA5) for public comment from January 7, 2022. A Federal Register Notice publicized the 45-day Public Comment Period, which ran through February 20, 2022. This notice sought public comments on the annotated outlines of each chapter, in particular on the scope and framing of the chapter's proposed topic areas. Input received was used by chapter author teams in developing their draft chapters. Input from the public was collected via an online comment system.

Names and affiliations of participants in the NCA5 Annotated Outline Public Comment Period were withheld from the authors, 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 and, as appropriate, revised their outline, noted the rationale for actions taken in their response to each comment, and/or made note of the comment for future action as they began developing the first draft of their chapter text. The full report underwent multiple additional rounds of review, including internal technical review, multiple rounds of agency review, an independent peer review conducted by the National Academies of Sciences, Engineering, and Medicine, and another public review (of the NCA5 Third Order Draft). THe development of NCA5 is an iterative process; edits or revisions made in response to subsequent rounds of review supersede the previous round. Thus, authors' responses to comments on the Zero Order Drafts, including edits to the annotated outlines described in the author's responses, may not appear in the final published version of NCA5 exactly as described. These responses to comments therefore represent a snapshot in time, early in the NCA5 development. Additionally, readers should note that, simultaneously to this public comment period taking place, every NCA5 chapter also held an online public engagement workshop where anyone could participate and speak to the authors about the development of their chapters. All participants were made aware that only comments submitted through the formal online system would receive written responses from authors. Nonetheless, these public engagement opportunities represented critical opportunities early in the NCA5 development process for public engagement to the scope and content of the report.

USGCRP thanks all participants in the public review process. These comments were, by and large, helpful and constructive, and served to make the report an even more useful document for the American People.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Gianluca	Alimonti	Whole Document	Full Report						In different chapters, e.g. 3, 5 and 21, a supposed increasing frequency, intensity, and duration of extreme weather is reported. A recent EPJ Plus publication [1] reviews recent bibliography on time series of some extreme weather events and related response indicators in order to understand whether an increase in intensity and/or frequency is detectable. The analysis is then extended to some global response indicators of extreme meteorological events, namely natural disasters, floods, droughts, ecosystem productivity and yields of the four main crops (maize, rice, soybean and wheat). None of these response indicators, on the basis of observational data, show a clear positive trend of extreme events and no statistical evidence emerges to support the supposed climate crisis. Even if this is a global analysis and does not refer only to US territory, it should possibly be taken into consideration before reporting over alarming conclusions. Thank you for your attention. [1] Alimonti, G., Mariani, L., Prodi, F. et al. A critical assessment of extreme events trends in times of global warming. Eur. Phys. J. Plus 137, 112 (2022). https://doi.org/10.1140/epjp/s13360-021-02243-9	We thank the commenter for this suggestion and have passed this reference along to relevant author teams for use at their discretion. Please also note the inclusion of an Indicators appendix in subsequent drafts.
Ally	Beasley	Whole Document	Full Report						We appreciate the thoughtful approach to both content and process in the NCA5 and the ongoing opportunities for public involvement. We encourage the authors to offer additional engagement workshops, and additional opportunities for frontline community members, in particular, to shape this report, and to work with those in frontline communities to make the process of commenting and engaging as accessible as posssible throughout. Many frontline people and communities are still dealing with the impacts of COVID-19 and its effects not only on individual, family, and community health but also on their ability to engage in public processes such as this one.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful. Future engagement opportunties will be provided to all interest members of the public as NCA5 is developed.
Scott	Bischke	Whole Document	Full Report						** National topics ---- includes chapters on Ecosystems, Forests, Oceans, Water... All that's great, yet I feel like wildlife (also plant life) always gets the short straw, getting folded --if at all--lightly into each of those other chapters without it's own callout. Perhaps one of these chapters could explicitly name and focus on wildlife, such as Ecosystems and Wildlife; Ecosystems and the Biosphere... ** Regions section ---- does not include an intermountain West or similar heading. That would better capture Montana, Wyoming, etc than what...I guess we are Northwest? Northern Great Plains? **Response section ---- has mitigation and adaptation chapters = great. But while Resilience is a result of both, I suppose, in our world right now the term "resilience" has taken on such magnitude that it probably deserves its own chapter, logically following the chapters on mitigation and adaptation. ---- I'd love it if they added a successes or best practices chapter, to catalog some of the great actions to combat climate change that are already happening in the US (and world). If they deem it inappropriate, such a chapter could be an appendix.	We appreciate this comment and will take it under advisement for future assessments, including assessments or special reports outside of the National Climate Assessment. The Federal Steering Committee for this report always seeks to create a report that effectively communicates the science of climate change in a compelling and useful way. While future assessments will be the purview of the future Federal Steering Committees to decide their details, we will ensure feedback like this is communicated to those Federal Steering Committees to allow inputs such as this to be taken into account. For NCA5, a committee called the Sustained Assessment Workgroup evaluated the definitions of the regions used in the National Climate Assesment, and determined that NCA5 should maintain the same regional breakdown as NCA4. The defintions of regions will be provided in the Front Matter in future drafts. While any drawing of regional bondaries will result in some regions being left out, areas that span the NCA regional chapters (e.g. the Great Lakes) or smaller regions within NCA5 regional chapter boundaries may be discussed in text boxes. Within NCA5, please also see the Adaptation and Mitigation chapters for examples of actions taken. The commenter is encouraged to also explore the Climate Explorer and Climate Resilience Toolkit for more disaggregated geographic data and adaptation and resilience case studies.
Landow	Bryant	Whole Document	Full Report						There is no Climate Crisis: - Despite the rise of CO2 , deaths from Climate have plummeted - Per the most recent satellite data Global temperatures have not measurably risen for over seven years - The earth is greener - Ice in the Arctic & Antarctic are expanding - Sea Level is not significantly rising - Hurricanes are not increasing - Burned Acreage is declining Moreover the NetZero policies you are proposing will do nothing to stop the rise of CO2 given the fact China & India are building 1000s of Coal plants. The coal plants in China are being used to provide the power needed to manufacture the Wind/Solar & EVs your NetZero policies mandate. Wind & Solar require the destruction of massive areas of land to erect. Wind & Solar are unreliable sources of energy which require Fossil Fuel backups and skyrocket energy costs which will plunge people into fuel poverty. Fossil Fuel is a reliable source of energy which is abundant dan in America & will create millions of jobs & weath in America ! Whereas if these policies are implemented America,Äôs wealth will flow to China to pay for Wind Turbines & Solar panels manufactured with COAL powered plants in China !!!	This comment is inconsistent with the report authors' thorough assessment of the science. Please also note that the National Climate Assessment is a scientific assessment and does not propose any policies.
Landow	Bryant	Whole Document	Full Report						There is no Climate Crisis: - Despite the rise of CO2 , deaths from Climate have plummeted - Global temperatures have not measurably risen for over seven years - The earth is greener - Ice in the Arctic & Antarctic is expanding - Sea Level is not significantly rising - Hurricanes are not increasing ,Äc Burned Acreage has decreased Moreover the NetZero policies you are proposing will do nothing to stop the rise of CO2 given the fact China & India are building 1000s of Coal plants! The coal plants in China are being used to provide the power needed to manufacture the Wind/Solar & EVs your NetZero policies mandate. Wind & Solar require the destruction of massive areas of land to erect. Wind & Solar are unreliable sources of energy which require Fossil Fuel backups that will skyrocket energy costs which will plunge people into fuel poverty. Fossil Fuel is a reliable source of energy which is abundant in America & will create jobs & wealth in America!!! Whereas if your NetZero policy is approved , America,Äôs wealth will flow to China where COAL is King !!!	This comment is inconsistent with the report authors' thorough assessment of the science. Please also note that the National Climate Assessment is a scientific assessment and does not propose any policies.
John	Christy	Whole Document	Full Report						I will be submitting a document with general comments on climate science to "review@usgcrp.gov"	We appreciate the reviewer's comment.

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John	Christy	Whole Document	Full Report						To be thorough I am also notifying NCA5 authors through this on-line notice that I have submitted my comments via email at "review@usgcrp.gov" titled "NCA5_Zero_Comments_v02.pdf" Thank you for this opportunity. John R. Christy	We appreciate the reviewer's comment.
Roy	Clark	Whole Document	Full Report						General Comment on NCA5 Draft, (NCA5ZOD_Full Report) Roy Clark PhD President Ventura Photonics Thousand Oaks CA 91360 Please Note: This is the first part of a General Comment on the NCA5 draft, NCA5ZOD_Full Report, that was sent as an e mail attachment to review@usgcrp.gov from Roy Clark,Âôs Ventura Photonics e mail address on 2/14/22. The title of the file is RoyClark_GeneralComment_NCA5.pdf Figures and references are given in the e mail attachment. The first step for the Fifth National Climate Assessment (NCA5) is the quantitative determination of the effects of an increase in the atmospheric concentration of so called ‚Äògreenhouse gases‚Äô, particularly CO2 on the earth‚Äôs climate. This then provides the foundation for any actions that need to be taken. Over the past 200 years, the atmospheric concentration of CO2 has increased by approximately 130 parts per million (ppm), from 280 to 410 ppm [Keeling, 2021]. The concentration is still increasing and is now approaching 420 ppm. This has produced a decrease near 2 W m-2 in the longwave IR (LWIR) flux emitted to space within the CO2 emission bands. There has also been a similar increase in the downward LWIR flux from the lower troposphere to the surface [Harde, 2017]. At present, the annual average increase in CO2 concentration is about 2.4 ppm. This produces an annual increase in the downward LWIR flux to the surface of approximately 0.034 W m-2. The earth is not in thermal equilibrium. The absorbed solar heat is stored and released over a wide range of time scales, especially by the oceans. The peak solar flux at low zenith angles (sun almost overhead) is near 1000 W m-2. At night and during polar winter it is zero. There are significant time delays or phase shifts between the peak daily or seasonal solar flux and the temperature response that	This comment is inconsistent with the author team's thorough assessment of the science.
Joyce	Coffee	Whole Document	Full Report						Hello, please keep front of mind the disproportionate impact of coastal climate risks (hazards, vulnerabilities and exposures) on marginalized communities and refer to these resources: A ten point plan on climate change grounded in environmental justice: https://anthropocenealliance.org/wp-content/uploads/2021/08/A2-Platform-on-Climate-Change.pdf The great American migration: https://anthropocenealliance.org/wp-content/uploads/2021/08/The-Great-American-Climate-Migration.pdf Flood survivors manifesto: https://anthropocenealliance.org/manifesto/ Please note these resources are not fringe, even if they are not peer reviewed from the Academy. They represent the work of over 100 flood survivor community groups, a voice that may not otherwise be within the NCA but is disproportionately impacted by the Assessment. For peer reviewed literature about the disproportionate impact of federal disaster recovery dollars, (the wealth getting wealthier, the poor poorer based on US taxpayer funded grant programs), please see here: http://www.juniahowell.com/ Thank you	We thank the reviewer for this comment. We will ensure that this point and these resources are considered by the appropriate author teams.
Joyce	Coffee	Whole Document	Full Report						Hello, as the NCA is not organized according to the solution providers, I am not sure where the best fit for this comment is: Please note that State Governors have a major role to play in adaptation. A group of them is taking that role seriously. Since the last NCA, they have released a new Governor's Resilience Playbook. I recommend the steps be considered as part of the solution set for many stakeholders - state government leaders, local government leaders, nonprofit leaders etc. http://www.usclimatealliance.org/publications-1 here is a taste: 12 steps to climate resilience: Assess your existing resilience programs and goals Make the case and set the tone in your state Center equity in your resilience agenda Develop good data Establish a system of resilience measurement Drive the shift from data and planning to implementation Identify and act on state-level opportunities to build resilience Identify and support local-level opportunities to build resilience Be prepared for opportunities to expand resilience initiatives after a disaster strikes Develop a federal resilience strategy Identify and leverage funding and finance opportunities for resilience activities Commit to continuous re-evaluation Thank you,	This comment does not appear to raise a question or suggest a revision. We have shared the comment with authors and have passed this reference source along to all author teams for use at their discretion.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Joyce	Coffee	Whole Document	Full Report						Hello, one more state climate resilience resource: HOW STATE GOVERNMENTS CAN HELP COMMUNITIES INVEST IN CLIMATE RESILIENCE https://www.climateresilienceconsulting.com/reports#:~:text=HOW%20STATE%20GOVERNMENTS%20CAN%20HELP,a%20comprehensive%C2%A0approach%20to%20resilience. Aligned state actions can help increase funding and financing for climate resilience investment through revenue-generating mechanisms, provision of basic state services related to climate resilience, and the administration of federal funding flows that can be used for resilience purposes. To help states consider and act on the recommendations, the report includes a State Climate Resilience Action Checklist that identifies the essential actions to build a comprehensive approach to resilience. Thank you.	We thank the commenter for this suggestion and have passed this reference source along to all author teams for use at their discretion.
Michael	Dettinger	Whole Document	Full Report						Given the many billion dollar climate disasters in the US during the past several years alone, and the nation's often-hamhanded preparations and responses to them, there really needs to be a separate chapter on disaster preparedness and response in a changing climate. FEMA and the panoply of other federal, state, and local agencies tasked with everything from disaster planning, first responses, disaster insurance programs, and recovery programs need to be at the table writing this chapter.	We thank the reviewer for this comment. While the report structure for NCA5 will not be changed, we will ensure that this point is provided to future NCA Federal Steering Committees to allow for consideration of expanded report chapter topics as needed in the future. NCA5 does include a chapter on Adaptation and also several authors from FEMA.
brian	huberty	Whole Document	Full Report						Where is the 'Wetlands' chapter? This is a bit of an oversight since IPCC labelled wetlands as the most vulnerable landscape feature subject to climate change.	We thank the reviewer for this comment. While the report structure for NCA5 will not be changed, we will ensure that this point is provided to future NCA Federal Steering Committees to allow for consideration of expanded report chapter topics as needed in the future. Additionally, while there is no planned chapter for NCA5 dedicated to wetlands, topics relevant to wetlands will be covered in a variety of chapters, including the Ecosystems chapter and many of the regional chapters.
Evan	Mills	Whole Document	Full Report						It is good to see insurance issues recognized at various points in this outline. It could prove worthwhile to strive for some uniformity across the regional sections where insurance is mentioned. For example, the issue of flood insurance prices is mentioned in Chapter 9 (Coastal Effects), but not in the other areas where flood-risk and insurance is a material exposure. Pursuing analogous data in each region would make for a more consistent and comprehensive picture of issues such as this, help identify hot spots, etc. One key cross-cutting issue is availability and affordability of insurance (these are both sector-specific indicators of sensitivity and impacts), with effects to both consumer and business sectors. There are significant implications here for lower-income and minority groups as well. Lastly, in Economics > Key Topic 3, one could note that insurance is not only an economic implication for households; it also plays a substantial role for businesses, and for governments and institutions that function as insurers of last resort. A few references regarding risks and responses from this industry are as follows; Mills, E., T. Lamm, S. Sukhia, E. Elkind, and A. Ezroj. 2018. "Trial by Fire: Managing Climate Risks Facing Insurers in the Golden State." Sacramento: California Department of Insurance, 93pp, https://drive.google.com/open?id=1zMar-AEbPjSszp5MSUHFWBVobnJVHCuD Mills, E. 2012. "The Greening of Insurance," Science 338:1424-1425, https://drive.google.com/open?id=0B1s8219SGDIjMFZ6cU03MXY5TIk Mills, E. 2005. "Insurance in a Climate of Change," Science 309:1040-1044, https://drive.google.com/file/d/0B1s8219SGDIjZThaYmM0OXhWWjg/view?usp=sharing	Authors were provided this comment for consideration.
Evan	Mills	Whole Document	Full Report						A cross-cutting theme that seems to be rarely explored in the literature, and particularly relevant to this document, is the impact of climate change on the public sector (local to national). A discussion could synthesize conduits of vulnerability, including the National Flood Insurance Program, the USDA‚Äôs crop insurance, public health expenditures, impacts to publicly owned utilities, impacts to publicly-owned property, costs of publicly-funded disaster response, costs of publicly-funded disaster preparedness and recovery, military infrastructure (as distinct from strategic) implications etc. While there are isolated references to some of these throughout the document (e.g., a reference to military in 26. Southern Great Plains chapter, but not elsewhere), an integrated discussion could be of value (identifying nodes of exposure, ballparking baseline costs, potential leadership by example through the relevant public programs and functions, etc.). This analysis could also shed light on the relative allocation of such costs between the public and private sectors, and, for example, how the public sector is assuming an ever-increasing burden as insurance companies withdraw from markets. A high-level, quantitative global overview is provided in the following document. Mills, E. 2006. "Synergisms between Climate Change Mitigation and Adaptation: An Insurance Perspective." Mitigation and Adaptation Strategies for Global Change, Special Issue on Challenges in Integration Mitigation and Adaptation Responses to Climate Change, Vol. 12, No. 5, pp. 809-842, https://drive.google.com/file/d/0B1s8219SGDIjT21uaUQzTThxbTg/view?resourcekey=0-GbymcbyohUMERG4nTgkF6Q	We thank the commenter for this suggestion and have provided this comment to all authors teams for consideration.
Evan	Mills	Whole Document	Full Report						It is good to see co-benefits discussed at various points in the outline. The current treatment is relatively specialized, e.g., with specific items called out in the Ecosystems, Agriculture, Built Environment chapters, Transportation, Air Quality chapters, and Mitigation chapters (along with some of the regional chapters). I did not see the concept (at least using this term) called out in the Human Health chapter, but clearly there are links there. A cohesive synthesis of the topic may merit consideration. Mills, E. 2006. "Synergisms between Climate Change Mitigation and Adaptation: An Insurance Perspective." Mitigation and Adaptation Strategies for Global Change, Special Issue on Challenges in Integration Mitigation and Adaptation Responses to Climate Change, Vol. 12, No. 5, pp. 809-842, https://drive.google.com/file/d/0B1s8219SGDIjT21uaUQzTThxbTg/view?resourcekey=0-GbymcbyohUMERG4nTgkF6Q	Authors were provided this comment for consideration.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Kai	Olson-Sawyer	Whole Document	Full Report						Comments for U.S. National Climate Assessment 5 1/11/2022 Kai Olson-Sawyer, Sr. Research and Policy Analyst, GRACE Communications Foundation kbynos@gmail.com Please accept my written comments, which were also presented to Dr. Jacobs and Mr. Scheetz at the virtual meeting earlier today. (NOTE: These identical comments were shared with the Human Social Systems chapter authors, and Mr. Scheetz asked that I also share them with the overall group.) ***** I,Äôd like to propose the addition of a new format and structure to NCA5 in light of the creation of the Human Social Systems chapter, which could help the entire report in terms of interest and accessibility for the general public. (Good on you for the HSS chapter.) While case studies are wise to include to explain climate impacts, there,Äôs an opportunity to gain greater attention with the media and buy-in from the public by refining case studies further to ‚Äúprofile,Äù individuals and the experiences they,Äôve encountered. These profiles would be empirical and based on the person,Äôs experiences, but could be told in first-person narrative style (as opposed to typical third-person; objective). This technique is not unusual in the social sciences, and could follow an ethnographic form. This less formal tone could personalize seemingly distant climate impacts and make climate change relatable when it,Äôs often thought to be alien. By selecting people from various backgrounds, regions and perspectives ‚Äìi a farmer in Nebraska, a tribal member in Arizona, a warehouse worker in New Jersey, a truck driver in Arkansas ‚Äìi you can also break down barriers that go up around explaining climate science and impacts. Not only can these profiles be employed in the Human Social Sciences chapter, but picked up throughout the entire report. I envision this being particularly useful in the regional reports as a way to ground the complexities of climate to where people actually live. Finally, this format could provide a good hook as the NCA5 team develops its communications and outreach strategy. I am available to discuss any of this further, so please feel free to reach out.	We appreciate this comment and will take it under advisement for NCA5 and future assessments, as well as in development of communications materials. The Federal Steering Committee for this report always seeks to create a report that effectively communicates the science of climate change in a compelling and useful way. While future assessments will be the purview of the future Federal Steering Committees to decide their details, we will ensure feedback like this is communicated to those Federal Steering Committees to allow inputs such as this to be taken into account.
Doug	Robbins	Whole Document	Full Report						Framing Statements for Certainty Whenever possible, probabilistic statements should be re-framed to make statements of reasonable certainty, for clarity in communicating climate issues to policy makers and the public. Probabilistic language in IPCC reports and earlier NCA reports has been an impediment to converting climate science into climate policy. In particular, the problem is with language showing less than certainty about the attribution of the human causes of climate change. In 2021, a US Senator,Äôs senior staffer, responsible for energy matters, said, ‚ÄúScientists really don,Äôt know how much of climate change is due to human influence and how much is due to natural factors, right?‚Äù Policies for serious restriction of greenhouse gas emissions will not be enacted until climate conclusions are delivered with certainty. It is the responsibility of scientists to frame conclusions that can be expressed with certainty. Changing the framing of the statements to a bounded range would allow statements of reasonable certainty, providing a stronger case for policy action on climate change. The legal standard of ‚Äúbeyond reasonable doubt,Äù would provide the public with a familiar grounding on the certainty of the findings. For example, rather than saying, ‚Äú[I]t is extremely likely that human activities, especially emissions of greenhouse gases, are the dominant cause of the observed warming,Äù (NCA4), NCA5 should frame statements as reasonable certainty within a bounded range, e.g.: ‚Äúit is certain that human emissions of greenhouse gases are responsible for at least **% of the warming of oceans, **% of the melting ice, and **% of the warming of the atmosphere.‚Äù	We thank the reviewer for this comment. Describing uncertainty is mandated in the Global Change Research Act. Key Messages in NCA5 will include calibrated language communicating confidence and likelihood of particular events and outcomes, as defined by the Federal Steering Committee. Additionally, every chapter will contain a Traceable Account that better explains the calibrated language that author teams felt was appropriate and accurate based on their assessment of the science.
Doug	Robbins	Whole Document	Full Report						Standardized Metrics for Climate Impacts There are many impacts to climate change, and it is difficult to understand the relative and absolute magnitude of the many impacts listed in the draft report. An improvement to the quantification of climate impacts is needed. How should we compare problems of water scarcity and wildfires in California to the impairment of Indigenous subsistence hunting in the Arctic? From a policy-maker,Äôs point of view, how should resources be allocated for adaptation in these areas? Standardized scoring of each impact, drafted into a table, would allow better evaluation of the individual facets of the climate problem, as well as the whole. The metrics for standardized scoring should include likelihood of the impact, personal severity (mental health, displacement, injury, death), prevalence (number of people impacted), monetary severity, and social justice. Separate standardized scores should be developed for each SSP. Perhaps another scoring system could be developed for impacts to natural systems.	We thank the reviewer for this comment on a challenging subject. This comment has been shared with authors for their consideration, namely the authors of the Overview chapter. The Overview chapter acts as an executive summary of the report and will include a summary of impacts across sectors, though it is not yet known whether the underlying chapters will provide enough information to develop a scoring system in the manner the commenter is suggesting. This comment will also be taken under advisement for future assessments, including assessments or special reports outside of the National Climate Assessment.
Doug	Robbins	Whole Document	Full Report						Political Polarization, Opposition and Maladaptation Political polarization of the climate issue should be acknowledged as an impediment to mitigation policies and a driver for maladaptation. Exploration of ideas for improved climate communication and policy consensus would be worthwhile.	We thank the reviewer for the comment and have passed this along to authors of relevant chapters. Please note that the National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. Thus discussion of policy options is beyond its defined scope.
Doug	Robbins	Whole Document	Full Report						National Progress toward Mitigation and Adaptation A call-out box or figure should show quantified national progress toward mitigation, compared to 1.5, 2.0 and 3.0 degree pathways. Also, another call-out box should show quantified national progress toward adaptation, compared to expected requirements at various SSPs.	We thank the reviewer for the comment and have passed this along to authors of relevant chapters, namely the Adatation and Mitigation chapters. These chapters will include information on historical trends and examples of mitigation and adaptation progress.

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David	Solan	Whole Document	Full Report						In The Zero Order Draft of the Fifth National Climate Assessment, Chapter 2, page 4, you stated: ‚Ä¶ changes in climate drivers continue to considerably influence the Earth‚Äôs energy balance. These climate drivers include greenhouse gases ‚Ä¶ [C]limate change [is] influenced by the warming due to increases in greenhouse gases ‚Ä¶ And in Id., Chapter 2, Page 6: ‚Ä¶ allowable greenhouse gas emissions [are related to] a given maximum warming target And in Id., Chapter 3, Page 9: ‚Ä¶ carbon dioxide [is a] greenhouse gas[] Similar allusions can be found repeated ‚Ä¶ in that report and, virtually ad infinitum, in the media and in college classrooms all over the world today. They are the usual fare we are all being subjected to now, throughout our lives, on a day-to-day basis. The question is, is any of it true? Or is it all baseless, originating in the 1890s from Arrhenius's benighted hypothesis of carbon dioxide's infrared absorption properties in the atmosphere warming the entire Earth? The fact is that the vast majority of scientists rejected this ‚Äúgreenhouse effect,‚Äù of Arrhenius because they found it to be a preposterous oversimplification of the cause of the temperature of the Earth ... in 1890 ... and for many years thereafter. But, around the 1990s and thereafter, they did start to come around and agree with it when it became very	This comment is inconsistent with the author team's thorough assessment of the science. Additionally, it does not appear to suggest a specific actionable revision.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Document	Full Report						Governance is addressed repeatedly in many chapters, which is definitely a huge (if not THE) barrier. Perhaps within the report it makes sense to explore (or verify using case studies that do already exist) successful mitigation or adaptation that might be more quickly mobilized by communicating directly to non-governmental entities or local communities.	We thank the reviewer for the comment and have passed it along to authors for their consideration. 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. However, cases studies are used in several chapters as examples of successful mitigation or adaptation actions. The commenter is encouraged to also explore the Climate Resilience Toolkit for more case studies.
Theodore	Weber	Whole Document	Full Report						Relevant to the overall NCA5 document, I emailed the document "2020.08.10_NOAA_NCA5 Scoping Comments.pdf" to review@usgcrp.gov. This document is a public comment on the proposed themes and framework of the Fifth National Climate Assessment submitted by Defenders of Wildlife (where I work on climate adaptation) to David Holst at NOAA on Aug. 10, 2020. I am providing it to the NCA5 authors as a comment regarding the overall document. Thank you!	Authors were provided this comment for consideration.
DAnn	Williams	Whole Document	Full Report						From: D‚ÄôAnn Williams, Johns Hopkins School of Public Health, Center for a Livable Future To: USGCRP ‚Äì NCA5 Chapter Authors Re: USGCRP NCA5 Chapter Outline Comment Disclaimer: The opinions expressed herein are our own and do not necessarily reflect the views of The Johns Hopkins University. February 19, 2022 Dear Chapter Authors, Thank you for the opportunity to comment on the United States Global Change Research Program Strategic Plan (2022-2031) Prospectus and Chapter Outlines. We are researchers at the Johns Hopkins Center for a Livable Future (CLF), an interdisciplinary research center based at the Johns Hopkins Bloomberg School of Public Health. CLF applies science and systems thinking to help build healthy, just, equitable, resilient, and sustainable food systems. We have reviewed the USGCRP strategic plan prospectus (SPP), reviewed the chapter outlines and have attended many of the NCA5 Public Engagement Workshops held by USGCRP and chapter authors. These virtual sessions have been informative, as well as interactive and inclusive. We strongly support the vison and mission of this multi-agency cooperative program to fully ‚Äúunderstand the forces shaping the global environment, both human and natural and their impacts on society.‚Äù There are four pillars for this work as stated in the USGCRP SPP: 1. advancing science, 2. informing decisions, 3. engaging the nation and 4. collaborating internationally. Under these four pillars are cross-cutting themes, diversity and inclusion, risk-based approaches, enhanced social science integration, communication, and workforce development. To adequately advance science and inform the development and implementation of climate change solutions, we urge you to stress the importance of developing multi-agency research and programs that improve our understanding of the public health implications of climate change and pathways to address agriculture and food systems contribution to climate change while protecting public health and environmental justice. Currently there are numerous gaps in our knowledge around current policies and practices and climate change and even fewer	We thank the reviewer for this comment. This comment opportunity was specifically asking for comments on the Zero Order Draft of the Fifth National Climate Assessment. Comments related to other materials or proposed drafts of other document should be directed toward those comment opportunties. The commentors are encouraged to review the future drafts of NCA5, especially the chapers on Agriculture and Human Health

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Michael	Wright	Whole Document	Full Report						The Federal Register Notice for the Zero Order Draft NCA5 states that ''Authors of each chapter of NCA5 will develop chapter content structured around the topic areas proposed in the Annotated Outlines, highlighting the risk climate change poses to the things Americans value.'' However, the values covered by each chapter seems incomplete. Here are some additional, general values to consider, all of which will be impacted by climate change, and ironically contribute significantly to it. A. Happiness Thru Consumption. An infinite variety and easy acess to products, constantly advertised through social and other media, induces more consumption and thus more emissions. More online purchases require packaging and shipping, while also creating solid waste from a high percentage of returns. Manufacturers reduce net weight of product to increase profits, which induces purchasing more of the product to get the same amount which increasese the amount of packaging and shipping for the same quantity of product. B. Instant Gratification. Americans have been ''conditioned'' to have short attention spans, a consequence of many factors, including availability of needs and desires requiring little effort and time, social media and instantaneous communications, entertainment at the press of a button or voice command, and other factors such as parents' behaviors during upbringing. Solving climate change, however, involves long term commitment to the common good, acceptance that what we need is not always what we want, and saving some natural resources, including a healthy climate, for future generations. C. Individual Freedom. The value of ''individual freedom'' that many Americans espouse directly competes with that of the common good, despite the fact that most who value individual freedom claim a religion that emphasizes ''love of neighbor.'' This individual freedom is interpreted as 'doing whatever one wants,' without accepting individual responsibility. It consequently contributes to greater consumption, waste, and carbon emissions.	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. Information on human behavior and social science may be found in future drafts of the Human Social Systems chapter.
Michael	Wright	Whole Document	Full Report						Include an introduction to each chapter that summarizes the topic and issue, similar to that for Ch.10, Oceans and Marine Resources.	Authors were provided this comment for consideration. Future drafts will be formatted differently than the annotated outlines shown in the Zero Order Drafts.
Michael	Wright	Whole Document	Full Report						Spell out acronyms and abbrevations upon first use.	Authors were provided this comment for consideration.
Michael	Wright	Whole Document	Full Report						In chapters covering specific geographic regions, specify the states that are included.	We appreciate the reviewer's comment. All regional chapters will contain a map specifying which states are included within their region. The regional outlines will also be presented in the Front Matter in future drafts.
Michael	Wright	Whole Document	Full Report						Include a schedule showing when each plan, requirement, need, or task identified in the report must be accomplished in order to reach 2050 emission reduction targets.	Information on mitigation targets and the emissions reductions needed to reach those targets can be found in the Mitgiation chapter. However, please note that 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; but policy recommendations are beyond the scope of NCA.
Michael	Wright	Whole Document	Full Report						In addition to ''What's New,'' include a section in each chapter for ''What's Needed.'' This can include data gaps, new technologies, public education and awareness, and funding for specific areas. These needs can then be identified in the proposed scheduie.	Some of these research gaps and other uncertainties will be identified in the Traceable Accounts section connected to every Key Message in the report. However, 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; but policy recommendations are byeond the scope of NCA.
Michael	Wright	Whole Document	Full Report						Include in each chapter a summary of the underlying contributors to climate change related to that particular topic area, to help identify mitigations. For example, increased shipping of goods ordered online and often returned induces carbon emissions, and applies to both Energy and Transportation.	Authors were provided this comment for consideration.
Michael	Wright	Whole Document	Full Report						There is an increasing amount of disinformation regarding climate change, its causes and impacts, particularly on the part of conservative media and the fossil fuel industry, e.g., ''greenwashing'' related to emissions reductions, per Ref.1. This disinformation and erroneous opinion, in turn, moves conservative voters to elect policymakers who generally oppose climate action and perpetuate disinformation, thus creating a 'vicious cycle' of climate inaction and opposition. Unless climate disinformation is constrained, the public and policymakers will have no informed understanding or concern about climate change, and therefore continue to dismiss or even oppose either climate mitigation or adaptation. Note: A good reference for disinformation counter arguments is Dr. John Cook's website SkepticalScience.com	Where the literature is available on human behavior and comnmunication, these topics will be covered in the Human Social Systems chapter. However, consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. Detailed coverage of these topics may be beyond the scope of this report.
Joseph	Zajac	Whole Document	Full Report						needs a glossary of nonstandard terms used such as megafire, noting the term is not in the AMS and NOAA glossaries	Thank you for the suggestion. As was done with NCA4, a glossary of relevant terms is provided on USGCRP's website, www.globalchange.gov, which will be updated by the release of the final version of NCA5.
Joseph	Zajac	Whole Document	Full Report						needs a disclaimer such as the one the IPCC uses on their website to read: The USGCRP does not conduct its own research, run models or make measurements of climate or weather phenomena. Its role is to assess the scientific, technical and socio-economic literature relevant to understanding climate change, its impacts and future risks, and options for adaptation and mitigation. Author teams critically assess all such information from any source that is to be included in the report.	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 will be provided in Front Matter and process appendices in later drafts.
Joseph	Zajac	Whole Document	Full Report						any paper cited must show proof of replication by a third-party	We thank the reviewer for this comment, but the suggestion is outside the scope of the 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	Full Report						state the margin of error for all data cited - confirm with the provider of the data	The NCA5 has complied with all required laws, including those mandating specific standards of data quality and evidenciary support.
Joseph	Zajac	Whole Document	Full Report						include 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	Full Report						avoid being politically correct	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.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Joseph	Zajac	Whole Document	Full Report						all models must specifically state the margin of error as the error increases over time	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	Full Report						all models must show observations vs projections	While not all models or dataets include both observations and projections, the authors of the National Climate Assessment are mandated by the Global Change Research Act to include information on both historical trends and projected impacts. Authors of NCA5 have done so.
Joseph	Zajac	Whole Document	Full Report						the word UNKNOWN only appears once in the entire document. energy independence 1 time, wildfire(s) appears at least 83 times. extreme 159 times, greenhouse 34 times, frequency 19 times, intensity 18 times, diverse 13 times, diversity 6 times, tribal 50 times, biodiversity 22 times, justice 66 times, equity 48 times, extreme event(s) 48 times, Indigenous 88 times, disproportionate 22 times, heavy 7 times, decreasing 1 time, decrease 3 times, increase 26 times, increases 21 times, increased 63 times, increasing 59 times, severe 5 times. doom and gloom.	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac	Whole Document	Full Report						no mention of the impact of tectonic plate shifting on sea level in the entire document. 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	Full Report						FALSE CLAIMS - repeatedly presents conclusions that are disputed as facts without references nor reviewing opposing positions	This comment is inconsistent with the author team's thorough assessment of the science. The NCA5 has complied with all required laws, including those mandating specific standards of data quality and evidenciary support.
Joseph	Zajac	Whole Document	Full Report						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.	This comment is inconsistent with the author team's thorough assessment of the science.
Joseph	Zajac	Whole Document	Full Report						there is a disconnect with numerous claims made in this document versus the IPCC AR6.	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac	Whole Document	Full Report						use of politically correct terms like "environmental justice issues" 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	Full Report						fails to acknowledge the failure of predictions and models from previous reports, and in IPCC reports	Authors were provided this comment for consideration.
Joseph	Zajac	Whole Document	Full Report						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	Authors were provided this comment for consideration.
Joseph	Zajac	Whole Document	Full Report						failure to state that CO2 is necessary for life on earth	Authors were provided this comment for consideration.
Joseph	Zajac	Whole Document	Full Report						NASA stated in 2015 that the data from over 3,000 monitoring stations was only 38% accurate. Why is the inaccuracy of data from NASA, NOAA, etc., NEVER stated nor addressed?	Describing uncertainty is mandated in the Global Change Research Act. Key Messages in NCA5 will include calibrated language communicating confidence and likelihood of particular events and outcomes, as defined by the Federal Steering Committee. Every chapter will contain a Traceable Account that better explains areas of uncertainty or research gaps. In addition, all figures, have extensive metadata records which will be made publicly available. These metadata records include information on observed and projected datasets, methods, and uncertainty.
Joseph	Zajac	Whole Document	Full Report						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?	Authors of the National Climate Assessment include both government employees and non-government employees and include participants from a wide range of professional fields, including private industries, non-governmental organizations, and tribal organizations. Authors are not paid for their participation in the National Climate Assessment, though some authors may be participating within the scope of their job descriptions. The employers of such authors have waived intellectual property rights over employee contributions to the National Climate Assessment.
Joseph	Zajac	Whole Document	Full Report						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	Full Report						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	Full Report						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	Full Report						another report whose goal is to create victims , create social conflict, and divide people because of climate change	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac	Whole Document	Full Report						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.	This draft of the report is an outline of topics the authors were proposing for consideration. The format of the final draft of the chapters will be more standardized upon publication, though topics will vary by chapter. Given space contraints, authors were instructed to prioritize topics for inclusion in their chapter.
Joseph	Zajac	Whole Document	Full Report						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)	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	Full Report						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	Full Report						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.

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Joseph	Zajac	Whole Document	Full Report						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	Full Report						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	Full Report						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 considerations can be found in the International chapter. 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	Full Report						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	Full Report						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	Full Report						Climate change is more a marketing term than an accurate climatological definition.	This comment is inconsistent with the author team's thorough assessment of the science.
Joseph	Zajac	Whole Document	Full Report						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, will be provided in Front Matter and process appendices in later drafts.
Joseph	Zajac	Whole Document	Full Report						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	Full Report						fails to state that old data is subject to error by today's measurement standards	Please see the Indicators appendix for information on historical observations, including methodology used for monitoring, uncertainty in these measurements, and methods used to account for changing monitoring methods over time.
Joseph	Zajac	Whole Document	Full Report						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	Full Report						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	Full Report						not seeing A-Team level players authoring this report. looks to be written to support a one-sided political agenda vs presenting verifiable facts.	We strongly disagree with this comment. The authors of NCA5 represent both a deep and broad set of climate experts from a wide array of fields, institutions, and expertise. All authors met criteria developed by the Federal Steering Committee, including criteria on diversity, and were approved by the U.S. Global Change Research Program reviewing agencies. Political appointees are not permitted to participate in the National Climate Assessment. The commenter does not offer specific expertise that is missing from the author teams. Furthermore, 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	Full Report						The US government deletes more than 50 years of early data on forest fires in order to make it look like forest fires are more widespread, and linked to CO2 https://notrickszone.com/2021/06/08/us-government-tries-to-erase-historical-forest-fire-data-to-fabricate-another-fake-crisis/	This comment does not appear to raise a question or suggest a revision. Please see the appendix on Indicators for information on monitoring data, including methodology and the time periods in which data is available for different datasets.
Joseph	Zajac	Whole Document	Full Report						any author pushing climate change caused wildfires should resign from this report	This comment is inconsistent with the author's thorough assessment of the science. The commenter provides no references for the authors to consider, nor does the commenter provide any explanation of why this should be the case. Authors are charged with assessing the state of science based on legal standards for quality of information and have complied with all required laws, including those mandating specific standards of data quality and evidenciary support.
Joseph	Zajac	Whole Document	Full Report						fails to mention that in the US, environmentalists do not consider nuclear power green and block the building of new nuclear plants with lawsuits. the EU considers nuclear green and the UK is building nuclear power plants.	We thank the reviewer for this comment, but the suggestion is outside the scope of the report.
Joseph	Zajac	Whole Document	Full Report						energy independence is only mentioned once in the entire document but GHG appears 27 times and greenhouse gas 34 times	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac	Whole Document	Full Report						there is no acknowledgement of the numerous FAILED predictions and models from previous reports	This comment does not appear to raise a question or suggest a revision. However, authors were provided this comment for consideration.
Joseph	Zajac	Whole Document	Full Report						an entire chapter should be added on energy independence	We appreciate this comment and will take it under advisement for future assessments. The Federal Steering Committee for this report always seeks to create a report that effectively communicates the science of climate change in a compelling and useful way. While future assessments will be the purview of the future FSCs to decide their details, we will ensure feedback like this is communicated to those FSCs to allow inputs such as this to be taken into account. The commenter is encouraged to review future drafts of the Energy chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Joseph	Zajac	Whole Document	Full Report						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, nor does it provide a specific location within the report for this claim, nor does it provide references or documentation to provide to authors for their consideration.
Joseph	Zajac	Whole Document	Full Report						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	Full Report						no mention of the deadly impact of solar panels and wind turbines killing millions of bats and birds including endangered species such as eagles.	Authors were provided this comment for consideration.
Joseph	Zajac	Whole Document	Full Report						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	Full Report						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	Full Report						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 to the report itself. Legal mandates, including those governing rights and responsibilities of authors, is managed by the NCA administrative agency, which is the National Oceanic and Atmospheric Administration. 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	Full Report						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, will be provided in Front Matter and process appendices in later drafts.
Joseph	Zajac	Whole Document	Full Report						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	Full Report						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	Full Report						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	Full Report						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. The NCA5 has complied with all required laws, including those mandating specific standards of data quality and evidenciary support. 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	Full Report						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	Full Report						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	Full Report						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	Full Report						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	Full Report						None of these response indicators show a clear positive trend of extreme events. In conclusion on the basis of observational data, the climate crisis that, according to many sources, we are experiencing today, is not evident yet. Alimonti, G., Mariani, L., Prodi, F. et al. A critical assessment of extreme events trends in times of global warming. Eur. Phys. J. Plus 137, 112 (2022).	This comment is inconsistent with the author team's thorough assessment of the science. However, we have passed this reference along to relevant author teams for use at their discretion. Please also note the inclusion of an Indicators appendix in subsequent drafts.
Joseph	Zajac	Whole Document	Full Report						From the beginning, climate models have consistently failed to project the Earth's temperatures and temperature trends accurately.	This comment is inconsistent with the author team's thorough assessment of the science.

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Joseph	Zajac	Whole Document	Full Report						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	Full Report						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.
Catherine	Buchanan	Whole Chapter	02. Earth System Processes						Pg. 3 from "What's New" section: Will the models include humidity? Pg. 4 under second bullet at top of page: Water vapor is a greenhouse because water absorbs heat. Will there be monitoring of atmospheric moisture content? Pg. 4 under Key Topic 1, 1st bullet: Will heat absorption of construction materials be added to the climate drivers? Pg. 5 under Key Topic 2, sub-bullet: "To a first order, however, changes in climate phenomena..." What does this sentence mean? Pg. 5 under 2nd bullet: Does large scale include temperature sensitive regions in the simulation as part of the sum of the total area that is being modeled? Pg. 5 under 2nd bullet: Please define "forced changes." Will there be a model to correlate humidity and atmospheric moisture to water quantity of floods to snow pack (or lack thereof) to daily temperatures over a year? Will there be a model to correlate humidity and atmospheric moisture to wind intensities?	Thank you for your questions. Climate models simulate humudity and the relationship between humidity and atmospheric moisture with winds by solving the primitive equations that describe the physics and dynamics of atmospheric circulation. We will provide more information and clarifications in future drafts.
Joseph	Zajac	Whole Page	02. Earth System Processes			4			Climate drivers - FALSE statements claiming humans and the industrial age are responsible for climate change. AMS and NOAA definitions of climate change do not assign a percentage for the change, nature vs human	IPCC assigns a percentage for the contributions of human vs. natural drivers to global warming.
Joseph	Zajac	Whole Page	02. Earth System Processes			4			Climate response - all hypothetical pie in the sky	Thank you and your opinion is noted.
Joseph	Zajac	Whole Page	02. Earth System Processes			5			list the variables that are NOT included in the models such as N number of annual hurricanes	Climate models simulate processes such as cyclogenesis and how hurricanes are influenced by their environments. The number of annual hurricanes is not directly simulated by the model but it can be calculated by tracking tropical cyclones in the simulations.
Joseph	Zajac	Whole Page	02. Earth System Processes			6			list the variables that you do not know or use or understand	Thank you and your opinion is noted.
Joseph	Zajac	Whole Page	02. Earth System Processes			7			megafire is a made up term	Thank you and your comment is noted.
Joseph	Zajac	Whole Page	02. Earth System Processes			7			FALSE CLAIM - Climate change has already affected the intensity, duration, and prevalence of weather and climate extremes across the US, including heat waves, cold snaps, wildfires, drought, rainfall, and coastal flooding.	We will provide more evidence and discussion in future drafts of our chapter.
Roy	Clark	Whole Chapter	02. Earth System Processes						Comment on NCA5 Chapter 2: Earth System Processes Roy Clark PhD President Ventura Photonics Thousand Oaks CA 91360 Please Note: This is the first part of a comment on Chapter 2 that was sent as an e mail attachment to review@usgcrp.gov from Roy Clark,Äôs Ventura Photonics e mail address on 2/14/2022. The title of the file is RoyClark_CommentChapter2_NCA5.pdf Figures and references are provided in the e mail attachment. The first step for Chapter 2 is the quantitative determination of the effects of the observed increases in the atmospheric concentration of so called ‚Äògreenhouse gases‚Äô particularly CO2 on the earth‚Äôs climate. This then provides the foundation for any actions that need to be taken. Over the past 200 years, the atmospheric concentration of CO2 has increased by approximately 130 parts per million (ppm), from 280 to 410 ppm. The CO2 concentration continues to increase and is now approaching 420 ppm [Keeling, 2021]. This has produced a decrease near 2 W m-2 in the longwave IR (LWIR) flux emitted to space within the CO2 emission bands. There has also been a similar increase in the downward LWIR flux from the lower troposphere to the surface [Harde, 2017]. At present, the annual average increase in CO2 concentration is about 2.4 ppm. This produces an annual increase in the downward LWIR flux to the surface of approximately 0.034 W m-2. To start, the earth is not in thermal equilibrium. Unlike the moon, the earth‚Äôs surface does not heat up under solar illumination so that emitted LWIR flux matches the absorbed solar flux. The absorbed solar heat is stored and released over a wide range of time scales, especially by the oceans. A change in flux produces a change in the rate of heating or cooling of the thermal reservoirs that form the climate system. A change in temperature related to CO2 has to be determined from the change in heat content or enthalpy of the thermal reservoir of interest over a thermal cycle with and without the	Thank you for your detailed comments. We agree that climate models should predict the measured variables of the climate system. We note that climate models have been and are continually subject to evaluation with observations. Chapter 3 of the IPCC AR6 summarizes many evaluations of CMIP6 models. Modes of variability including the AMO have been evaluated in a number of studies (Coburn and Pryor 10.1175/JCLI-D-21-0359.1, Lee et al. 10.1175/JCLI-D-20-0832.1, 10.1175/JCLI-D-19-1024.1). Climate sensitivities of CMIP6 models vary widely but as a whole the sensitivity agrees well with the observationally derived estimate, even as some models may lie outside the very likely range (Figure 7.18a of IPCC AR6). In broad terms, climate models perform satisfactorily at simulating the mean state, modes of variability and the response to forcing and thus their predictions form a suitable basis to assess likely changes in the climate for North America. The NCA report synthesizes published research that use both measurements and climate models to provide multiple lines of evidence for support the conclusions. Climate models are not equilibrium models. To estimate equilibrium climate sensitivity, climate models are used to run over long time periods (e.g., > 500 years) but the models themselves are not equilibrium models. We will provide more information in future drafts.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Richard	McNider	Whole Chapter	02. Earth System Processes						Chapter 2 Earth System Processes Key topic 1 Report states ‚ÄúThis human-driven warming far outweighs the contributions from changes in natural climate drivers, including changes in incoming solar radiation, and cooling effects from volcanic eruptions, and natural variability.‚Äù While there is no doubt about increased CO2 and accompanying radiative forcing, ‚Äúfar outweighs‚Äù appears overstated. Variations in shortwave forcing largely from variations in albedo can approach 1 w compared to ~2 w from CO2. With our limited record he magnitude of natural variability that produced significant warming 1900-1950 and cooling 1950-1980 is not fully understood. Also, the report states - Although there are uncertainties in the various processes that feedback on climate, the combined effect of all known feedback processes has been to amplify human-induced warming over the industrial era. This is a model result. it should be noted that almost all models CMIP3-CMIP6 overstate the warming of the deep atmosphere as mentioned by IPCC. See Scafetta 2021 Climate and Christy and McNider 2017 Asia-Pac. J. Atmos. Sci. . Key Topic 2: Advances in observations and modeling Report States: High-resolution global and regional climate simulations have produced more credible information related to extreme events such as extreme precipitation and strong winds associated with tropical cyclones and other storms, as well as improved physical understanding of such phenomena. I think you have to be careful here. As discussed more fully below, observed warming from several sources including the IPCC indicates that the deep atmosphere is not warming nearly as much as in CMIP3-CMIP6 models. In fact, most of the Earth‚Äôs warming is occurring in a shallow layer in high latitudes of the Northern Hemisphere and at night in mid-latitudes. Thus, all the feedbacks in models such as increased water vapor forcing and accumulated water vapor supporting increased (extreme) precipitation are not in play in the shallow boundary layers in the observed atmosphere as much as they are in models. The report under Modeling extreme event uses the phrase ‚Äúphysical climate storylines.‚Äù This is not appropriate you don ‚Äôt use story lines you are implying developing a story that supports your	Thank you for your detailed comments. IPCC AR6 Figure 3.9 shows good agreement of CMIP6 models (in simulations with all forcings) with the observed temperature trends over the last 150 years across multiple regions. Note that the agreement is good over the ocean, where the diurnal temperature changes are small and the stable boundary layer issue pointed out by the reviewer is not at play. The disagreement in tropical tropospheric warming between models and observations for the period 1979 to 2014 is incompletely understood but derives in substantial part from the particular realization of natural variability experienced in the real world and comes with significant observational uncertainty (Section 3.3.1.2 of IPCC AR6, Mitchell et al. 2020 10.1088/1748-9326/ab9af7, Po-Chedley et al. 2021, doi:10.1073/pnas.2020962118). In contrast, climate models do show agreement between model and observations in trends of surface temperature trends over longer periods (IPCC AR6 Figure 3.9) among other fields. Taking a broader assessment of the evidence as a whole, we do not feel that the disagreement in tropospheric warming over the one identified period is definitive enough to discount all use of climate models in the NCA5.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Page	02. Earth System Processes			6			Carbon and biogeochemical cycling changes - there are increased number of studies on the role of wetlands, lakes, and rivers in the carbon budget and carbon cycling. Would be good to include some of these sources in the text or create a graphic of some kind that helps put some of these sources/sinks in perspective with one another.	Thank you for your suggestions. More information about the biogeochemical cycle will be provided in the next drafts.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	02. Earth System Processes						Would be good to include some information on what we donv¢–Ä–ôt know or what the uncertainties are (e.g. cloud cover, wind speed) in comparison to variables that we know more about (air temperature, precipitation)	Thanks you for your suggestion. We will cite studies that have assessed uncertainties in the next drafts.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	02. Earth System Processes						It would be helpful to put the various RCPs into more layman's terms as best we can. Some possible coverage on tesearch on impacts of various scenarios may make the communication piece a bit easier. It would put climate changes in perspective for a non-technical audience.	Thank you for your comment. We agree on the importance to explain various scenarios in more layman's terms. We will address this in future drafts.
Juanita	Constible	Whole Page	02. Earth System Processes			4			Key Topic 1, Climate Drivers: This section should specifically call out fossil fuels as the overwhelming majority driver of GHG emissions. Specifically, it should be noted that available data from the U.S. Energy Information Administration indicates that fossil fuel combustion accounts for 92 percent of total U.S. anthropogenic CO2 emissions and 80 percent of total U.S. anthropogenic GHG emissions.	Thank you for your comment. We will highlight the overwhelming contribution of GHG emissions from human activities to global warming observed in the past.
Evan	Mills	Whole Page	02. Earth System Processes			3			Re: Bullet 5 It is good to see compound events flagged for discussion. The following report may provide useful case-study information on the southern California fires of 2018, linked with torrential rain mudslides in Montecito following atmospheric-river storm. Mills, E., T. Lamm, S. Sukhia, E. Elkind, and A. Ezroj. 2018. "Trial by Fire: Managing Climate Risks Facing Insurers in the Golden State." Sacramento: California Department of Insurance, 93pp., https://drive.google.com/open?id=1zMar-AEbPjSszp5MSUHFWBVobnJVHCuD	Thank you for your comment, which is of direct relevance to a figure under consideration for the draft (Compound Weather and Climate Extreme Events) and explanatory text. Authors will check the provided resource.
Ally	Beasley	Whole Page	02. Earth System Processes			6			Under Key Topic 3, the fourth bullet point (carbon and biogeochemical cycle changes), the outline notes that increases in megafire in the western US over the past 5 years are likely affecting the regional carbon budget. Elsewhere in the annotated outline, regional carbon budgets do not seem to be mentioned. It might be helpful to include a section or graphic, whether here or elsewhere in the report, discussing carbon budgets in further detail and perhaps breaking them down by region and emissions source or sector.	Thank you for your suggestion. We will discuss the carbon budget briefly in the next drafts.
Michael	Wright	Whole Chapter	02. Earth System Processes						What's New IIIII Cite nonprofit organizations, e.g., Carbon Mapper, MethaneSAT, GHGSat, that make space-based observational data available to government, industry, and other stakeholders.	Thank you for your comment. We will provide examples of advances in observational data and how they have been used to improve modeling in the next drafts.
Michael	Wright	Whole Chapter	02. Earth System Processes						Key Topic 1 IIIII Uncertainties and confidence in projections should be tempered by comparisons between historical estimates of uncertainty and actual observations, e.g., glacial melting. The latter implies that earlier estimates were too conservative, e.g., forecasting less change, and that future changes may again be greater than anticipated due to, e.g., unaccounted for fugitive emissions, inaccurate reporting by emitters, etc.	Thank you for your comment. We will consider uncertainties and confidence in projections and provide more information in the next drafts.
Michael	Wright	Whole Chapter	02. Earth System Processes						Key Topic 1 IIIII Include feedback and forcing related to human caused responses to impacts of climate change, such as extreme weather, disasters, and sea level rise, such as A. Emissions immediately following disasters, including gas powered generators, heavy equipment, emergency supplies, fossil fuel infrastructure failure, e.g., pipelines, flooding and failures in petrochemical facilities. B. Emissions from cleanup and reconstruction, including heavy equipment, materials, land use changes. C. Long term emissions from decomposition of post disaster landfill waste. D. Relocation and migration emissions, including deforestation, land development, new roads, other infrastructure. E. Fossil fuel power emissions, including decreased hydropower due to drought, lack of support for nuclear power plants due to flooding, and increased indoor confinement that drives more HVAC usage.	We thank the reviewer for the comment, but the suggestion is outside the scope of this chapter, which focuses on Earth system processes.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	Wright	Whole Chapter	02. Earth System Processes						Key Topic 1 IIIII Include feedback and forcing from the direct impacts of climate change, such as A. Tree and plant loss, including loss of carbon sequestration due to climate induced disasters, e.g., flood, fire, disease and insect infestation, pollinator loss, invasives, and sea level rise. B. Increase in airborne particulates due to wildfires and drought and aridity.	Thank you for your comment. Climate feedback will be discussed in the context of how improved understanding of their various components has helped narrowed the range of warming projected for a doubling of atmospheric CO2 concentration.
Michael	Wright	Whole Chapter	02. Earth System Processes						Key Topic 3 IIIII Include a graphic showing best estimate of regional warming through 2100 vs. level of emissions reductions, similar to that in EGR21.	Thank you for your suggestion. This graphic may be more relevant for the Trends chapter, as our chapter focuses on Earth system processes.
Michael	Wright	Whole Chapter	02. Earth System Processes						Key Topic 3 IIIII Under ''changes in single and compound extreme events,'' include weather and climate extremes induce even more emissions from disaster response, reconstruction, and utiility power demand, which further exacerbate climate change in a human-caused feedback loop.	Thank you for your comment but may be outside the scope of this chapter, which focuses on Earth system processes.
Catherine	Buchanan	Whole Chapter	03. Climate Trends						Key Topic 1: Heat waves, droughts, and wildfires are also connected to the oil drilling and mining activities because of the massive extraction of ground water that drains aquifers, and the cutting into the aquifers for open pit mining activities changing the path of the water and exposing the water to evaporation. Oil drilling and mining are activities that contribute to climate change. Will these two activities be added to the man made impacts to climate change?	The points the commenter raises are beyond the scope of this chapter and we have not revised the text.
Joseph	Zajac	Whole Page	03. Climate Trends			8			FALSE CLAIM - there have been multiple extreme events that can now quantitatively be linked to human caused climate change - only fires started by humans	This comment is inconsistent with the current state of the science on this topic.
Joseph	Zajac	Whole Page	03. Climate Trends			8			FALSE CLAIM -New observational products and reconstructions of past climate show how the frequency and intensity of extreme events are changing largely as projected.	This comment is inconsistent with the current state of the science on this topic.
Joseph	Zajac	Whole Chapter	03. Climate Trends						reads like the authors threw everything out there to see what sticks	This comment does not appear to be relevant to the material at hand.
Kenneth	Pickering	Whole Page	03. Climate Trends			10			Thunderstorms are listed under Key Topic 3. Trends in lightning flash occurrence should be covered here, as lightning has effects on wildfire frequency and on air quality, in addition to the obvious effects on public safety. Links to other chapters covering these topics should be made from the Climate Trends chapter. There are several data sets that are useful for trend analysis for lightning over the United States: the National Lightning Detection Network (operated by Vaisala), the Earth Networks Total Lightning Network (operated by Earth Networks), the Optical Transient Detector and Lightning Imaging Sensor (LIS) instruments on board a series of NASA orbital platforms from 1998 to present, and the Geostationary Lightning Mapper instruments on board the GOES-16 and GOES-17 satellites operated by NOAA. Analyses of trends from some of these systems are ongoing at NASA Marshall Space Flight Center and should be included in the assessment.	The text has been revised to incorporate a brief discussion of lightning. 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 are not able to provide a discussion at this level of detal.
Roy	Clark	Whole Chapter	03. Climate Trends						Comment on NCA5 Chapter 3: Climate Trends Roy Clark PhD President Ventura Photonics Thousand Oaks CA 91360 Please Note: This is the first part of a comment on Chapter 3 that was sent as an e mail attachment to review@usgcrp.gov from Roy Clark,Äôs Ventura Photonics e mail address on 2/14/2022. The title of the file is RoyClark_CommentChapter3_NCA5.pdf Figures and references are provided in the e mail attachment. The first step for Chapter 3 is the quantitative determination of the effects of the observed increases in the atmospheric concentration of so called ‚Äògreenhouse gases,Äô, particularly CO2 on the earth,Äôs climate. This then provides the foundation for any actions that need to be taken. Over the past 200 years, the atmospheric concentration of CO2 has increased by approximately 130 parts per million (ppm), from 280 to 410 ppm. The concentration is still increasing and is now approaching 420 ppm [Keeling, 2021]. This has produced a decrease near 2 W m-2 in the longwave IR (LWIR) flux emitted to space within the CO2 emission bands. There has also been a similar increase in the downward LWIR flux from the lower troposphere to the surface [Harde, 2017]. At present, the annual average increase in CO2 concentration is about 2.4 ppm. This produces an annual increase in the downward LWIR flux to the surface of approximately 0.034 W m-2. The short answer of course is that the observed increase in the atmospheric CO2 concentration over the last 200 years has had no effect on the earth,Äôs climate. The climate models used to create the illusion of a connection between CO2 and ‚Äòanthropogenic climate change,Äô are completely fraudulent, based on the underlying assumptions used to build the models. The fundamental error, introduced in the nineteenth century is the equilibrium assumption [Arrhenius, 1896]. In its modern form, the equilibrium assumption starts with a contrived annual planetary flux balance between the	This comment is inconsistent with the current state of the science on this topic.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Richard	McNider	Whole Chapter	03. Climate Trends						Chapter 3 Climate Trends Again since there is no data will suggest data and analyses. All trends where data is available should include the 1930,Äôs and 1950,Äôs. Starting in the 1960s or 1970s does not include natural variability which is important. You should also address the asymmetry in Tmax and Tmin trends and DTR and the failure of models to capture the observed asymmetry (see McNider et al. 2012 JGR). Based on analyses we have carried DTR decreased from about 1940-1970. But since then DTR has increased largely due changes in precipitation and cloudiness. Models generally don,Âôt capture the magnitude of this behavior. Observed trends in Tmax and Tmin for the rest of the globe have shown that most of 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 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 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. You should also address the relative lack of warming in observed deep atmosphere ,Äì satellites, balloons and re-analysis data sets. The essence of GHG gas climate change is the accumulation of heat in the deep atmosphere. This allows water vapor feedback to amplify the GHG signal. Observed tropospheric warming significantly lags what models produce so that the positive water vapor feedback	This comment is inconsistent with the current state of the science on this topic.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	03. Climate Trends						Add information on flooding, Great Lakes water levels, Mississippi river flooding and drought conditions in some of the extreme event contexts.	We address drought conditions in the extreme events, as well as extreme rainfall. The relationship between precipiation extremes and flooding is complex, dependent on land use and other factors, and is addressed in the Water chapter.
Daniel	Brown	Whole Chapter	03. Climate Trends						Re: Key Topic 4: Future Projections Thank you for describing impacts at GWLs using reference temperatures. Please use reference temperatures (1.5¬ºC, 2¬ºC, 3¬ºC, and 4¬ºC, etc.) instead of only referring to scenarios. As RCP8.5 is no longer representative of our trajectory, and is no longer a "Business as Usual" scenario as it was often described in the literature until recently, describing impacts relative to global reference temperatures will be easier to understand and more useful.	We thank the reviewer for the comment, and nowhere in the chapter do we refer to any future scenario as "BAU". We use global warming levels to report impacts and use scenarios only to contextualize when these GWLs might be reached.
Daniel	Brown	Whole Chapter	03. Climate Trends						Re: Key Topic 2: Global Trends Re: Key Topic 4: Future Projections Please consider incorporating information about projected temperatures, sea level rise, and metrics that have potential long-term effects beyond 2100 when possible. As practitioners consider bridges, dams, and large infrastructure projects with lifetimes greater than 100 years, considerations of climate change beyond 2100 need to be factors in decision making. Please see: Christopher Lyon, Erin E. Saupe et al. Climate change research and action must look beyond 2100. DOI: 10.1111/gcb.15871	While coupled climate model projections are available only through 2100, we do discuss changes on longer timescales such as sea level rise.
William	Koshak	Whole Page	03. Climate Trends		10				Under Key Topic 4 one could add a sub-bullet "Lightning". For the purposes of making better projections of lightning across the US, recent advances have been made in better understanding the inter-relationships between cloud-to-ground lightning, CAPE, and precipitation; performance of re-analysis based proxies are introduced. Details are provided in: Tippett, M. K., & Koshak, W. J. (2018). A baseline for the predictability of U.S. cloud-to-ground lightning. Geophysical Research Letters, 45, 10,719,Äì10,728. https://doi.org/10.1029/2018GL079750. Tippett, M. K., C. Lepore, W. J. Koshak, T. Chronis, and B. Vant-Hull, 2019: Performance of a simple reanalysis proxy for US cloud-to-ground lightning, Int. J. Climatol., 39, 3932-3946, https://doi.org/10.1002/joc.6049.	The text has been revised to incorporate a brief discussion of lightning. 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 are not able to provide a discussion at this level of detal.
Doug	Robbins	Whole Page	03. Climate Trends		9				Chapter 3, Climate Trends Key Topic 2, page 9 Anthropogenic Atmospheric Changes Most presentations of anthropogenic changes to the atmosphere show only CO2 and methane observations at a single site (Mauna Loa, the Keeling Curve). The presentation could be improved by including observations from the Scripps CO2 global network of sampling stations, and by including other parameters of anthropogenic atmospheric change. A careful ordering of the data curves and color selection can give a coherent display of global data, as shown in the file ,ÄúAnthropogenic Atmosphere Charts.pdf,Äù and supporting files submitted by e-mail to review@usgcrp.gov. Recommended parameters include CO2, ÔÂ§13C, oxygen, methane, and possibly halocarbons. Charts show that the Northern Hemisphere leads the Southern Hemisphere in atmospheric change, as anthropogenic influences predominantly happen in the Northern Hemisphere and propagate to the Southern Hemisphere. It should be noted that the depletion of atmospheric oxygen nicely matches the expected stochiometric consumption of oxygen for fossil fuel combustion and land-use change (unpublished work).	We have reviewed the source of information suggested by the comment and find that it does not meet the guidance to authors on Information Quality. This guidance assures that sources comply with Information Quality Act and Evidence Act requirements for (1) utility, (2) transparency and traceability, (3) objectivity, and (4) integrity and security.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Evan	Mills	Whole Page	03. Climate Trends		9				Re: Key Topic 1 It is good to see compound events flagged for discussion. The following report may provide useful case-study information on the southern California fires of 2018, linked with torrential rain mudslides in Montecito following atmospheric-river storm. Mills, E., T. Lamm, S. Sukhia, E. Elkind, and A. Ezroj. 2018. "Trial by Fire: Managing Climate Risks Facing Insurers in the Golden State." Sacramento: California Department of Insurance, 93pp. [PDF]	Compound extremes will be addressed in a cross-cutting box that will span several report chapters. The authors of that box will consider this reference.
Ally	Beasley	Whole Page	03. Climate Trends		9				In discussing equity and justice implications of extreme and compound events, we encourage the authors to consider possible implications for agricultural workers----both in terms of worker health and safety/working conditions and housing conditions (e.g. during heat waves) and broader implications with respect to effects on crops, seasonality and availability of work, wages, etc.	Thank you for this suggestion. The chapter will be revised to mention the equity and justice implications for agricultural labor, but a comprensive treatment is out of scope for the Climate Trends physical science chapter.
Jhoset	Burgos	Whole Page	03. Climate Trends		9				Under Key Topic 2; Under: Observed large scale trends in climate; Under: Loss of glacier and sea ice. Add: ‚Äúice sheet‚Äù Suggested Language: Loss of glacier, ice sheet, and sea ice	Glacier, ice sheet, and sea ice changes are all covered in the longer draft of the report.
Jhoset	Burgos	Whole Page	03. Climate Trends		10				Under Key Topic 4: Future projections; pacts at global warming levels (GWLs) of 1.5¬∞C, 2¬∞C, 3¬∞C, and 4¬∞C above preindustrial levels. Add: a subsection for sea level rise	Sea level rise projections are covered in the longer draft of the report.
Jhoset	Burgos	Whole Page	03. Climate Trends		11				Under Key Topic 1: What is changing? Trends, projections, and physical effects; Comment: Consider the effects of saltwater intrusion due to sea level rise on water availability.	This will be addressed in discussion of the effects of sea level rise
Jhoset	Burgos	Whole Page	03. Climate Trends		11				Under Key Topic 1: What is changing? Trends, projections, and physical effects. Comment: Consider the effects of saltwater intrusion due to sea level rise on water availability.	See response to above.
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 1 IIIII include reference to ''dry'' thunderstorms, e.g., Portugal, June 2017	ue to the breadth of the topic and the page limit for the chapter, we were not able to treat lightning and storms with this level of detail.
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 1 IIIII Ensure consistency in event references, e.g., wildfires are primarily a consequence of drought, that is, a manifestation of extreme weather events.	Wildfires will be addressed in a cross-cutting box.
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 1 IIIII Under ''Ocean extremes,'' include consequences such as dead zones and changes to the jet stream that affect regional climate.	Changes to dead zones are included. Jet stream dynamics and influence on midlatitude weather are addressed in another section.
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 1 IIIII Under ''Why these extremes matter,'' mention with regard to security that national and personal security will become more at risk due to climate change. The former is per DoD assessment. Personal security will be threatened by increasing violence associated with social stressors like scarcity of food, water, and other resources.	In the longer draft of the report, we note national security risks. An assessment of the vast and complex social science literature on scarcity, crime, and interpersonal violence is beyond the scope of this chapter.
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 2 IIIII Under ''loss of ice,'' mention change in ocean salinity	The text has been revised to incorporate this suggestion, with both current and projected salinity trends now noted.
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 2 IIIII Specify reference to biosphere changes, e.g., forest and plant loss, desertification, etc.	Biosphere changes are beyond the scope of this chapter other than to note possible changes to the carbon cycle, and will be addressed in the sectoral chapter on ecosystems.
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 2 IIIII Under ''unusualness of trends,'' mention both temporal, i.e., rate of warming, as well as severity, e.g., extreme rainfall, prolonged drought, frequent 100 year floods, etc.	This is done in the longer version of the report, which discusses trends in both mean states and extremes.
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 2 IIIII Under ''connecting global changes,'' mention occurances of unusually cold weather in U.S. concurrent with unusual warming in Arctic.	We assess the literature on midlatitude weather connections to Arctic changes, which is not straightforward, in the longer version of the report.
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 2 IIIII Under ''regional drought,'' clarify reference to runoff, since more associated with rainfall	We will distinguish between meteorological, hydrological, and agricultural drought in the longer version of the report.
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 2 IIIII Under ''connecting faraway changes to U.S.,'' mention tropic deforestation effects on weather patterns and atmospheric moisture, and clarify and explain more wrt summer midlatitude weather.	Tropical deforestation effects are unfortunately beyond the scope of this chapter. We have clarified and explained the observed and projected influence of jet stream changes on midlatitude weather.
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 3 IIIII Ensure consistency in extreme weather; omit wildfires since primarily a consequence of extreme weather, i.e., drought. Other consequences, like flash flooding from downpours and famine from drought, are correctly not included.	Wildfires will be addressed in a cross-cutting box, as will other compound extremes.
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 3 IIIII Include tornadoes, cyclones, and other significant weather events.	In the longer report draft we include observed and projected trends to many types of storms.
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 4 IIIII Clarify that locked in warming is GHG dependent.	This is a useful point, and we will edit the text to better differentiate between zero emissions commitment (ZEC) results for CO2 and other GHGs (CH4 in particular)
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 4 IIIII Include feedback and forcing related to human caused responses to impacts of climate change, such as extreme weather, disasters, and sea level rise, such as A. Emissions immediately following disasters, including gas powered generators, heavy equipment, emergency supplies, fossil fuel infrastructure failure, e.g., pipelines, flooding and failures in petrochemical facilities. B. Emissions from cleanup and reconstruction, including heavy equipment, materials, land use changes. C. Long term emissions from decomposition of post disaster landfill waste. D. Relocation and migration emissions, including deforestation, land development, new roads, other infrastructure. E. Fossil fuel power emissions including decreased hydropower due to drought, lack of support for nuclear power plants due to flooding, and increased indoor confinement that drives more HVAC usage.	We report impacts in terms of global warming level and use standard scenarios to translate these into timescales. An assessment of possible changes to human bebahior is out of scope for this chapter.
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 4 IIIII Include feedback and forcing from the direct impacts of climate change, such as A. Tree and plant loss, including loss of carbon sequestration due to climate induced disasters, e.g., flood, fire, disease and insect infestation, pollinator loss, invasives, and sea level rise. B. Increase in airborne particulates due to wildfires and drought and aridity.	We discuss possible carbon cycle feedbacks in the longer version of the report. An increase in airborne particulates due to fires is out of scope for this chapter and will be covered, among other places, in the dedicated Air Quality chapter and the Cross-Cutting Box on Compound Extremes
Michael	Wright	Whole Chapter	03. Climate Trends						Key Topic 4 IIIII Under ''uncertainty and choices,'' include a graphic showing best estimate of regional warming through 2100 vs. level of emissions reductions, similar to that in EGR21.	We are focusing on regional warming at different global warming levels (1.5C, 2C, 3C, 4C) rather than specific 2100 outcomes of different policy choices (as highlighted in the EGR21 report). However, we (and the mitigation chapter) provide some information about likely 2100 climate outcomes under current/stated policies that can be mapped to GWLs, as well as a mapping of SSPs to GWLs in Figure 3.11

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Catherine	Buchanan	Whole Chapter	04. Water						Pg. 11 under What's New, 1st bullet, hydrologic datasets: Will the hydrologic datasets include the changes in hydrology caused from mining, oil drilling and fracking? Pg. 11 under Key Topic 1: What is changing?: Is the increase in evaporation rate from the ocean included in the Surface water bullet? The ocean has increased in temperature by almost two degrees. The increase in water vapor from the ocean needs to be included. Pg. 12 under the Droughts bullet: Will overdraft from the aquifer be included in regional drought severity, especially the overdraft from bottling companies? Pg. 13 under Compound hazards bullet examples should include: Annual severely decreasing snow pack because the floods are connected to the water that runs off the mountains where the snow is supposed to accumulate. Pg. 13 under Compound hazards bullet, the last bullet should be changed to include: Land disturbance leading to impacts on water quality, water quantity, hydrology and hydraulics.	We thank the reviewer for these comments and questions. a) The hydrologic datasets measure hydrologic response whatever the cause - mining, oil drilling, land use change, or climate change. In the chapter's discussion of changes to the hydrologic cycle, we focused on those changes that can be attributed to climate change. b) The increase in evaporation from the ocean is not included in the surface water bullet. Instead, we focused this chapter on how evapotransipiration is affecting local freshwater resources and terrestrial hydrologic patterns. c) Overdraft from aquifers can certainly affect drought and water availability. While we do not specifically mention bottling companies, we do note that groundwater pumping is an important consideration in understanding impacts and risks. d) We are including in our chapter text information on the effect of changing snowpack on downstream conditions. e) We have included information about how land use can affect hydrology, including both water quantity and quality. Discussion of compound hazards has been moved to a featured topic in the NCA5.
Emily	Bell	Whole Page	04. Water			14			Under "Adaptation and resilience challenges faced by frontline communities (Coordinate with Ch. 16: Indigenous Peoples as appropriate)," it may be worthwhile specifying that a voice in decision making for those represented and participating will require identifying/leveraging procedural mechanisms to ensure equity in that participation. Also, it may be useful to specify that this will require careful, tailored attention to how we link equitable participation to decisions that produce equitable outcomes (not always the case in practice).	We thank the reviewer for their comment. We have included as part of one of our key messages that frontline communities do not have equal representation in decision making.
Emily	Bell	Whole Page	04. Water			13			Under "Frontline communities,Âîdisproportionate impacts and inequitable resource allocation (Coordinate with Ch. 16: Indigenous Peoples as appropriate)," when you talk about inadequate infrastructure for water delivery, does this pertain to local and regional infrastructure? I think, as, written, this would suffice. I do think, though, that there is opportunity for that specification, especially since there is so much rural-urban migration that is creating new pressures for not only local water and infrastructure needs, but the dynamics between local systems (e.g., the future of interconnections and inter-basin transfer contracts and capital investment, especially with increasing variability in drought and flooding).	We thank the reviewer for this comment. Our chapter notes the challenges faced by different communities, with a focus on infrastructure.
Kavita	Heyn	Whole Chapter	04. Water						I would like to suggest that you include examples of climate adaptation strategies for the water sector under "Key Topic 3: How to adapt and build resilience? Advances and challenges". It is important for readers to see practical, actionable strategies that they can learn from. I would like to recommend you highlight the Water Utility Climate Alliance's set of Leading Practices in Climate Adaptation in this section of the chapter. These leading practices were developed pulling from the climate adaptation expertise of 12 large water utilities that serve 50 million American their drinking water, so they are tested on the ground in very large public infrastructure agencies. You could link to the interactive website here: https://www.wucaonline.org/adaptation-in-practice/leading-practices/index.html, or/and you could also provide one or two examples of these strategies in the chapter (maybe in a call out box)? For example, making the business case for climate adaptation (https://www.wucaonline.org/adaptation-in-practice/leading-practices/sustain.html#business-case), or plan for a range of futures: https://www.wucaonline.org/adaptation-in-practice/leading-practices/plan.html#plan. Tirusew Asefa is a member of WUCA and can share more about this resource but I think water chapter readers will really benefit from not just understanding the risks, but how they can respond. Thank you.	We thank the reviewer for this suggestion. We have added a reference to WUCA in the chapter. The Southwest chapter also includes additional discussion of adaptation strategies.
Jim	Angel	Whole Chapter	04. Water						One thing to consider in discussing snowpack or snow droughts are that these are not just isssues for the West. They are equally important in the upper Midwest, the upper Great Plains, and the Great Lakes region in terms of water supply, soil moisture recharge, risk of spring flooding, and water levels on the Great Lakes.	We thank the reviewer for this suggestion. We describe snow drought in a general section on drought types and are including an example as a case study. We do note that this is a case study only.
Jim	Angel	Whole Chapter	04. Water						While the Mississippi River is vitally important for the nation, it has received little attention in NCA reports. Here in the Midwest, the Big River is important for agiculture, manufacturing, commercial navigation, water supply, energy production, etc. A recent economic report estimated the value of the Upper MS River corridor alone at $345 billion annualy. Source: https://umrba.org/sites/default/files/documents/umr-econ-profile.pdf I can only speak for the Upper Mississippi River; however, climate change impacts we have seen are increased flooding , high loads of nitrates and phosphorous, increased sediment loads, and the Asian Carp invasion. I hope in the future that the Mississippi River system is considered as a whole. In the meantime, it would be worth a call-out-box or a paragraph recognizing the issues involved.	We thank the reviewer for this suggestion. The chapter does not address specfic rivers except in a few examples and instead focuses on national trends and projections. However, the regional chapters and some of the sector chapters do have additional information about the Mississippi River and its watershed.
Joseph	Zajac	Whole Chapter	04. Water						looks OK but needs more detail, the overview is general	Thank you for your comment. Please look for regional and sectoral specifics in the regional and sectoral chapters.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Roy	Clark	Whole Chapter	04. Water						Comment on NCA5 Chapter 4: Water Roy Clark PhD President Ventura Photonics Thousand Oaks CA 91360 The assessment of the influence of ‚Äòclimate change‚Äô on the water resources of the United States requires the quantitative determination of the effects on these water resources of the observed increase in the atmospheric concentration of CO2 and other ‚Äògreenhouse gases‚Äô. Over the past 200 years, the atmospheric concentration of CO2 has increased by approximately 130 parts per million (ppm), from 280 to 410 ppm. The concentration is still increasing and is now approaching 420 ppm [Keeling, 2021]. This has produced a decrease near 2 W m-2 in the longwave IR (LWIR) flux emitted to space within the CO2 emission bands. There has also been a similar increase in the downward LWIR flux from the lower troposphere to the surface [Harde, 2017]. At present, the annual average increase in CO2 concentration is about 2.4 ppm. This produces an annual increase in the downward LWIR flux to the surface of approximately 0.034 W m-2. Over the oceans, the penetration depth of the LWIR flux into the ocean surface is less than 100 micron [Hale and Querry, 1973]. Here it is fully coupled to the wind driven evaporation or latent heat flux. Using long term zonal averages, within the ¬±30¬∞ latitude bands, the sensitivity of the latent heat flux to the wind speed is approximately 15 W m-2/m s-1 [Yu et al, 2008]. For each increase in wind speed of 1 meter per second, the latent heat flux increases by 15 W m-2. Near the equator, the average wind speed is approximately is 5 ¬±2 m s-1, with higher wind gusts. The entire increase of 2 W m-2 in downward LWIR flux from CO2 to the surface for the last 200 years is dissipated by an increase in wind speed of about 13 centimeters per second. For reference, a typical pet tortoise can run at about 10 cm s-1. An annual average increase in LWIR flux of 0.034 W m-2 from CO2 is dissipated by an increase in wind speed of 3 millimeters per second. This means that there can be no	We thank the reviewer for this comment. While we do not discuss atmospheric circulation in this chapter, the point about focusing the discussion of changes to water resources on what has been observed in the historical record is well taken. We have included the references that describe those changes, and the chapter details observed changes in a number of hydrological variables.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Page	04. Water		12				Flooding in northern Wisconsin might be a good example of impacts/risks. Flooding and road washouts prevented whole counties from being able to access emergency services.	We thank the reviewer for this suggestion. While we did not include a specific example from Wisconsin, we hope that the chapter's discussion of flooding trends, risks and impacts adequately addresses these concerns.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Page	04. Water		13				"conflict and competition" - would include risk of water diversions from Midwest to less water-rich areas and impact that can have on Midwest ecosystem as well as water availability.	We thank the reviewer for this comment. While we note the issue of competition for water, we were unable to include this specific example. We have noted the Midwest as an example of an area where upstream-downstream impacts of flooding need to be considered when designing flood control measures.
Chris	Manganiello	Whole Chapter	04. Water						Hello. Page 14: I fully support the intention to move water to a central part of the NCA5 conversation, and to link water with other chapters and content. Often, I find water topics relegated to a secondary level when compared to measuring carbon emissions, adaptation strategies, etc. Pages 12, 13: The author team may consider other relevant regional examples for drought, flooding, tropical/hurricane activity, compound hazards, etc. For example, the ‚Äúhumid‚Äù southeast experienced record-breaking hydrologic drought in 2006-08, and the drought was followed by record flooding in 2009. Flash droughts are also prevalent in the region. Page 14: Finally, the ‚ÄúProgress, gaps, and opportunities‚Äù section seems like a great place to discuss ‚Äòthe internet of water.‚Äô For an example, New Mexico‚Äôs Water Data Act (2019) is an example of a planning tool with the goal to better understand water use data to better inform decision making. Thank for the opportunity to comment on this process.	We thank the reviewer for their support of a separate water chapter. We appreciate the suggestion for examples in the southeast part of the country. We hope the examples that have been included adequately addresses the issues of concern, even if the specific examples you cited are not included. While we have not used the term "internet of water," which may not be as familiar to readers, the chapter does discuss increasing data availability and equity concerns around access to that information.
Theodore	Weber	Whole Chapter	04. Water						The Water chapter of NCA5ZOD does not mention impacts to fish and other aquatic organisms, or measures to reduce such impacts. It contains only this under the "Drought risk" bullet: "Wetlands, riparian, and aquatic ecosystems, contaminants, algal blooms,‚Äîcoordination with Ch. 8: Ecosystems." NCA4 contained similar oversights; there were some mentions of ecosystems but the primary emphasis was on water provision and services. Further, climate change effects are not limited to drought. Floods, heat waves, and other climate change effects will also affect streams, rivers, lakes, and other water bodies and their natural communities. See Lynch et al., 2016, Climate Change Effects on North American Inland Fish Populations and Assemblages, at https://afspubs.onlinelibrary.wiley.com/doi/epdf/10.1080/03632415.2016.1186016.	We thank the reviewer for this comment. This chapter discusses climate change effects on other aspects of hydrology and on water quality. We included a brief description of flood and drought impacts on ecosystems but are limited in space to devote to this important issue. Ecosystem impacts of changes to water quantity and condition are important. While we did not cover them in depth here, they are addressed in the Ecosystems chapter.
Theodore	Weber	Whole Page	04. Water		13				Water adaptation measures should include ecosystem and whole-watershed approaches.	We thank the reviewer for this comment. While we did mention nature-based solutions, we were, unfortunately, unable to include examples due to space limitations.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Theodore	Weber	Whole Page	04. Water		14				Biodiversity and human well-being are inextricably linked (Millennium Ecosystem Assessment, 2005). Human civilization relies on nature,Äôs ability to provide food, fiber, and many other goods and services, and nature functions most effectively when all the pieces (e.g., species) and processes (e.g., nutrient cycling, pollination) are present. Thus, the ecological integrity of streams and other water bodies must be maintained. Not just stream segments alone, but their floodplains, valleys, watersheds, and connected aquifers must be considered. In arid or semi-arid regions, groundwater-fed seeps and springs can support persistent populations of highly diverse taxa, both aquatic and terrestrial (Morelli et al., 2016). They are biodiversity hotspots and keystone ecosystems that have a disproportionate influence on surrounding landscapes despite their relatively small size (Cartwright et al., 2020a). Some springs served as evolutionary refugia during previous climate drying, supporting relict species (Cartwright et al., 2020a). Cold-water aquatic organisms, like salmon, trout, hellbenders, spring salamanders, and a number of macroinvertebrate species, are among the most vulnerable taxa to climate change. They are becoming more and more restricted to persistent cold-water habitats such as forested headwater streams, spring-fed streams, and/or habitats supported by groundwater or seasonal snowmelt (Ebersole et al., 2020). Streams and rivers that are buffered from regional air temperatures via cold groundwater inputs provide cold, sustained streamflows in regions where water temperatures would otherwise become too warm or streamflows too low during the summer months (Morelli et al., 2016). Shading by valley walls and/or trees can also help regulate stream temperatures. Sufficiently large and connected cold-water stream networks can provide refugia for imperiled fish populations facing increasing pressures from temperature warming and other stressors (Morelli et al., 2016). For sensitive freshwater fishes,Äînot just cold-water obligates,Äîclimate change is likely to enhance exposure to multiple stressors. To maintain viable populations, fish require sufficient food, protective cover from predators, suitable water quality, appropriate flow regimes, spawning substrates, and capacity to deal with parasites and diseases. Increases in water temperature and other stressors, such as excessive sedimentation, pollutant load, and eutrophication, must be minimized. In addition, climate	We thank the reviewer for these comments and suggested references. We have included a short discussion of the impacts of climate change on aquatic ecosystems. Although we could not cover this topic in greater depth, the Ecosystems chapter discusses many of these concerns.
Daniel	Brown	Whole Chapter	04. Water						Re: The need for projected extreme event recurrence intervals in the style of NOAA Atlas 14: NOAA Atlas 14 is used extensively throughout the country by municipalities, state governments, federal officials, and private engineering firms to design infrastructure, manage stormwater, manage wastewater, and plan natural landscape restoration projects. There is perhaps no other single climate change resource that has more direct, practical importance than Atlas 14. Numerous decision makers at all levels of government regularly express interest in designing infrastructure to be able to safely manage future storms of increasing severity and frequency. Unfortunately, science-based climate projections that provide this information is usually unavailable. A product that functions similarly to the current NOAA Atlas 14 tables and maps, but includes projected values for various storm sizes, would be extremely informative and useful for entities of all sizes.	We thank the reviewer for this comment. We agree that NOAA Atlas 14 has been an important reference and discuss the need for information that is more relevant to planning and designing infrastructure for the future climate. Chapters 2 and 3 of NCA5 includes additional information on precipitation.
Daniel	Brown	Whole Chapter	04. Water						Re: The need for coupling climate and hydrological models at a watershed scale: The risk of floods is increasing with the greater risk of severe storms, but the relationship of flood risk to precipitation magnitude is nonlinear and is often unclear. Numerous stakeholders, from watershed organizations to dam operators, would benefit from more widespread development of coupled climate-hydrologic models. Scientists with the NE CASC have worked on dimensions of this problem for specific watersheds. The Huron River Watershed Council has worked with experts at the University of Michigan to try and understand how precipitation events of varying magnitude and duration affect in-stream flows through our watershed and how various landscape types affect runoff and flow. Unfortunately, the process is far too complicated and costly for most regional conservation organizations in the U.S. to support, but the benefits of improved coupled climate-hydrology models could be critical for avoiding future costs or mistakes in land development that could adversely affect runoff, flows, or unnatural erosion.	We thank the reviewer for this comment. We agree and devote a section of the chapter to this important issue.
Daniel	Brown	Whole Chapter	04. Water						Re: The need for extensive evaluation of the vulnerability of dams to climate change As the probability of damaging storms continues to increase, many communities struggle to accurately assess the future vulnerability of dams and other in-stream infrastructure. The catastrophic failure of the Edenville and Sanford Dams in Michigan in 2020 highlight the need to consider precipitation projections in future dam maintenance, repair, construction and removal decisions. During the summer of 2021, the Huron River watershed in southeast Michigan experienced 3 storms that fit the criteria of a 50-year storm as described by NOAA Atlas 14. The flood that broke the Edenville and Sanford dams near Midland, Michigan, was characterized as a 500-year year flood event. In 1986, the same area experienced a 100-year flood. Three such storms of similar magnitude have hit the area of Michigan in the past 34-years. These types of events and precipitation patterns have reinvigorated discussion of dam safety and dam removal in the Midwest. Of note: the following study should be reviewed by authors as they consider future precipitation recurrence intervals, flood risk, and vulnerable infrastructure. Kirchmeier-Young, M. C. and Zhang, X.: Human influence has intensified extreme precipitation in North America, P. Natl. Acad. Sci. USA, 117, 13308,Äì13313, 2020.	We thank the reviewer for this comment and the reference. We have noted the importance of hazard planning and management given the many changes that are occurring to hydrology, though we do not discuss the important issue of dam safety due to space limitations.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
DAnn	Williams	Whole Chapter	04. Water						From: D,ÃôAnn Williams, Johns Hopkins School of Public Health, Center for a Livable Future To: USGCRP ,Äì NCA5 Chapter Authors Re: USGCRP NCA5 Chapter Outline Comment Disclaimer: The opinions expressed herein are our own and do not necessarily reflect the views of The Johns Hopkins University. February 19, 2022 Dear Chapter Authors, Thank you for the opportunity to comment on the United States Global Change Research Program Strategic Plan (2022-2031) Prospectus and Chapter Outlines. We are researchers at the Johns Hopkins Center for a Livable Future (CLF), an interdisciplinary research center based at the Johns Hopkins Bloomberg School of Public Health. CLF applies science and systems thinking to help build healthy, just, equitable, resilient, and sustainable food systems. We have reviewed the USGCRP strategic plan prospectus (SPP), reviewed the chapter outlines and have attended many of the NCA5 Public Engagement Workshops held by USGCRP and chapter authors. These virtual sessions have been informative, as well as interactive and inclusive. We strongly support the vison and mission of this multi-agency cooperative program to fully ,Äúunderstand the forces shaping the global environment, both human and natural and their impacts on society.,Äù There are four pillars for this work as stated in the USGCRP SPP: 1. advancing science, 2. informing decisions, 3. engaging the nation and 4. collaborating internationally. Under these four pillars are cross-cutting themes, diversity and inclusion, risk-based approaches, enhanced social science integration, communication, and workforce development. To adequately advance science and inform the development and implementation of climate change solutions, we urge you to stress the importance of developing multi-agency research and programs that improve our understanding of the public health implications of climate change and pathways to address agriculture and food systems contribution to climate change while protecting public health and environmental justice. Currently there are numerous gaps in our knowledge around current policies and practices and climate change and even fewer	We thank this group of reviewers for their comments and resources. Within the water chapter, we have noted the important linkage between water and agriculture, as well as water and public health. We have also noted that there are inequities in what and how different communities will be facing changes.The NCA5 also includes a chapter devoted to human health and another devoted to agriculture and rural communities.Both will address the issues you've raised.
Ally	Beasley	Whole Chapter	04. Water						We appreciate the intent to include a better understanding of disproportionate water-related impacts to frontline communities, attention to issues of representation and who is at the table for decision-making, and attention to issues around data collection, mapping and monitoring, and data sovereignty. The priorities, knowledge and expertise of those in frontline communities who understand these impacts firsthand are of paramount importance. We hope this chapter will expressly take into account underlying inequities in reliable access to running/potable water in certain communities (including but not limited to border colonias and unincorporated communities), and existing water quality and quantity issues in these communities due to historical and ongoing pollution and extraction (e.g. from oil and gas, mining, etc.).	We thank the reviewer for this comment. Our chapter does point out that frontline and indigenous communities are often especially vulnerable due to unreliable or nonexistant infrastructure. A proposed figure highlights communities where access to indoor plumbing is limited. The NCA5 has a Tribal and Indigenous Peoples chapter as well as a COVID feature topic that both address universal access to clean water.
Jhoset	Burgos	Whole Page	04. Water			14			Key Topic 3: How to adapt and build resilience? Advances and challenges; Under: Our ability to adapt may be constrained by existing frameworks; Under: Adoption of new regulations: water quality, waste treatment, floodplains, building codes, and infrastructure design and operations standards. Comment: Consider projected and potential multimeter sea level rise plus short-term flooding events and coastal erosion when adopting new regulation. Not that it is important to recognize our inability to precisely predict long-term sea level rise.	We thank the reviewer for this comment. While water plays an important role in coastal systems, our charge is to focus on the nation's freshwater resources. The NCA5 has a chapter devoted to coastal issues generally (Coastal chapter) and regional chapters that address coastal issues locally.
Michael	Wright	Whole Chapter	04. Water						What's New IIIII Include significant increase in impervious surfaces that impairs ground water supplies, increases contaminated runoff, and reduces amount of vegetation that uptakes carbon. This in turn exacerbates climate change. Also noted under Land Cover, Built Environment.	We thank the reviewer for this comment. We briefly discuss the role of impervious surfaces on flooding. We have noted in the chapter that there are many different factors affecting hydrologic processes, some of them, like impervious surfaces, compounding the effects of climate change.
Michael	Wright	Whole Chapter	04. Water						What's New IIIII Include increased incidences of drought, particularly in the midwest, southwest, and northwest, contributing to large wildfires, loss of trees, and runoff and flooding.	We thank the reviewer for this suggestion. The chapter includes a broad overview of the trends and projections of flooding and drought.
Michael	Wright	Whole Chapter	04. Water						Key Topic 1 IIIII Add to list of water volume and movement oceans, atmospheric water content	We thank the reviewer for this suggestion. The water chapter is focused on freshwater processes, trends and projections. The NCA5 has additional, individual chapters devoted to climate processes, oceans, and coasts.
Michael	Wright	Whole Chapter	04. Water						Key Topic 1 IIIII Under ''extreme events,'' include to flood factors the loss of ground vegetation and trees due to land use changes, e.g, development impervious surfaces, climate related disease and infestation, and drought induced wildfires.	We thank the reviewer for this suggestion. The chapter discusses these factors and the role they may play in changes to flooding.
Michael	Wright	Whole Chapter	04. Water						Key Topic 1 IIIII Cite more recent droughts than 2015, e.g., northwest and southwest U.S. Further, droughts in poorer nations, e.g., in South Africa that are already causing famine for hundreds of millions, will require more international aid from U.S. coffers.	We thank the reviewer for this comment. We have a section devoted to drought across the nation. The NCA5 is focused on the US, please see the IPCC for international drought information.
Michael	Wright	Whole Chapter	04. Water						Key Topic 1 IIIII Mention increase in salinity of fresh and brackish water due to salt water intrusion from sea level rise, and decrease in salinity of sea water due to melting ice.	We thank the reviewer for this suggestion.The section on groundwater does mention saltwater intrusion, but more specific and in-depth discussion can be found in the coastal and regional chapters.
Michael	Wright	Whole Chapter	04. Water						Key Topic 1 IIIII Identify likely consequences to water resources and imposed constraints by mid century, if no significant emissions reductions are effected by 2030. Include drought due to loss of icemelt, and increased salinity due to flooding and sea level rise.	We thank the reviewer for this comment.The chapter provides a broad overview of the changes to the nation's freshwater resouces that are currently being experienced and are projected for the future. We refer readers to the Mitigation chapter for emission reduction information, and to the Coastal chapter for impacts related to sea level rise.
Michael	Wright	Whole Chapter	04. Water						Key Topic 1 IIIII For potential figures, include one showing interactions of factors that drive drought. Besides climate-induced drought, mention water consumption for human activites such as agriculture, hydraulic fracturing, residential and commercial buildings, lawns and recreation, e.g., swimming, skiing, washing cars and urban pavement.	We thank the reviewer for this suggestion. We were unable to include a figure with the specific activities listed, we are proposing a figure that highlights the role of human activities in causing or exacerbating some droughts.
Michael	Wright	Whole Chapter	04. Water						Key Topic 1 IIIII Under potential figure showing proportion of flood damage, clarify reference to ''economic growth,'' what aspects of economic growth influence flooding, and consider omitting the word ''damage.''	We thank the reviewer for this comment. We have not mentioned economic growth in our current draft, but do note that floods can cause economic and other damages.
Michael	Wright	Whole Chapter	04. Water						Key Topic 1 IIIII Under potential figures, include map of forecasted sea level rise and impact to coastal regions	We thank the reviewer for this suggestion.This topic is covered in detail in the coastal, oceans, and regional chapters.
Michael	Wright	Whole Chapter	04. Water						Key Topic 2 IIIII Drought risk erroneously includes wetlands, riparian, and aquatic ecosystems, contaminants, algal blooms. Relocate to a new section, such as Water Quality.	Thank you for this suggestion. We have reorganized the chapter to briefly discuss water quality and ecosystems under both drought and flood impacts.
Michael	Wright	Whole Chapter	04. Water						Key Topic 2 IIIII Under ''water-energy nexus,'' include water consumption for hydraulic fracturing and power plant cooling that exacerbates drought risk.	We thank the reviewer for this suggestion. This topic will be covered in the Energy chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	Wright	Whole Chapter	04. Water						Key Topic 2 IIIII Under ''compound hazards,'' to make the connection to flooding more explicit, change ''Relationship between drought and wildfire,'' to ''Relationship between drought, wildfire, and flooding.''	We thank the reviewer for this comment. Discussion of compound hazards has been moved to a NCA5-wide featured topic with contributions from multiple chapters, allowing for a deeper treatment of the topic.
Michael	Wright	Whole Chapter	04. Water						Key Topic 2 IIIII Under ''compound hazards,'' clarify reference to land disturbance, i.e., natural or human caused. If the latter, cite impervious surfaces, e.g., roads, runways, buildings and clearcutting for development that increase contaminated runoff and flood risk.	We thank the reviewer for this comment. Discussion of compound hazards has been moved to a NCA5-wide featured topic with contributions from multiple chapters, allowing for a deeper treatment of the topic.
Michael	Wright	Whole Chapter	04. Water						Key Topic 3 IIIII Under ''advances,'' cite flood-resistant transportation systems that have been proven in decades of operation around the world. Elevated systems like monorail, per Ref.2, are more climate resistant and sustainable than urban and suburban highway travel to reduce emissions, impervious surface runoff, and thereby help reduce flooding. The same is true for high speed elevated rail, which can be alternative to regional air travel. Conversely, building and expanding existing highways and runways will only increase emissions and exacerbate climate induced flooding. Also noted under Land Cover, Transportation.	We thank the reviewer for this comment. We were unable to include information about flood-resistant transportation systems in this chapter, instead focusing mainly on how floods and droughts are changing and how that impacts different communities.Thank you for providing this comment to the Transportation and Land Cover chapters as well.
Michael	Wright	Whole Chapter	04. Water						Key Topic 3 IIIII Regarding gaps in information, include additional funding for federal rainfall data, i.e., NOAA to support effective flooding assessment and mitigation planning at the state level, per Ref.9. Also noted under Coastal Effects.	We thank the reviewer for this comment. Though the chapter does not make recommendations on funding, it does address the issue of precipitation data and whether it is adequate for planning.
Whitney	Berry	Whole Chapter	04. Water	1	11	1	12	1	talks about front lines communities and how they intend to coordinate activities and actions with Chapter 16 on indigenous People as appropriate	We thank the review for this comment. We have included information on disproportionate impacts to frontline communities and are coordinating with Chapter 16.
Jason	Shafer	Whole Chapter	05. Energy						The words nuclear, biomass, wind, tidal, and hydrogen are mentioned as energy sources, but there is no mention of solar. Solar should at least have some mention. Regarding technology innovations, I did not see any mention of intermittency and how to manage this better with higher wind and solar penetration. While this could be couched under some of the technological improvements, it may be worth expanding on these challenges and the need for more storage, and grid flexibility with its modernization. Earth System Modeling - it's great to see a section included on this. As someone who has run dynamically downscaled climate models, from my experience GCMs struggle to resolve extreme storm events. A variety of methods need to be used besides dynamical climate models, such as learning from past behavior (trends), and other statistical-dynamical connections to extreme state behavior leveraged from base state changes.	We thank the reviewer for the comment. The chapter text has been revised to incorporate more mentions of solar energy. As for earth system modeling--we include it in the mitigation section, but we also mention various model outputs in the context of climate effects on energy.
Sydney	Heck	Whole Page	05. Energy		15				One issue seen on a large scale is the implication that climate change is the result of the individual. Commercial buildings and companies contribute astronomical amounts more to GHG emissions. It should be in those companies best interest to be environmentally friendly on the simple basis that if these extreme events keep occurring there will be no consumers left.	We thank the reviewer for the comment. The comment does not appear to suggest a revision.
Doug	Robbins	Whole Chapter	05. Energy						Sub-Dividing the Energy Chapter The current outline focuses on impacts of climate change on energy systems, and understates the impact of energy system on climate change. Energy is a major topic, given that fossil fuels are the primary source of GHG. Different facets of the energy issue deserve more extensive treatment, as subdivisions of the chapter or separate chapters. Consider changing the structure of the chapter into four sub-sections, reflecting current and past conditions and future scenarios: 1) Impact of energy systems on climate change and the status on decarbonizing the energy economy. How are we doing in decarbonizing our energy systems (US and globally)? What SSP pathway are we on in 2022? 2) Impacts of climate change on energy systems. 3) Show the magnitude and timing of expected impacts of various decarbonizing policies (compare cessation of Federal oil & gas leasing, carbon tax, cap & trade, etc.). Recognize regional differences -- GHG mitigation actions and policies, including market approaches, may impact regions and communities differently. Include a forecast of the future national energy mix, depending on policies adopted. 4) Compare economic and environmental impacts of decarbonizing energy options, depending on the scale of non-carbon energy solutions adopted (mining, nuclear waste, ecosystem impacts of wind & solar).	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 appreciably. Presumably, the introductory chapters will mention the role of energy systems in causing climate change and in meeting carbon targets; these were addressed in Chapter 2 of the 4th National Climate Assessment. The mitigation chapter handles some aspects of decarbonization beyond what is described here. Discussion of environmental and economic impacts of decarbonization are beyond the scope of this report.
Doug	Robbins	Whole Page	05. Energy		15				"What's New" Topics: > Describe the current pace of replacing US fossil-fuel energy with low-carbon energy, relative to the pace needed to meet appropriate targets (e.g., the 2 degree pathway, or achieve zero-carbon electrical generation and on-road transportation by 2035). > Update on distributed electrical production, such as home-scale solar, including cost impacts to utilities and other customers. > Energy delivery and security ,Äì discuss the February 2021 low-temperature and energy shortfall event. There is a need to examine the loss of gas supply in this event. There has been a major shift in south-central gas supply since 2005, replacing gas from the Gulf of Mexico with gas from onshore shale-gas wells, which are more likely to be impacted by cold weather. Low volume, onshore wells are prone to gas hydrate problems in freezing weather due to exposure to cold in gathering lines before moisture can be removed in gas processing facilities.	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 to specifically address these additional topics but in numerous areas the trends noted are referenced in directly. For example, the last suggested topic is very important, but we only have space to mention these changes quickly.
Doug	Robbins	Whole Chapter	05. Energy						Tensions and conflicts > Recognize conflicting priorities of restoring natural rivers in the Pacific NW, versus maintaining existing carbon-free electrical generation > Recognize conflicting priorities of shutting down existing nuclear generating capacity versus maintaining existing carbon-free electrical generation (e.g. Diablo Canyon Power Plant, California). > Recognize conflicting priorities of employment and economy versus transition to carbon-free energy in fossil-fuel extraction economies (Alaska, West Virginia, North Dakota, Texas, Louisiana, Wyoming, etc.), > Recognize conflict of distributed household power generation versus utility reliability and profitability, and the shift of infrastructure fixed costs to low-income utility customers.	We appreciate this suggestion, but space is limited and does not allow a treatment of all the societal tradeoffs associated with mitigation and adaptation, although the text now includes several examples to supplement the information presented in the Mitigation and Adaptation Chapters.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Doug	Robbins	Whole Chapter	05. Energy						Electrification and Decarbonization Status and Forecast A call-out box or figure is needed to show the history of national electrical generation capacity, with the percentage of zero-carbon component over past decades. A forecast figure is also needed, showing needed electrical generation by 2050 assuming electrification of ground transportation and economic growth. Include estimate of required capital investment in renewable energy to reach that goal.	We thank the reviewer for the comment. The chapter has been revised to incorporate a figure on the changing percent of renewable energy. Future projections are dependent upon a range of policy assumptions, deployment scenarios, and goals among other variables. Space limitations do not allow an adequate treatment of this issue.
Joseph	Zajac	Whole Chapter	05. Energy						fails to state the obvious - no sun, no wind, no green power generated	The variability of specific generation sources is addressed in both areas addressing role of a diverse generation portfolio to address diurnal and seasonal impacts on the energy system as well as the role of storage.
Joseph	Zajac	Whole Chapter	05. Energy						fails to state that green power must be backed up by fossil fuel power	We thank the reviewer for the comment. The chapter has been revised to address the intermittent nature of certain renewables.
Joseph	Zajac	Whole Chapter	05. Energy						fails to present the unreliability of green power generation	We thank the reviewer for the comment. The chapter has been revised to address the intermittent nature of certain renewables.
Joseph	Zajac	Whole Chapter	05. Energy						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.	We thank the reviewer for the comment. However, the authors believe this comment is inconsistent with the current state of the science on this topic. Increased frequency and intensity of wildfire is attributable to climate change, even if ignitions are caused by humans.
Joseph	Zajac	Whole Chapter	05. Energy						nothing appears to cover the COST of what is being discussed	We thank the reviewer for the comment. Space limitations do not allow a robust treatment of the costs of all impacts or mitigation/adaptation scenarios, but the text has been revised to include illustrative cost examples.
Joseph	Zajac	Whole Chapter	05. Energy						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.	We thank the reviewer for the comment. The chapter text has been revised to address the use of critical materials for a clean energy economy and the potential vulnerability to the supply chain.
Roy	Clark	Whole Chapter	05. Energy						Comment on NCA5, Chapter 5 .Energy Supply, Delivery and Demand Roy Clark PhD President Ventura Photonics Thousand Oaks CA 91360 The first step for Chapter 5 is the quantitative determination of the effects of the observed increases in the atmospheric concentration of so called ‚Äògreenhouse gases‚Äô, particularly CO2 on the earth‚Äôs climate. This then provides the foundation for any actions that need to be taken. Over the past 200 years, the atmospheric concentration of CO2 has increased by approximately 130 parts per million (ppm), from 280 to 410 ppm. The concentration is still increasing and is now approaching 420 ppm [Keeling, 2021]. This has produced a decrease near 2 W m-2 in the longwave IR (LWIR) flux emitted to space within the CO2 emission bands. There has also been a similar increase in the downward LWIR flux from the lower troposphere to the surface [Harde, 2017]. At present, the annual average increase in CO2 concentration is about 2.4 ppm. This produces an annual increase in the downward LWIR flux to the surface of approximately 0.034 W m-2. A quantitative thermal engineering analysis of the effects of these CO2 induced LWIR flux changes on temperatures in the troposphere, and on land and ocean thermal reservoirs shows that there can be no measurable effect on the earth‚Äôs climate [Clark, 2013]. The results from equilibrium climate models such as the CMIP5/6 ‚Äòensembles‚Äô are fraudulent and should not be used for climate assessment. The fundamental climate modeling error is the assumption of an equilibrium average climate that can be perturbed by CO2 [Knutti and Hegerl, 2008]. Since there is no equilibrium, a change in flux produces a change in the rate of heating or cooling. A change in LWIR flux cannot be used directly to calculate a change in ‚Äòsurface temperature‚Äô. A ‚Äòdoubling‚Äô of the CO2 concentration from 287 to 574 ppm at mid latitudes produces a maximum increase in the tropospheric heating rate of 0.08 K per day at an altitude near 2 km. [Jacono et al	We thank the reviewer for the comment, and the references provided.
Deen	Syed	Whole Chapter	05. Energy						This outline touched on several very important points regarding the production and use of energy in the United States. Producing and distributing energy throughout the country and at all times is a significant topic, as is how existing climate change trends can impact the current energy grid, but I believe that there should be more of a focus on clean energy sources going forward. The third key topic only mentioned "nuclear technologies" once, but it is imperative that new, clean energy sources and their potential implementation are talked about in great detail. This as well as carbon dioxide capture efforts, ocean energy, electric vehicles, and the elimination of carbon-centric energy systems must be spoken about in greater detail. Aside from this one point of interest, the rest of the chapter's key topics and subtopics are all necessary and adequately summarized.	We appreciate this suggestion, but space is limited and does not allow a detailed treatment of all the existing and innovative clean energy technologies but the majority, if not all, of the technologies you reference in this comment are included in the revised chapter.
Emily	Eisenhauer	Whole Chapter	05. Energy						The chapter should address the impact on jobs of the transition to new forms of energy and new industries. It should discuss both the loss in fossil fuel sectors and the growth in renewable sectors, evidence about the social impacts and what can be done to alleviate them. This is part of addressing climate justice.	We thank the reviewer for the comment. Space limitations do not allow a robust treatment of all the impacts of mitigation and adaptation strategies in this chapter. These aspects will be addressed in the Mitigation and the Adaptation Chapters.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Joseph	Sollod	Whole Page	05. Energy		18				This chapter should consider including discussion on the important role of building codes, for both climate mitigation and adaptation. 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. This will ultimately enhance energy system, social, and infrastructural resilience. Energy codes are an important policy tool in both climate mitigation and adaptation. Energy codes are 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. It will be important to touch on the impact of building codes, and their proper implementation and enforcement, as a solution to "hardening" energy systems and building function. Increasing levels of energy efficiency in buildings can lead to less energy demand,ÄÎthus decreasing reliance on fossil fuels and enhancing the ability to achieve zero energy goals through increased renewable energy deployment. Additional buildings policies including incentives to drive retrofits or ongoing performance requirements should be coordinated with building energy codes to assure a holistic policy approach aligned with overall energy and GHG reduction goals. In addition to protecting residents from the impacts of hazard events, buildings use energy to support occupant comfort and health, and the important functions they house. Assuring buildings use energy efficiently is essential for protecting human health, economic prosperity and reducing the impacts of climate change. Other building codes beyond energy codes protect building occupants from hazards,ÄÎincluding those driven by climactic conditions. As climate change influences the intensity and frequency of disasters, building codes must adjust to address the changing risks buildings and infrastructure will face over their lifetime (sometimes 50 to 100 years). The availability of climate science in a format and level of granularity necessary to support the design, construction and operations process will be essential	We appreciate this suggestion. While space is limited, the authors have added a section on GEBs (Grid-interactive efficient buildings) which covers technologies of energy efficiency, demand flexibility, storage, on-site PV and controls. The Built Environment chapter may have room to further illustrate the impacts and significance of building energy codes and standards.
Joseph	Sollod	Whole Chapter	05. Energy						Energy codes are highly effective in reducing energy use and greenhouse gas emissions while also saving building owners and tenants money and enhancing their resilience. Implementation of energy codes also results in job creation. 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 CO2 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 2021 IECC also includes an appendix for achievement of zero energy buildings. DOE has also found that use of the 2021 IECC will save U.S. homeowners an average of $2,320 over the lifetime of a typical mortgage (30 years) and, if implemented nationally, would create over 22,000 jobs in the first year and 632,000 jobs cumulatively over 30 years.	We appreciate this suggestion. While space is limited, the authors have added a section on GEBs (Grid-interactive efficient buildings) which covers technologies of energy efficiency, demand flexibility, storage, on-site PV and controls. The Built Environment chapter may have room to further illustrate the impacts and significance of building energy codes and standards.
Juanita	Constible	Whole Page	05. Energy		16				Key Topic 1, Climate Impacts on Energy Supply, Delivery, and Demand: This section should address the particular vulnerability of fossil fuel infrastructure to climate change-driven weather disasters. Pipelines and refineries are particularly vulnerable to cascading disasters. Severe storms and heavy rains can cause erosion and sedimentation that may cause shifting of the pipe, which can in turn lead to explosions, as well as damage to waterbodies or farmland. Hurricanes and resultant flooding have frequently caused damage to refineries, not only threatening energy supply but risking oil spills and hazardous air pollutant releases.	We thank the reviewer for the comment. The outline has been revised, and the chapter now includes several references and examples of effects of extreme events on fossil fuel infrastructure.
Evan	Mills	Whole Page	05. Energy		16				Re: Key Topic 1 > Energy Demand, third bullet There is significant recent analysis and discussion of heat pump water heating (all sectors), as well as its potential for short-term storage, in the following report. This includes a national assessment of applications in the U.S. industrial and municipal sectors (virtually unexamined in the past). Alstone, P., E. Mills, J. Carma, and A. Cervantes. 2021. "Towards Low-Carbon Hot Water and Industrial Heat with Efficient and Flexible Heat Pumps." Humboldt State University, 113 pp. https://drive.google.com/file/d/1iqZ1ANdveB_bVdNxlHyKUs0pmDGkHkel/view?usp=sharing	We thank the reviewer for the comment. The chapter has been revised to address heat pumps.
Ally	Beasley	Whole Page	05. Energy		15				What does a resilient carbon-pollution-free energy system entail? What is meant by "clean" hydrogen and what types of hydrogen production are included or excluded from that definition for the purposes of this report? Fossil gas hydrogen production should not be considered "clean." As one peer-reviewed study stated, "there really is no role for blue hydrogen in a carbon-free future,Äù because of the largely unavoidable climate pollution that would accompany it. See, e.g., Howarth R. Jacobson M. (2021). How Green is Blue Hydrogen? Energy Science and Engineering. Available at https://onlinelibrary.wiley.com/doi/full/10.1002/ese3.956.	We thank the reviewer for the comments. The authors have modified the text to clarify the use of terms such as "clean" hydrogen.
Jhoset	Burgos	Whole Page	05. Energy		17				Under Key Topic 2: Changes that can affect the energy system vulnerability to climate change. Add: projected and potential multimeter sea level rise plus short-term flooding events and coastal erosion. Suggested Language: The energy system must confront multiple changes in threats due climate change, ageing energy infrastructure, projected and potential multimeter sea level rise plus short-term flooding events and coastal erosion, cyber and physical assaults, supply chain issues, and changes in energy technologies, markets, and energy policies.	We thank the reviewer for the comment. This chapter will utilize the climate science information presented in the Climate Trends chapter, which is not supportive of the reviewer's comment on projected sea level rise.
Michael	Wright	Whole Chapter	05. Energy						General Comments IIIII America continues to subsidize and consuming fossil fuels as primarily energy source, waste significant quantities of electrical power and vehicular fuel, and generally oppose nuclear power.	We thank the reviewer for the comment. The comment does not appear to raise a question or suggest a revision.
Michael	Wright	Whole Chapter	05. Energy						General Comments IIIII Natural gas continues to be promoted as a transition fuel, even though DoE has concluded, per Ref.3, that it has higher upstream emissions than even coal, while releasing fugitive emissions of indeterminate quantity from infrastructure and abandoned wells.	We thank the reviewer for the comment. The comment does not appear to raise a question or suggest a revision.
Michael	Wright	Whole Chapter	05. Energy						General Comments IIIII A comprehensive life cycle analysis of nontraditional fossil fuels, e.g., natural gas from fracking, oil from tar sands, oil and gas from shale must be conducted to better inform the public and policymakers regarding their costs in extraction, emissions, and climate impacts.	We thank the reviewer for the comment. Life-cycle analysis is not within the scope of the chapter, and it is not the role of this report to indicate what types of LCAs must be conducted.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	Wright	Whole Chapter	05. Energy						What's New IIIII Under ''Advances in IT, etc.,'' also mention the increased energy demand due to development of large data processing and computing centers.	We appreciate this suggestion, but space is limited and does not allow a detailed treatment of all areas of future growth in energy demand but references that trend overall.
Michael	Wright	Whole Chapter	05. Energy						What's New IIIII Cross reference threats to national security with ''Climate Effects on US International Interests'' and and or ''Sector Interactions, Multiple Stressors, and Complex Systems.''	We thank the reviewer for the comment. The Energy Team can coordinate with the International and Complex Systems Chapter for where to best address national security.
Michael	Wright	Whole Chapter	05. Energy						What's New IIIII Include increased production of higher carbon, nontraditional energy sources, such as natural gas from hydraulic fracturing, and oil from tar sands and shale. Consequences include water contamination, land development, habitat loss, and carbon and other hazardous emissions, both local and distributed, e.g., along pipeline routes and at distribution points.	We appreciate this suggestion, but space is limited and does not allow a detailed treatment of all the existing fossil energy operations and their environmental impacts that have already been addressed in prior National Climate Assessment reports.
Michael	Wright	Whole Chapter	05. Energy						What's New IIIII Include increased availability and consumption of ethanol blended gasoline produces high upstream emissions and induces greater fuel consumption due to its lower energy content, i.e., lower mpg compared to pure gasoline, requiring burning more fuel to travel the same distance. Also noted under Land Cover, Agriculture, Transportation, Economics.	We appreciate this suggestion, but space is limited and does not allow a detailed treatment of all the existing fossil energy operations and their environmental impacts that have already been addressed in prior National Climate Assessment reports.
Michael	Wright	Whole Chapter	05. Energy						What's New IIIII Include increased awareness of thousands unidentified methane sources, including faulty natural gas equipment, improper flaring operations, and fugitive emissions from coal mines and gas wells, per Ref.4.	We appreciate this suggestion, but space is limited and this topic can be addressed under the Mitigation chapter.
Michael	Wright	Whole Chapter	05. Energy						What's New IIIII Include increased development of buildings and vehicular transportation infrastructure, like, roads, parking lots, etc., that induces increased energy consumption while also not incorporating occupation sensors or smart controls to reduce energy use when not needed.	We appreciate this suggestion, but space is limited, and this topic can be addressed in the Transportation chapter.
Michael	Wright	Whole Chapter	05. Energy						What's New IIIII Include increased energy demand due to A. increased use of personal electronics, B. more parasitic and standby loads in homes and businesses, C. increased vehicular idling, e.g., for smart phone use and drive throughs, D. greater proliferation of higher ethanol gasoline that yields lower mpg, E. inherently more vehicles, buildings, and people, F. increased shipping of goods ordered online and returned, with concomitant use of resources for packaging, G. post COVID reductions in mass transit ridership resulting in higher overall vehicle miles travelled, or VMT, H. proliferation of EV's that induce increased demand for electricity. Also noted under Land Cover, Transportation, Economics.	We appreciate this suggestion. While space is limited, the authors have addressed many of the topics highlighted in the comment. We focused more on energy demand that was increasing because of climate change, e.g., additional cooling needed in regions that are warming.
Michael	Wright	Whole Chapter	05. Energy						What's New IIIII Include decreased energy demand due to: replacement of incandescent and CFL lighting with LED's; increased efficiency of new appliances.	We appreciate this suggestion, and language has been added to address this point.
Michael	Wright	Whole Chapter	05. Energy						What's New IIIII Include proliferation of disinformation campaigns, often funded by the fossil fuel industry and spread on social media, is increasing opposition to renewable energy, per Ref.5.	We thank the reviewer for the comment, but this comment is outside the scope of this report.
Michael	Wright	Whole Chapter	05. Energy						What's New IIIII Include billions in federal infrastructure funding that is being used to plug approx. 2 million abandoned oil and gas wells that leak methane and contaminate water, per Ref.6. Also noted under Economy, Northeast.	We thank the reviewer for the comment. Space limitations do not allow a robust treatment of all the impacts of the energy system on climate, including the oil and gas sector. Additional treatment will be provided in the Mitigation chapter. This chapter is focused more on the effects of climate change on the energy sector.
Michael	Wright	Whole Chapter	05. Energy						What's New IIIII Include new technologies for fossil fuel exploration, e.g., deep water, artic and extraction, e.g., shale, tar sands, hydraulic fracturing. These produce high upstream emissions, per Ref.3, while also increasing production, thereby exacerbating climate change through fugitive leaks and more end use emissions.	We thank the reviewer for the comment. Space limitations do not allow a robust treatment of all the impacts of the energy system, including the oil and gas sector. Additional treatment will be provided in the Mitigation chapter.
Michael	Wright	Whole Chapter	05. Energy						What's New IIIII Include that the fossil fuel industry is increasing greenwashing claims of investments in renewables, although the data shows this is not being implemented in practice, per Ref.1.	We thank the reviewer for the comment, but this comment is outside the scope of this report.
Michael	Wright	Whole Chapter	05. Energy						What's New IIIII Include availability of airborne and space based observations of energy sector emissions, e.g., methane that help identify not only released and fugitive emissions, but also infrastructure deficiencies and vulnerabilities that can be corrected and reparied to reduce emissions. This also includes the ability to identify orphan and abandoned coal mines and oil and gas wells that leak methane, e.g., CarbonMapper.	We appreciate this suggestion. While space is limited, the authors have added language to recognize technology advances for monitoring GHG emissions.
Michael	Wright	Whole Chapter	05. Energy						What's New IIIII Include fact that new pipelines have been completed that enable greater distribution and consumption of fossil fuels, e.g., Mariner East in PA that transports high carbon gas from the Marcellus Shale Formation.	We thank the reviewer for the comment. Space limitations do not allow a robust treatment of all the potential impacts of an evolving energy system. However the regional chapters do provide an opportunity to address these changes at the regional level.
Michael	Wright	Whole Chapter	05. Energy						Key Topic 1 IIIII Under ''Energy Supply,'' first sentence is not clear, since it mentions benefits. Suggested wording: ''Climate change is impacting energy generation and supply systems. Examples include . . . ''	We appreciate this suggestion. The authors have revised the text to address the comment.
Michael	Wright	Whole Chapter	05. Energy						Key Topic 1 IIIII Under ''Energy Delivery'' Item 6, mention impact of permafrost melting on pipelines that then exacerbates climate change due to methane emissions and also contaminates land and water.	We thank the reviewer for the comment. The authors have modifed the text to include the issue of permafrost thawing and impacts on both delivery as well as methane emissions.
Michael	Wright	Whole Chapter	05. Energy						Key Topic 1 IIIII Delete ''Energy Demand'' Item 4, since it is a means of mitigating climate change, not an impact.	This comment is inconsistent with the current state of the science on this topic. It is anticipated that climate change will have direct impacts how, where, and when energy is used.
Michael	Wright	Whole Chapter	05. Energy						Key Topic 1 IIIII Under ''Energy Demand,'' mention Americans' laissez faire attitude toward energy use. Examples include A. driving for coffee or fast food, and then idling in lots or drive throughs, B. vehicular idling to power smart phones, and to heat and cool vehicle interior, C. using leaf blowers for landscaping and snow blowers for clearing pavement, D. lighting unoccupied spaces, including building interiors and exteriors, parking lots, E. leaving doors for stores and other facilties open during hot and cold weather, F. excessive HVAC temperature settings, G. using laundry driers rather than hanging clothes, as is done in other countries, H. ornamental lighting, backlit signage, and excessive highway illumination.	We thank the reviewer for the comment. Indeed energy conservation through human behavior changes should be part of the mitigation strategies to reduce energy use and carbon emissions in buildings (and transportation). Due to the space limit of the Energy chapter, this topic is better covered in the Chapter Human Social Systems.
Michael	Wright	Whole Chapter	05. Energy						Key Topic 1 IIIII Under ''Equity,'' include that these high risk populations have paradoxically contributed the least to climate change	We thank the reviewer for the comment. While the authors have not addressed attribution for different groups and their relative contribution to climate change, we have highlighted in the chapter the disproportionate impacts of climate change on disadvantaged communities.
Michael	Wright	Whole Chapter	05. Energy						Key Topic 1 IIIII Mention increasing climate induced extreme weather events cause power outtages that then induce even more emissions, such as increased use of fossil fueled generators and cutting trees for firewood.	This comment is inconsistent with the current state of the science on this topic.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	Wright	Whole Chapter	05. Energy						Key Topic 2 IIIII In the introduction, clarify that this section addresses both negative and positive changes.	We thank the reviewer for the comment. The authors believe the text effectively communicates the positive or negative implications of the described changes.
Michael	Wright	Whole Chapter	05. Energy						Key Topic 2 IIIII Under ''Compounding and Cascading,'' clarify and explain how COVID 19 can impact the energy system, and what is meant by ''electromagnetic pulse events,'' e.g., coronal mass ejections, foreign adversary EMI, domestic terrorist attacks, etc.	We appreciate this suggestion. The authors have modifed the text to clarify the terms.
Michael	Wright	Whole Chapter	05. Energy						Key Topic 2 IIIII Under ''Compounding and Cascading,'' mention that more resilience and tolerance is afforded with distributed energy systems like solar, which also help to mitigate climate change itself.	We thank the reviewer for the comment. The authors believe this point is already addressed elsewhere in the chapter, and due to space constraints believe it's unnecessary to repeat it in this section of the chapter.
Michael	Wright	Whole Chapter	05. Energy						Key Topic 3 IIIII Under ''Technology Development and Deployment,'' the first sentence is confusing. Explain how decarbonizing the energy system is accomplished through large scale use fo fossil fuel and petrochemicals.	We thank the reviewer for the comment. The authors have modified the text to address the comment.
Michael	Wright	Whole Chapter	05. Energy						Key Topic 3 IIIII Under ''Compounding Threats,'' explain how pandemics can impact the energy system, and what is meant by ''electromagnetic pulse events,'' e.g, coronal mass ejections, foreign adversary EMI, domestic terrorist attacks, etc.	We appreciate this suggestion, and language has been added to address this point.
Michael	Wright	Whole Chapter	05. Energy						New Key Topic IIIII Add new key topic to address continued expansion of fossil fuel exploration, extraction, production, and distribution that counterpoises efforts to reduce emissions and mitigate climate change.	Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations including cost analysis of alternative measures.
Michael	Wright	Whole Chapter	05. Energy						New Key Topic IIIII Address fossil fuel subsidies and accountability with regards to new drilling and wells, to ensure that company's budget sets aside money for plugging after decomissioning, per Ref 6.	Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations including cost analysis of alternative measures.
Michael	Wright	Whole Chapter	05. Energy						Other Comments IIIII Mention conservation measures, both lacking and possible, including building insulation, incentives to use less rather than more power, technology to deactivate lighting and HVAC when areas are unoccupied, and energy saving equipment. Also noted under Built Environment.	We appreciate this suggestion. While space is limited, the authors have added a section on GEBs (Grid-interactive efficient buildings) which covers technologies of energy efficiency, demand flexibility, storage, on-site PV and controls.
Michael	Wright	Whole Chapter	05. Energy						Other Comments IIIII There is currently no incentive for the fossil fuel industry to plug abandoned wells. Although they are required to do so, penalties are insufficient compared to the cost of plugging, per Ref.6. Also noted under Economics, Northeast.	Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations including cost analysis of alternative measures.
Michael	Wright	Whole Chapter	05. Energy						Other Comments IIIII Identify likely consequences to the energy industry and imposed constraints by mid century, if no significant emissions reductions are effected by 2030.	We appreciate this suggestion, but space is limited and does not allow a detailed treatment of various scenarios and timeframes regarding the consequences to the energy system in the absence of emission reductions. The Mitigation chapter does provide some additional discussion.
Michael	Wright	Whole Chapter	05. Energy						Other Comments IIIII Renewable energy supply is currently insufficient to support increased popularity of EV's, and forecasted number of EV's to meet emissions reduction goals.	This comment is inconsistent with the current state of the science on this topic.
Michael	Wright	Whole Chapter	05. Energy						Other Comments IIIII Policy and funding at the state level predominantly disincentivize renewable energy, including a lack of subsidies to the industry, and grants and financing for prospective customers. At the same time, billions in fossil fuel subsidies continue, at a time when that industry is repleat with billions in profits. Unless this policy disconnect is addressed, carbon emissions are likely to increase with increasing demand.	Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations including cost analysis of alternative measures.
Michael	Wright	Whole Chapter	05. Energy						Other Comments IIIII Address other fossil fuels used for fuel, such as propane, including upstream emissions and fugitive leakage.	We thank the reviewer for the comment. Due to space limitations the authors believe that this topic has adequately been made in the Energy Chapter of NCA4.
Catherine	Buchanan	Whole Chapter	06. LCLUC						Pg. 19, under What's New, second bullet: Will agriculture intensification separate livestock grazing from plants? Pg. 20, second bullet under "Landslides, rockfalls, debris flows..." Will the logging of hillslopes be included with the "Increased risk of physical landscape disturbances with climate change"? When hillslopes are logged, the influence of increased storm intensities creates the perfect conditions for larger landslides, rockfalls, etc., of the logged hillslopes because the protective vegetation and the root systems that had held the land in place has been removed. Pg. 20, Under the bullet "One example is the large die-off of pinyon and juniper forests, believed to stem from global change-type drought (i.e., hot drought), interaction with beetles..." This is inaccurate because another stressing factor that is not included is the overdraft of the aquifer, which effectively lowered groundwater levels out of the reach of the root systems. Trees naturally are able to repel beetles and other harmful insects if there is enough water to flow throughout the tree. In the semi-arid regions where the groundwater has been pumped dry, the trees then solely relied on precipitation. Conditions became extreme when climate change intensified and increased the temperature. The trees responded to increased temperatures and increased the rate of transpiration.	The current draft now includes consideration of intensification of both grazing and cropping. The current draft now includes the influence of logging and hillslope disturbance on landslide occurrence. The construction of new roads as part of logging activities is often associated with these types of landslides. The current draft now includes mention of drought-related tree mortality in forests in the southwest.
Yi-Lin	Tsai	Whole Page	06. LCLUC			19			When we say, "connecting historical and future scenarios of land use," maybe we can clarify by indicating what kinds of technologies are used. For example, we could say, "connecting historical and future scenarios of land use by satellite imagery or Google Earth Engine."	We cite the relevant literature that gives these details in the current draft.
Yi-Lin	Tsai	Whole Page	06. LCLUC			20			When debris flows are mentioned in "Landslides, rockfalls, debris flows, flooding and other storm damage, and wildfires are all more likely (risk to life/property) in response to or exacerbated by severe weather events," maybe we could emphasize the points that landslides, rockfalls, and debris flows could be triggered by compound effects of severe weather events, worse land use and land cover condition, or frequent earthquake. In other words, landslides, rockfalls, and debris flows may not just caused by severe weather events but multiple factors of climate, Land Cover and Land-Use Change, and local disaster risks.	We agree that landslides and debris flows are sometimes triggered or exacerbated by compound influences (rain after wildfire, for example), and this is discussed using the Montecito post-fire debris flows of 2018 as an example in our current draft; we do mention there that multiple factors of climate fed into this (fire plus extreme rain). We also mention some land uses exacerbating landslide risk. However, expanding the discussion to include seismically triggered landslides and other effects of earthquakes was, we felt, beyond the scope of this report, given space limitations.
Yi-Lin	Tsai	Whole Page	06. LCLUC			21			In Key Topic 2: Goods and services, maybe we can also include the disaster resilience ecosystem and Land Cover and Land-Use can provide, such as protect coastal areas from flooding, not just coastal erosion.	Coastal responses are mentioned in our 1OD but details of coastal area flooding and erosion will be handled by the Coastal Effects chapter.
Yi-Lin	Tsai	Whole Page	06. LCLUC			22			In addition to "Consider links between land use and risks of future pandemics.", maybe we could say integrating traffic system like roads or commute style into future planning of Land Cover and Land-Use Change when people work from home more often.	Space limitations have prevented us from discussing the connections between land cover change and shifting work patterns.
Yi-Lin	Tsai	Whole Page	06. LCLUC			22			In the Potential figure, maybe a mind-map style can be helpful in brainstorming with these multiple land-use options.	Current draft includes a figure illustrating dynamics of land cover over time, a figure describing connections among aspects of land system resilience, and a conceptual figure describing drivers and outcomes for future land use options.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Joseph	Zajac	Whole Chapter	06. LCLUC						the authors give the impression that they know more about land management than the farmers who are driven by market forces and consumer demands	We agree that it is important to center farmers, landowners, and other local decision-makers when describing either current land use trends or possible land use futures. We intend that our chapter will describe land use trends from both top-down (i.e., IPCC scenario analyses) and bottom-up (i.e., individual landowner decision-making) perspectives. We intend to explore how future climate-driven disruptions to agricultural productivity might initially manifest for individual farmers (e.g., increasing yield variability, and increasing reliance on crop insurance payments).
Richard	McNider	Whole Chapter	06. LCLUC						6. Land Cover and Land-Use Change You should note that the ‚ÄúWarming Hole‚Äù over the Southeast and extending up into the dry Midwest may have its roots in land use change. For the SE this may be due to the loss of agriculture beginning in the 1930‚Äôs resulting in reforestation (see Ellenburg, W.L., McNider, R.T., Cruise, J.F. and Christy, J.R., 2016. Towards an understanding of the twentieth-century cooling trend in the Southeastern United States: biogeophysical impacts of land-use change. Earth Interactions, 20(18), pp.1-31.) For the dry upper Midwest it may be due to increased irrigation (Nikiel, C.A. and Eltahir, E.A., 2019. Summer climate change in the Midwest and Great Plains due to agricultural development during the twentieth century. Journal of Climate, 32(17), pp.5583-5599)	The contribution of land use change (including agrucltural abandonment in the SEUS and intensification in the Midwest) to cooling and precipitation increase is included in current draft.
Theodore	Weber	Whole Chapter	06. LCLUC						Relevant to Ch. 6 of NCA5ZOD, I emailed the following documents to review@usgcrp.gov: 1. "Achieving climate connectivity in a fragmented landscape.pdf" (McGuire, J. L. et al. 2016. Achieving climate connectivity in a fragmented landscape. PNAS 113(26):7195-7200. https://doi.org/10.1073/pnas.1602817113) Under rapidly changing climatic conditions, in which many species must adapt or move to preclude extinction, fragmentation limits one critical coping strategy, especially for amphibians, reptiles, and small mammals. The authors found that corridors will be critical for movement, given high habitat fragmentation levels. This need is particularly critical in the southeastern United States and regions with fragmented landscapes and few nearby climatic refuges. Facilitating movement between natural lands will greatly improve the chances of species being able to track suitable climates. 2. "Protecting irrecoverable carbon in Earths ecosystems.pdf" (Goldstein, A., et al. 2020. Protecting irrecoverable carbon in Earth‚Äôs ecosystems. Nature Climate Change 10:287,Ä‚295. https://doi.org/10.1038/s41558-020-0738-8) Avoiding catastrophic climate change requires rapid decarbonization and improved ecosystem stewardship. To achieve the latter, ecosystems should be prioritized by responsiveness to direct, localized action and the magnitude and recoverability of their carbon stores. The authors show that a range of ecosystems contain 'irrecoverable carbon' that is vulnerable to release upon land use conversion and, once lost, is not recoverable on timescales relevant to avoiding dangerous climate impacts. Mature forests and wetlands have especially high stores of carbon. To achieve climate goals, we must safeguard these irrecoverable carbon pools through an expanded set of policy and finance strategies. 3. "Resilient_and_Connected_Landscapes_For_Terrestial_Conservation.pdf" (Anderson, M.G., Barnett, A., Clark, M., Prince, J., Olivero Sheldon, A. and Vickery B. 2016. Resilient and Connected Landscapes for Terrestrial Conservation. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office. Boston, MA.) A mapping of areas best able to support plants and animals in a changing climate, and representing	We will review the suggested publications and consider them for inclusion. We agree that it is valuable to highlight the asymmetry between the speed at which ecosystem carbon stocks can be lost versus the time required to regain them, and we will look for opportunities to make this point in the chapter. Our current draft includes the topic of landscape fragmentation; space is highly constrained and an extensive discussion is not possible.
DAnn	Williams	Whole Chapter	06. LCLUC						From: D‚ÄôAnn Williams, Johns Hopkins School of Public Health, Center for a Livable Future To: USGCRP ‚Äì NCA5 Chapter Authors Re: USGCRP NCA5 Chapter Outline Comment Disclaimer: The opinions expressed herein are our own and do not necessarily reflect the views of The Johns Hopkins University. February 19, 2022 Dear Chapter Authors, Thank you for the opportunity to comment on the United States Global Change Research Program Strategic Plan (2022-2031) Prospectus and Chapter Outlines. We are researchers at the Johns Hopkins Center for a Livable Future (CLF), an interdisciplinary research center based at the Johns Hopkins Bloomberg School of Public Health. CLF applies science and systems thinking to help build healthy, just, equitable, resilient, and sustainable food systems. We have reviewed the USGCRP strategic plan prospectus (SPP), reviewed the chapter outlines and have attended many of the NCA5 Public Engagement Workshops held by USGCRP and chapter authors. These virtual sessions have been informative, as well as interactive and inclusive. We strongly support the vison and mission of this multi-agency cooperative program to fully ‚Äúunderstand the forces shaping the global environment, both human and natural and their impacts on society.‚Äù There are four pillars for this work as stated in the USGCRP SPP: 1. advancing science, 2. informing decisions, 3. engaging the nation and 4. collaborating internationally. Under these four pillars are cross-cutting themes, diversity and inclusion, risk-based approaches, enhanced social science integration, communication, and workforce development. To adequately advance science and inform the development and implementation of climate change solutions, we urge you to stress the importance of developing multi-agency research and programs that improve our understanding of the public health implications of climate change and pathways to address agriculture and food systems contribution to climate change while protecting public health and environmental justice. Currently there are numerous gaps in our knowledge around current policies and practices and climate change and even fewer	Thank you for these comments. We agree that it is important to consider both climate change effects on agriculture, and the contribution of the agricultural sector to climate change. Our evolving chapter draft currently devotes substantial space to the former topic. The latter topic falls largely within the purview of the Agriculture chapter, though we do mention that food waste and high-meat diets both carry a substanting land use footprint, and that reducing that footprint might free up agricultural land for other uses. We also include explicit discussion of how land cover and land use change contribute directly to greenhouse gas emissions, including conversion of forest to agriculture.
Michael	Wright	Whole Chapter	06. LCLUC						What's New IIIII Under ''New focus on environmental justice and socioeconomic,'' mention increased development of agricultural land driven by unjust distribution of profits away from farms that are then sold, and converting forests and other natural areas driven by land value and zoning policies.	Our current chapter does highlight changes in developed area over time as a dominant feature of recent land cover change. We have included reference to societal drivers of land use change.
Michael	Wright	Whole Chapter	06. LCLUC						What's New IIIII Add ''Advanced space based observatories, e.g., LandSat 9, data processing systems, and information systems that make land use data widely available. Also noted under Forests, Oceans, Built Environment.	This information is included in the current draft.
Michael	Wright	Whole Chapter	06. LCLUC						What's New IIIII Include COVID impacts, i.e., zoonotics due to increases in proximity of human activity to wildlife.	Thank you for the suggestion. Space limitations have prevented going into discussion of zoonotics and connections to land cover and land use. There is a brief mention in our current draft.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	Wright	Whole Chapter	06. LCLUC						What's New IIIII Add ''Significant increase in illegal logging in rainforests such as the Amazon, driven by: political inaction, lack of public awareness of problem and of its impacts to climate change, and lack of policies to disincentivize importing products, e.g., wood, produce, meat from rainforest regions.'' Also noted under Forests.	While deforestration in regions outside the US does affect global climate patterns, this topic is outside the scope of the Land Use and Land Cover chapter, which is focused on domestic drivers and impacts. Due to space constraints, a wider scope cannot be accommodated.
Michael	Wright	Whole Chapter	06. LCLUC						What's New IIIII Add ''Significant increase in impervious surfaces such as buildings, roads, parking lots, that impairs ground water supplies, increases contaminated runoff, and reduces amount of vegetation that uptakes carbon, thus exacerbating climate change. Also noted under Water, Built Environment.	A brief discussion of impervious surfaces and related impacts is included in the resilience section of the current draft.
Michael	Wright	Whole Chapter	06. LCLUC						What's New IIIII Add "More resource extraction on federal and state lands, particularly under the Trump Administration, including those set aside for indigenous peoples such as Indian reservations. Some of this includes copper mines identified as required for technologies like computers and EV's that are tied to climate change mitigation,''per Ref.7. Also noted under Tribes and Indigenous Peoples.	We agree that decarbonization creates new demand for metals and minerals, and that establishment of new mines in the US can be highly controversial. We hope to mention this in our chapter, as space permits. However, these new mining projects are likely relatively small in physical footprint compared to other mitigation-driven land use changes (e.g., wind & solar deployment, biomass production), so we may need to prioritize our limited space accordingly.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 1 IIIII In introductory para, mention biodiversity as critical for ecosystem resilience.	Biodiversity and its connections to goods and services as well as resilience is discussed in the current draft.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 1 IIIII Under ''Physical landscape disturbances'' bullet, include to parenthetical and to wildlife and habitat	Wildlife habitat is addressed in the current draft.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 1 IIIII Under ''Physical landscape disturbances'' bullet, include new subbullet addressing loss of coastal areas due to sea level rise.	Exposure of coastal infrastructure to sea level rise is included in the current draft.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 1 IIIII Under ''Cooling'' bullet, move subtopic covering precipitation to a separate bullet.	The connections to precipitation are discussed in several places in the current draft.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 1 IIIII For impervious surfaces, mention impairing of ground water supplies, increasing contaminated runoff, and reducing amount of vegetation that uptakes carbon, thus exacerbating climate change.	We mention land transition to urban / built environment in the current draft, and discuss connections to loss of carbon/vegetation. This is expected to be dealt with in more detail by the chapter on built environment.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 1 IIIII Include as a potential figure sequence of aerial and orbital images showing gradual increase in U.S. land use change, with insets showing details of selected areas, e.g., urban sprawl, wildfire damage, sea level rise. For online report, consider including a time lapse video.	Thank you for the suggestions. The current draft includes figures like this.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 2 IIIII Change title to ''Goods, services, and health impacts of LCLUC.''	Space limitations have prevented us from addressing health impacts in a comprehensive way. We do include discussion of health impacts from airborne dust in the current draft.Infectious disease is also briefly addressed.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 2 IIIII Under ''Threats'' bullet, include subbullet addressing risk of food chain collapse due to: loss of habitat and pollinators, invasive pest and plant intrusions, animal and plant diseases, changes in seasonal timing, e.g., pollinators, migration patterns, and unforeseen consequences of biodiversity loss.	We will consider this topic in future drafts and aim to include text related to invasive species and phenological consequences of climate change.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 2 IIIII Include new bullet addressing human health impacts of LCLUC.	Health impacts from airborne dust and infectious disease are mentioned in the current draft.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 2 IIIII Move bullets on dust, smoke, and heat as subbullets under new ''health'' bullet.	Our discussion of dust and smoke impacts has been kept in 1OD because these directly relate to land use/cover, but we determined we did not have space to create a new "health bullet" but instead can link to human health chapter.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 2 IIIII Add to new ''health'' bullet a subbullet addressing zoonotics due to increases in proximity of human activity to wildlife, i.e., the human wildlife interface (Ref TBD Also noted under Human Health.	Linkage to infectious disease is mentioned in the current draft.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 2 IIIII Add to new ''health'' bullet a subbullet addressing mental health, including ecoanxiety, ecostress, and solastagia associated with loss of natural environment and open spaces, and with prospect of climate change. Also noted under Human Health.	This is being addressed in the Human Health chapter.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 2 IIIII There are few market based incentives to conserve forested and other natural land cover that sequester carbon, compared to profits gleaned through development or in some cases agriculture. Also noted under Forests, Agriculture, Economics.	We agree that policies and incentives will be essential to realizing the protection and enhancement of ecosystem carbon stocks in a variety of systems. We mention the role of government incentive programs and private carbon markets in our chapter.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 2 IIIII Identify likely impacts to goods and services by mid century, if no significant emissions reductions are effected by 2030.	This is addressed in our current draft.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 3 IIIII In introductory para, note that for decades land development has been prioritized over conservation, the latter usually implemented reactively rather than proactively. Often, the case for development is couched as a need for flexibility and ''balance'' between the economy and the environment, without acknowledgement that balance has already been lost to the former. As a result, the acceptable baseline continues to shift toward more development. Thus, land conservation must now be prioritized above development, with recognition that the economy and indeed the future of humanity depends on protecting what's left of natural lands and healthy ecosystems. Also noted under Economics.	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.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 3 IIIII Under ''Threshold type,'' clarify and explain what is meant by management options and provide examples.	This topic is explored in detail in the current draft.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 3 IIIII Under ''Scenarios,'' mention in conjunction with ethanol the fact that corn based ethanol produces higher carbon emissions than traditional gasoline, due to energy required for corn production and processing, and to lower energy content in ethanol mixed gasoline that requires more fuel to travel the same distance. Also noted under Energy, Agriculture, Transportation, Economics.	Our current chapter draft briefly reviews corn ethanol in the context of land-based climate mitigation measures, noting that there is widespread debate about the degree to which it might contribute to mitigation. Corn ethanol is also mentioned as a potential driver of land use change from native grassland to cropland in certain parts of the Great Plains.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 3 IIIII Under ''Connections,'' include after ''future pandemics,'' ''including zoonotics due to increases in proximity of human activity to wildlife, i.e., the human wildlife interface.''	Linkage to infectious disease is mentioned in the current draft. Space limitations have prevented us from exploring the topic in depth in our chapter.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 3 IIIII Under ''Connections,'' include increased online orders and returns that drive significant increases in shipping, with concomitant use of resources for packaging, fuel for transporting; and construction of freight distribution warehouses that reduce land and forest carbon sequestration capacity. Also noted under Energy, Transportation, Economics.	Thank you for the comment. In the current draft we do address the increase in developed land, and relate that trend to impacts on natural and managed carbon sinks.
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 3 IIIII For proposed potential figure, suggest a diagram that better conveys the criticality of land conservation, e.g., a graph that shows the amount of land development over time, or the amount of untouched and pristine land that still remains in the U.S.	We have included a timeseries of forest area in the current draft, but only from 1985. We are working on a new figure that will include available data from a longer historical perspective.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	Wright	Whole Chapter	06. LCLUC						Key Topic 3 IIIII Include new bullet highlighting that more constraints on land development are necessary to retain what's left of natural lands, in order to maintain the health of ecosystems and mitigate climate change. Alternatively, include under proposed new Key Topic.	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.
Michael	Wright	Whole Chapter	06. LCLUC						New Key Topic IIIII Add new key topic, probably before Key Topic 3. to address consequences of land development on climate change, and impacts of climate change on land use.	This topic is included in our current draft, and has been extensively covered in NCA4 and earlier reports.
Michael	Wright	Whole Chapter	06. LCLUC						New Key Topic IIIII The U.S.'s overemphasis on highway travel for passengers and freight has resulted in over 60,000 sq. miles of pavement for roads and parking lots, per Ref.8. This has been at the expense of more sustainable modes like intercity rail. Thus, less intrusive, small footprint transportation systems such as elevated monorail, per Ref.2, can reduce A. impervious surfaces and runoff, B. carbon emissions, C. habitat loss and fragmentation, D. susceptibility to flooding, E. nonenvironmental problems associated with highway travel, e.g., at grade accidents, congestion, individual user costs, etc. Also noted under Transportation.	Our current draft does examine trends in developed area, and relates these to other land use and land cover changes, goods and services, and resilience.
Michael	Wright	Whole Chapter	06. LCLUC						New Key Topic IIIII The construction of highways on previously undeveloped land induces additional land development along the corridor, such as housing, retail, office buildings, and freight distribution warehouses. This further exacerbates climate change by increasing emissions for construction and building operations, and by eliminating carbon sequestration afforded by natural land cover. Also noted under Built Environment, Transportation.	Our current draft does examine trends in developed area, and relates these to other land use and land cover changes, goods and services, and resilience.
Michael	Wright	Whole Chapter	06. LCLUC						New Key Topic IIIII Migration induced by sea level rise will result in more development on inland forests, grasslands, and farmland. This significant increase in development on land with natural cover decreases carbon sequestration capacity, while also increasing risk of climate change impacts in these areas. Also noted under Forests, Coastal Effects, Built Environment, Human Social Systems.	We expect that this topic will be better covered in other chapters
Jhoset	Burgos	Whole Page	06. LCLUC			20			Under Key Topic 1: Ecosystem resilience; Under: Cooling due to agricultural intensification and warming due to forest loss are both examples of how complex interactions connect land cover and climate systems. We will also assess the influence of land-cover changes on precipitation. This subtopic will explore the resilience of the climate system in the face of disturbances imposed from land-cover change. Under: Other examples from urban/built environment, including impervious surfaces increasing flooding, urban heat islands, and climate impacts on aging infrastructure (e.g., roads, pipelines, dams) Add: sea level rise plus short-term flooding impact on infrastructure Suggested Language: Other examples from urban/built environment, including impervious surfaces increasing flooding, urban heat islands, sea level rise plus short-term flooding impact on infrastructure, and climate impacts on aging infrastructure (e.g., roads, pipelines, dams)	Our current draft includes a brief mention of sea level influence on infrastructure. We expect this topic to be covered in the Coastal chapter.
Jhoset	Burgos	Whole Page	06. LCLUC			21			Under Key Topic 3: Future land-use options. Comment: Consider including the risks of current and future land use in face of projected and potential multimeter sea level rise plus short-term flooding events and coastal erosion.	Our current draft includes a brief mention of sea level influence on infrastructure. We expect this topic to be covered in the Coastal chapter.
brian	huberty	Whole Chapter	07. Forests						In general, the chapter misses the mark of how to measure, map and quantify growing forests over all lands (private lands in particular) for forest carbon growth assessment. Where are the NRCS forest reps given 40% of the forest land ownership base is private? And you may want to have tribal representation given their treaty rights are quite substantial.	Thank you for the comment. All estimates of forest attributes or associated goods and services reported in the chapter were taken directly or indirectly from peer-reviewed scientific literature where the methods, maps, and models were vetted prior to publication. The author team is committed to considering all people, including tribal and Indiginous communities, in the chapter.
Juliann	Aukema	Whole Chapter	07. Forests						The chapter seems to be entirely focused on trees. Forests are defined by trees but are more than trees. Climate change, forest management, and management response to climate change impacts already impacts relationships between plants and pollinators (e.g. phenology), seed dispersers, threatened and endangered species, pests and pathogens, and ecological relationships in general. Perhaps this is covered in ecosystems, but it seems short sighted to ignore all other organisms (at least fungi were mentioned) in a chapter on forests.	We greatly appreciate this comment. We have revised the chapter to include attention to non-timber related forest ecosystem goods and service impacts of climate change, including on all biota, and we cite new research assessing the overall effects of climate on biodiversity and the link therein to forest based ecosytem goods and services.
Joseph	Zajac	Whole Chapter	07. Forests						historical data disputes claims about wildfires. US forest fire burn acreage was well below average and down 80% since the 1930s.	Thank you for this comment. In the revised chapter, we now acknowledge the connection between climate change and historical land management on the forest ecosystem goods and services and include estimates and figures of recent forest fire area burned and emissions.
Joseph	Zajac	Whole Chapter	07. Forests						mismanagement of land by state and federal government is overlooked as a major contributing cause of wildfires	Thank you for the comment. It is not clear from the comment what is meant by "mismanagement". The author team has worked to include the role of land use and management into all areas of the chapter when considering natural disturbances, good and services, and adaptation strategies to combat climate change.
Joseph	Zajac	Whole Chapter	07. Forests						there is a conflict of interest with the chapter authors who work for government forest management organizations and fail to acknowledge the failure of the organizations in manage the forests	Thank you for the comment. The Forests chapter was designated as an "all federal" authored chapter by the USGCRP Federal Steering committee.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	07. Forests						Forest section should include proforestation and include better quantification of the role of old-growth forests in sequestering carbon	Thank you for the comment. Given word limitations we have not specifically described the role of forests at different stages in stand development on carbon sequestration and storage but we do provide details on the role of forests in carbon sequestration and storage and land management activities which promote carbon sequestration and storage as well as many other goods and service.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	07. Forests						Forest section might consider linking wildfire management needs with forest product resources that replace plastics and steel https://www.mdpi.com/journal/sustainability/special_issues/mass_timber_sus	Thank you for the comment. While we did not have the space to specifically include details on material substitution with forest products we do provide the current and historic contributions of wood products in the US GHG Inventory and the importance of wood products more broadly in the US economy.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
David	Cleaves	Whole Chapter	07. Forests						Comments on Fifth National Climate Assessment ,Äì Annotated Outline. Zero Order Draft - Chapter 7. Forests Federal Register Notice: FR Doc 2022-00097 Filed 1/6/22. Office of Oceanic and Atmospheric Research (OAR), NOAA, Department of Commerce. Submitted by the Forest Climate Working Group. (FCWG) David Cleaves (American Forests), and Danielle Watson (Society of American Foresters), Co-chairs. FCWG Science and Research Task Group. February 18, 2022. Contact: davidacleaves@gmail.com Thank you for allowing us to comment on this NCA5 Chapter. We rely on USGCRP assessments heavily to communicate the issues and opportunities for dealing with the changing climate. Please call on us at any time to clarify or expand the comments offered below. The Forest-Climate Working Group (FCWG) was founded in 2007 to provide a unified voice across the United States forest sector to help meet the challenges and opportunities of a rapidly changing climate. Our 80-member coalition reflects the wide diversity of actors who help conserve and manage America,Äôs forests and forest products and services markets: private landowners; professional foresters; forest products companies; state foresters and other government agencies; forestry, conservation and wildlife non-profits; carbon finance specialists; and academic researchers. The FCWG,Äôs Science and Research Task Group was formed to foster improvements in research, science application, and education about forests and forest products as natural climate solutions. Our primary goals are maintaining forest cover, improving forest practices, enhancing markets, and improving science and its application, all toward finding solutions for the climate crisis. Following is a set of high-level questions and comments that we feel are important in helping the NCA5 Forests and other chapters contribute to key policy and communication issues we encounter in our work in the forest sector. You may already be planning to address some of these issues completing your chapter and if so, we would be happy to provide additional perspectives and expertise as the chapter develops. Our comments are keyed to your three topics. Key Topic 1: Climate change is increasing the frequency, scale, and severity of multiple disturbances	Thank you for the detailed questions and comments. The author team has evolved the Forest chapter text to address many of the questions and concerns raised in this comment. That said, we are limited to 5000 words total in the main body of the chapter which has required that the author team prioritize what to include in the chapter. As a result, details on the underlying methodologies and models used in the published literature that has been referenced in the chapter are beyond the scope of the chapter. We have focused on providing the latest information since NCA4 on the status and projected future of forest conditions in a changing climate as well as adaptation solutions and tools to address the impacts of climate change on forest ecosystems.
Theodore	Weber	Whole Chapter	07. Forests						Relevant to Ch. 7 of NCA5ZOD, I emailed the following documents to review@usgcrp.gov: 1. ,Äú2021.04.29_USDA-2021-0003 Cover Letter.pdf,Äù Defenders of Wildlife submitted these recommendations to USDA in response to a Request for Public Comment on the Executive Order on Tackling the Climate Crisis (Docket No: USDA-2021-0003). 2. "2021.04.29_USDA-2021-0003 Attachment-2.pdf" Defenders of Wildlife directed these recommendations specifically to the USDA Forest Service in response to a Request for Public Comment on the Executive Order on Tackling the Climate Crisis (Docket No: USDA-2021-0003). Among the Forest Service recommendations were: a.The Forest Service should capitalize on its full existing legal, regulatory, and supporting policy architecture that governs sustainable natural resource use on our national forests and grasslands, including NFMA and its implementing regulations, to develop a climate smart policy framework. b.The Forest Service should recommit to the deliberative, transparent decision-making processes that are foundational principles of NFMA and the NEPA, their implementing regulations and associated policies. c.The agency should conduct a complete analysis of agency decision-making, use of science, and public engagement processes as it relates to planning for and adapting to climate change, and then craft a strategy to address operational, capacity and organizational culture issues. d.The agency should recommit to innovative, transparent, and inclusive collaboration at every step of NEPA decision-making processes and recognize the value of local expertise and knowledge in land management decisions, including traditional ecological knowledge and indigenous and local knowledge. e.The Forest Service should make available all information used to set policy as a matter of course, ensuring policy processes are clear and understood by participants, reaching out directly to under-represented stakeholders to assure their perspectives are incorporated into decisions and integrating traditional ecological knowledge. f.The Forest Service should elevate and strengthen the capacity and leadership effectiveness of the	Thank you for comments and suggestions. We have considered these in the development of the Forests chapter.
Theodore	Weber	Whole Chapter	07. Forests						Relevant to Ch. 7 of NCA5ZOD, I emailed the following documents to review@usgcrp.gov: 1. "Are wood pellets a green fuel.pdf" (Schlesinger, W. H. 2018. Are wood pellets a green fuel? Science 359(6382):1328-1329. DOI: 10.1126/science.aat2305) Recent evidence shows that the use of wood as fuel is likely to result in net CO2 emissions and decreases forest biodiversity. 2. "Wood Pellet Forest Destruction.pdf" (Wisner, A., et al. 2019. Clear Cut: Wood Pellet Production, the Destruction of Forests, and the Case for Environmental Justice. Rachel Carson Council, Bethesda, MD) Though touted as a clean, environmentally safe alternative to fossil fuels, wood pellets are a carbon-intense, destructive and polluting industry based in flawed carbon accounting in international agreements. Wood pellet material sourcing leads to massive deforestation of critical habitats, and Enviva alone is responsible for 50 acres a day of clear-cut land. Pellet production facilities release dangerous air pollutants including particulate matter and volatile organic compounds putting surrounding communities at higher risk for health complications. Finally, burning wood pellets releases 65% more CO2 than coal per megawatt hour. In order to keep global climate change below 1.5 degrees Celsius, wood pellets must not be used as an energy alternative. 3. "Assessment and Valuation of Forest Ecosystem Services - State of the Science Review.pdf" (Binder, S., et al. 2017. Assessment and Valuation of Forest Ecosystem Services: State of the Science Review. U.S. Forest Service, General Technical Report NRS-170) This review focuses on the assessment and economic valuation of ecosystem services from forest ecosystems. 4. "Carbon sequestration and biodiversity co-benefits of preserving forests in the western US.pdf" (Buotte, P. C., et al. 2020. Carbon sequestration and biodiversity co-benefits of preserving forests in the western USA. Ecol Appl. 30(2):e02039. doi:10.1002/eap.2039) Forest carbon sequestration via forest preservation can be a viable climate change mitigation	We appreciate the suggestion and have reviewed the source of information. However, the author team determined that the current references are appropriate and adequate given the chapter's space limitations.

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William	Koshak	Whole Page	07. Forests		23				A bullet could be added under Key Topic 1 that states: Advances are being made in understanding the inter-relationships between dry-lightning, precipitation, and the occurrence of lightning-caused wildfires. For specific details, see: Vant-Hull, B., T. Thompson, and W. J. Koshak, 2018: Optimizing precipitation thresholds for best correlation between dry lightning and wildfires, J. Geophys. Res.-Atmos., 123. https://doi.org/10.1002/2017JD027639.	Thank you for the reference. We will consider this as we develop the Forests chapter.
Evan	Mills	Whole Chapter	07. Forests						Since the NCA4, more literature has emerged about the adverse impacts of common timber-harvesting practices on wildfire severity. This should be reviewed, as it is not a familiar issue to most in the public and even many policymakers. Another issue meriting attention is the extent to which climate change,Äôs multiple adverse impacts on forest growth, disturbance, and regeneration will modify downwards the prevailing assumptions about the rates of carbon uptake, particularly in the nearer-term (decadal) timeframes of immediate concern,Äîand thus the calculus of ‚Äúoptimum‚Äù harvest type and frequency. Proactive responses could include ‚Äúleadership by example‚Äù in better managing public forest lands. Tirtha Banerjee. 2020. ‚Äúlmpacts of Forest Thinning on Wildland Fire Behavior.‚Äù Forests 2020, 11(9), 918; https://doi.org/10.3390/f11090918 Harold S. J. Zald, Christopher J. Dunn. 2018. Severe fire weather and intensive forest management increase fire severity in a multi-ownership landscape. Ecological Applications; DOI: 10.1002/eap.1710 Beverly E. Law, Tara W. Hudiburg, Logan T. Berner, Jeffrey J. Kent, Polly C. Buotte, and Mark E. Harmon. 2018. ‚Äúland use strategies to mitigate climate change in carbon dense temperate forests.‚Äù PNAS 115 (14) 3663-3668, https://doi.org/10.1073/pnas.1720064115 Curtis M. Bradley, Chad T. Hanson, Dominick A. DellaSala. 2016. ‚Äúdoes increased forest protection correspond to higher fire severity in frequent-fire forests of the western United States?‚Äù Ecosphere, 7(10) https://doi.org/10.1002/ecs2.1492 John L Campbell, Mark E Harmon, Stephen R Mitchell. 2011. ‚Äúcan fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions?‚Äù, Frontiers in Ecology and the Environment https://doi.org/10.1890/110057 Russell T. Graham, Alan E. Harvey, Theresa B. Jain, Jonalea R. Tonn. 1999. ‚Äúthe effects of thinning and similar stand treatments on fire behavior in Western forests.: USDA DOI: https://doi.org/10.2737/PNW-GTR-463	We appreciate the suggestion and have reviewed the source of information. However, the author team determined that the current references are appropriate and adequate given the chapter's space limitations.
Evan	Mills	Whole Page	07. Forests		25				Re: Key Topic 3 Consider exploring recent concerns about the over-crediting (and reversibility) of carbon offsets claimed by brokers of such credits. Grayson Badgley, Jeremy Freeman, Joseph J. Hamman, Barbara Haya, Anna T. Trugman, William R. L. Anderegg, Danny Cullenward. 2021. ‚Äúsystematic over-crediting in California's forest carbon offsets program.‚Äù Global Change Biology, 28(4):1433-1445 https://doi.org/10.1111/gcb.15943	We appreciate the suggestion and have reviewed the source of information. However, the author team determined that the current references are appropriate and adequate given the chapter's space limitations.
Michael	Wright	Whole Chapter	07. Forests						What's New IIIII Include advanced airborne lidar, space based observatories, e.g., LandSat 9, data processing systems, and information systems that make forest data, such as tree health, deforestation, etc., widely available. Also noted under Land Cover, Oceans, Built Environment.	Thank you for the comment on new and emerging monitoring technologies that may be used to assess forest conditions. We acknowledge the value of these technologies but unfortuantely due to word limitations and the scope of the chapter we are unable to specifically discuss these advances in monitoring.
Michael	Wright	Whole Chapter	07. Forests						What's New IIIII Mention that a significant increases in illegal logging in rainforests such as the Amazon is driven by A. political inaction, B. lack of public awareness of problem and of its impacts to climate change, C. lack of policies to disincentivize importing products, e.g., wood, produce, meat from rainforest regions. Also noted under Land Cover.	Thank you for this comment. The National Climate Assessment provides a basis for decision making but does not prescribe policy, and discussion of policy options is beyond its defined scope.
Michael	Wright	Whole Chapter	07. Forests						Key Topic 1 IIIII Under ''Chronic disturbances,'' include long term insect infestations, e.g., emerald ash borer, red palm weevil.	Thank you for the comment. Due to word limitations the author team is not able to include all potential examples of disturbances or disturbance agents that may be altered by climate change. That said, we worked to highlight the role of chronic and abrupt disturbances and climate change on forest ecosystems and reference many studies with additional examples such as those suggested here.
Michael	Wright	Whole Chapter	07. Forests						Key Topic 1 IIIII Under ''Compound disturbances,'' change harvests to logging, since trees are not, strictly speaking, a crop.	Thank you for the comment. The term "harvests" is used throughout the scientific literature to refer to the extraction of materials from forest ecosystems, not just logs.
Michael	Wright	Whole Chapter	07. Forests						Key Topic 1 IIIII Under ''Compound distrubances,'' include development as an example of human perturbations.	Thank you for the comment. We have reference land use and human activities throughout the chapter as drivers of forest change.
Michael	Wright	Whole Chapter	07. Forests						Key Topic 2 IIIII Revise topic heading and description to include manmade impacts to forests that are appropriately included in bullet statements, e.g., land use changes.	Thank you for this important comment. We have included new text and a citation recognizing how climate impacts on forest goods and services interact with a changing society, which includes land use, human population, and economic activity.
Michael	Wright	Whole Chapter	07. Forests						Key Topic 2 IIIII Under ''Description of potential figures,'' move second sentence on wildfire to a separate bullet above, since the importance of this issue dictates highlighting it.	This is an important comment, and we thank you for alerting us to the need to highlight the impacts of climate-related wildfire changes on humans. In the text and in a figure, we highlight data showing climate related increases in destroyed structures and worsened air quality from wildfire smoke, leading to higher human mortality.
Michael	Wright	Whole Chapter	07. Forests						Key Topic 3 IIIII Relient forests require that management policies and practices limit development, e.g., housing, roads and resource extraction within forests that reduce carbon sequestration capacity and also drive suppression of normally occuring periodic fires.	Thank you for the comment. The National Climate Assessment provides a basis for decision making but does not prescribe policy, and discussion of policy options is beyond its defined scope.
Michael	Wright	Whole Chapter	07. Forests						Key Topic 3 IIIII Add to potential figures satellite images showing deforestation over time, with online report possibly including a time lapse video, and a figure showing the amount of old growth forest that still remains in the U.S.	Thank you for the comment. We have added a figure to the chapter documenting change in tree cover from 1985- 2020 which will include a link to dynamic animations of tree cover change over time in the US.
Michael	Wright	Whole Chapter	07. Forests						Key Topic 3 IIIII There are few market based incentive to conserve forested or other natural land cover that sequesters carbon, compared to profits gleaned through development, or in some cases agriculture. Also noted under Land Cover, Agriculture, Economics.	Thank you for the comment.
Michael	Wright	Whole Chapter	07. Forests						Other Comments IIIII Identify likely consequences to forests by mid century, if no significant emissions reductions are effected by 2030.	Thank you for the comment. We have included figures and text to describe potential future conditions under alternative climate scenarios and the role of these changes forest ecosystem goods and services.

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Michael	Wright	Whole Chapter	07. Forests						Other Comments IIIII Cite the importance of high resolution monitoring, both spatial and temporal, of U.S. rainforest loss.	Thank you for the comment on new and emerging monitoring technologies that may be used to assess forest conditions. We acknowledge the value of these technologies but unfortuantely due to word limitations and the scope of the chapter we are unable to specifically discuss these advances in monitoring.
Michael	Wright	Whole Chapter	07. Forests						Other Comments IIIII Migration induced by sea level rise will result in more development on inland forests, grasslands, and farmland. This significant increase in development on land with natural cover decreases carbon sequestration capacity, while also increasing risk of climate change impacts in these areas. Also noted under Land Cover, Coastal Effects, Built Environment, Human Social Systems.	Thank you for this comment. In Key Message 2, we now recognize how sea level rise caused by warming is leading to species range shifts (especially mangrove in coasts of the Atlantic Basin), forest loss, saltwater marsh replacement, all of which impact fishing opportunities and create changes in coastal protection from storms.
Catherine	Buchanan	Whole Chapter	08. Ecosystems						Will the changing landscape ecology in the various ecosystems be included in the models to quantify the shrinking carrying capacities of the natural resources (i.e. native vegetation, small prey) and correlated to the changing climate cycles brought about by climate change and the major anthropogenic impacts to regional areas? For example, link the shrinking carrying capacity of native vegetation brought about by overgrazing cattle, plus the increased drought seasons from climate change. Then quantify the variety of wildlife that depends on the native vegetation for sustenance, and project their survivability by calculating the wildlife numbers to the shrinking availability of the native vegetation and small prey.	Thank you for this comment. The ecosystems chapter does not produce new models but reviews existing literature. We have noted in Figure 8.6 that several ecosystems that overlap with rangelands are affected by compound stressors (climate plus overgrazing as an example) but do not refer to carrying capacity as that is not a key focus of the literature we reviewed, which is more focused on complex interactions.
Theodore	Weber	Whole Chapter	08. Ecosystems						A resource worth examining: Advancing the National Fish, Wildlife, and Plants Climate Adaptation Strategy into a New Decade - https://www.fishwildlife.org/application/files/4216/1161/3356/Advancing_Strategy_Report_FINAL.pdf	We thank the commenter for this suggestion and have added the suggested citation to the chapter where we discuss various federal agencies' strategies to help species adapt (Key Message 2)
Joseph	Zajac	Whole Chapter	08. Ecosystems						looks OK but needs more detail, the overview is general	The commenter is refering to an annotated outline, which was necessarily general. The more recent chapter drafts have a great deal more detail.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Page	08. Ecosystems			27			In challenges for natural resource management section - include funding for implementing strategies, and lack of information and resoruces for practioners to develop actions AND then study and learn from those adaptive management techniques	Thank you for this comment. We have included a section of KM1 on adapting management of ecosystems that addresses the challenges of doing so, including funding constraints and need for research/information.
Daniel	Brown	Whole Chapter	08. Ecosystems						Please the consider the following publication: Nahlik, A., Fennessy, M. Carbon storage in US wetlands. Nat Commun 7, 13835 (2016). https://doi.org/10.1038/ncomms13835 As the authors suggest: Wetland soils contain some of the highest stores of soil carbon in the biosphere. However, there is little understanding of the quantity and distribution of carbon stored in our remaining wetlands or of the potential effects of human disturbance on these stocks. ... These data highlight the need to protect wetlands to mitigate the risk of avoidable contributions to climate change.	Thank you for this comment. We have used more recent references on multifunctional ecosystem services from wetlands but this remains an important foundational reference that may be used in other chapters that are more focused on carbon (e.g. in mitigation or coastal chapters or blue carbon cross-chapter box).
Michael	Wright	Whole Chapter	08. Ecosystems						Key Topic 3 IIIII Revise first sentence to read, ''Besides being necessary for life itself, ecosystems also provide numerous benefits in the form of ecosystem services. Among these are ecosystem based mitigation and adaptation opportunities, often called 'nature based solutions'.''	After consideration, the author team determined that the key message narrative flows best as written.
Michael	Wright	Whole Chapter	08. Ecosystems						Other Comments IIIII Identify likely consequences to ecosystems by mid century, if no significant emissions reductions are effected by 2030.	Thank you for this comment - we have added a figure from the recent IPCC 2022 report (so-called 'burning embers' diagram) which highlights possible transition risks to ecosystems at additional global warming levels. We have used GWLs in this chapter rather than discussions of emissions reductions/projections as that topic is addressed elsewhere in the NCA.
Whitney	Berry	Whole Chapter	08. Ecosystems	1	27	1	27	1	Under Key topic 1, under bullet related to monitoring of ecosystems: in addition to monitoring, there is value in putting changes into perspective or context using indicators and reference points or targets. These can aid in identifying when approaching tipping points or thresholds. If it is identified that a threshold is being approached, managers should consider increasing monitoring efforts (see e.g. Selkoe et al. 2015 ?Managing Ocean Tipping Points? at https://www.tandfonline.com/doi/pdf/10.1890/EHS14-0024.1).	Thank you for this comment. Key message 1 of this chapter addresses both the need for expanded monitoring as well as a more in-depth discussion of tipping points. The reference suggested has been used in the chapter bibliography.
Melissa	Tier	Whole Page	09. Coastal Effects			31			Under "residents and businesses inside and outside..." (What's New section): In terms of residents, might be worth distinguishing between impacts to homeowners vs. impacts to renters. And/or single-family housing vs. multi-family housing.	We thank the reviewer for the comment, but this suggestion is outside the scope of this report. This level of analysis is generally completed at local scale rather than a national scale. Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples. The authors are, however, discussing the impacts to frontline communities (economically disadvantaged, communities of color, Indigenous and tribal communities) which can provide a potential frame of reference for the inequities between homeowners and renters. We appreciate the suggestion, but space is limited to include this level of analysis in a robust way.
Melissa	Tier	Whole Page	09. Coastal Effects			32			Under "barriers to adaptation remain prevalent..." (What's New section): Related to misinformation and lack of will are common psychological biases/characteristics that can lead to a preference for the status quo over change. It would be helpful to include some mention of behavioral science concepts here.	We appreciate the reviewers comment. The chapter text has been revised to incorporate this suggestion.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Bill	Mayben	Whole Chapter	09. Coastal Effects						Dear Chapter contributors; I agree wholly, and based on my research into the long-range projections toward a stable sea level, want to review a few of those moving parts. 1. I believe if we can spend a public or investment dollar one time, verse 12 times, whenever possible, we will have more viable mitigation and adaptation measures, and to a greater extent. regarding SLR, this involves, inevitably, a retreat. 2. This will be engendered by a combination of private insurance, mortgage industry, and governmental agencies progressively refusing to support continued flooding in coastal areas. Our challenge is to act to prevent climate refugees, by planning and developing viable alternatives for residential and commercial development. 3. We can map elevations corresponding to projections of sea level rise. We could map the 100 year shoreline, and add the effects of King tides and storm surge. We can map the ultimate ambient shoreline after glacial melt, with reasonable confidence. 4. That land is probably relatively inexpensive now; and will be come dear later. Could we plan for community development in safe locations; and rebuild there; rather than rebuild in what everyone agrees is no longer safe? 5. Non-flooding coastal impacts include saltwater or brackish intrusion into domestic water wells; impacts on jobs, schools, transportation, reduction in investment capital; emigration. Our sustainable intent should be to maintain self-sufficient community viability on all levels, over time. 6. America now has climate refugees. This dislocation tremendously compounds our mitigation and adaptation efforts, pulling vital resources away from what is already a daunting set of challenges. It may lead to a set of regional mega-cities, rather than a disbursed population. This effect is already happening worldwide, and should be discussed in the light of resilience and sustainability. It is agreed that success looks like an economically viable population. Personally, I am in favor of decentralization of an increasing population. 7. None of this is to say that local measures could not be used to extend the viability of coastal	We appreciate the reviewers comments. We have included discussion within the chapter on managed retreat, and its potential to be the most cost effect option while also being the surest method to protect communities from increasing risks. We agree that these challenges require consideration, and this theme is included across multiple chapters and is associated with a growing body of research. Numerous nation-wide maps of future sea level rise, including extreme scenarios, are already readily available and will not be included within our chapter. Our chapter does address the increasing migration to the coasts, which places a higher population at risk. We have also included discussion on the cascading impacts to other sectors. However, consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. Although the reviewer raises excellent points, fully addressing them would delve into the policy sphere.
Joyce	Coffee	Whole Chapter	09. Coastal Effects						Hello, please keep front of mind the disproportionate impact of coastal climate risks (hazards, vulnerabilities and exposures) on marginalized communities and refer to these resources: A ten point plan on climate change grounded in environmental justice: https://anthropocenealliance.org/wp-content/uploads/2021/08/A2-Platform-on-Climate-Change.pdf The great American migration: https://anthropocenealliance.org/wp-content/uploads/2021/08/The-Great-American-Climate-Migration.pdf Flood survivors manifesto: https://anthropocenealliance.org/manifesto/ Please note these resources are not fringe, even if they are not peer reviewed from the Academy. They represent the work of over 100 flood survivor community groups, a voice that may not otherwise be within the NCA but is disproportionately impacted by it. For peer reviewed literature about the disproportionate impact of federal disaster recovery dollars, (the wealth getting wealthier, the poor poorer based on US taxpayer funded grant programs), please see here: http://www.juniahowell.com/ Thank you	We thank the review for the comment. The chapter text incorporates this suggestion and included discussion the disproportionate impact on frontline and marginal communities, the importance of considering equity and environmental justice in adaptation planning across all scales, and the legacy of issues related to coastal flooding and recovery efforts that have widened wealth inequalities.
Joyce	Coffee	Whole Chapter	09. Coastal Effects						Hello, you might find it interesting to review (Island Press) A BLUEPRINT FOR COASTAL ADAPTATION: ADAPT | PREPARE | RETREAT, A TALE OF TWO CITIES We explore social-ecological vulnerability and economic and political factors in coastal resilience through a critical analysis of Miami Beach, Florida and Buras, Louisiana. Thank you	We thank you for the comment. The chapter text has been revised to include literature on social-ecological vulnerability and economic and political factors related to climate resilience.
Theodore	Weber	Whole Chapter	09. Coastal Effects						If you haven't already, see TNC's coastal resilience site at https://coastalresilience.org/. Also see Maryland,Äôs Coastal Resiliency Assessment: https://dnr.maryland.gov/ccs/coastalatlas/Pages/CoastalResiliencyAssessment.aspx Maryland,Äôs Coastal Resiliency Assessment is a landscape-level spatial analysis and modeling effort that identifies where natural habitats provide the greatest potential risk reduction for coastal communities. It attempts to identify residential areas impacted by coastal hazards and rank shorelines where restoration and conservation efforts can provide coastal protection alongside habitat, water quality, and recreational benefits. Priority areas for restoration and conservation actions were identified based on the presence of existing habitat, its current role in risk-reduction along the shoreline, and the presence of nearby coastal neighborhoods. (Full report: https://dnr.maryland.gov/ccs/Documents/MARCH-2016_MDCoastalResiliencyAssessment.pdf) Regarding vulnerable communities, Maryland,Äôs Coastal Resiliency Assessment incorporates a Social Vulnerability Index (SVI) that ranks residential areas from low to high based on the ability of populations to prepare for, respond to, and/or recover from coastal hazard events. Criteria/Metrics: AGE: % Population ,â§ 17 years or ,â• 65 years POVERTY: % Population with income below poverty LANGUAGE: % Population of non-proficient English speakers Source Data: 2013 American Community Survey 5-year estimate (Age, Poverty status in the last 12 months, Language spoken at home/Ability to speak English)	We appreciate the comment. There is an every growing body of scientific literature on coastal resilience efforts and vulnerable communities. Due to space limitations, we cannot include the richness of detail that is available in a geographic specific assessments. Although Maryland's study would make an excellent case study in the coastal chapter, after thorough deliberation and conversations with regional chapters, we have selected a different case study for inclusion.
Joseph	Zajac	Whole Page	09. Coastal Effects			32			Invalid comparison: The rate of SLR from 2006--2018 has approximately tripled compared to the rate from 1901--1971	We thank the reviewer for the comment. The National Climate Assessment draws upon a variety of sources. All sources were assessed to ensure that they comply with Information Quality Act and Evidence Act requirements for (1) utility, (2) transparency and traceability, (3) objectivity, and (4) integrity and security. This chapter relies on the latest peer reviewed science, and appropriate citations are included related to observed SLR at tide gauges along the U.S. coastlines.

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Joseph	Zajac	Whole Page	09. Coastal Effects		32				not mentioned: using known erroneous and incomplete data, scientists claim they can model a rise in the level of CO2, while avoiding the impact of billions of weather events, to project global climate out to 2050 and 2100.	We thank the reviewer for the comment. This comment is inconsistent with the current state of the science on this topic. The chapter includes discussion of the worsening impacts related to extreme weather events and the increasing damage that is occurring. The National Climate Assessment draws upon a variety of sources. All sources were assessed to ensure that they comply with Information Quality Act and Evidence Act requirements for (1) utility, (2) transparency and traceability, (3) objectivity, and (4) integrity and security.
Joseph	Zajac	Whole Page	09. Coastal Effects		33				cherry picked fear mongering - Photos of challenges: school buses navigating tidal flooding; flooded NY subway system; compelling video of flash flooding caused by compound flood issues	We thank the reviewer for the comment. The photo suggestions within the Zero Order draft have not been included in the chapter at this time.
Joseph	Zajac	Whole Page	09. Coastal Effects		34				use of politically correct terminology has no place in this report: Key Topic 5: Diversity, equity, environmental justice, and access	We thank the reviewer for the comment. The author team has deliberated and discussed this topic across several chapters. As a whole, the team has agreed that discussion of the impacts on disadvantaged communities is important to include in National Climate Assessment.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	09. Coastal Effects						include information on Great Lakes coasts in this chapter	We thank the review for the comment. Due to limitations on space in the Coastal Effects chapter and the need to cover the East, Gulf, and West coasts, discussion related to the Great Lakes is most relevant for inclusion in the regional chapters where space is less constrained.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	09. Coastal Effects						Include information about cumulative impact to disadvantaged communities (tribes, POC, low income, etc.)	We thank the reviewer for the comment. We have included discussion within the chapter on the cumulative and disproportionate impacts on disadvantaged communities.
John	Wiener	Whole Chapter	09. Coastal Effects						While this chapter outline is almost comprehensive, it does not mention a significant problem on which there seems to be little or no interest. That can be called, for shorthand, "coastal rinsing". Industrial, urban and residential wastes and stored or deposited materials will be increasingly mobilized by rising sea level, increased acidity and intensity of precipitation, and compound flooding. The impacts should not be assumed to be dissipated because pulses and sediment capture may lead to adverse and unsafe conditions for fisheries and shell fisheries, affecting the ecosystems and the human uses. Therefore, investigation, at least on a sampling basis, may help reveal the extent of this additional threat. Academics could be commissioned to collaborate with NOAA and other agencies.	We appreciate the reviewers comment. The author team agrees that this is an important topic to include in the Coastal Effects chapter and have selected a case study for inclusion.
Juanita	Constible	Whole Chapter	09. Coastal Effects						Equity and environmental justice are a critical component of coastal effects, so it is great to see a targeted discussion included as Key Topic 5. However, please consider also emphasizing equity and justice considerations throughout the chapter wherever possible, instead of only discussing them in a separate Key Topic.	We thank the reviewer for the comment. We agree with the comment and have included discussion throughout the chapter on the cumulative and disproportionate impacts on disadvantaged communities.
Juanita	Constible	Whole Chapter	09. Coastal Effects						Consider coordinating with authors of the Adaptation chapter to ensure that key points are consistent (and not duplicated). Some overlap in content is likely unavoidable, but the material under Key Topic 4 in particular should be closely coordinated with that chapter.	We thank the reviewer for the comment. The author team is coordinating with the Adaptation chapter, and many other chapters within the National Climate Assessment, to reduce the likelihood for redundancy across the chapters. Additional coordination is occurring as each chapter evolves throughout the assessment development process.
Juanita	Constible	Whole Page	09. Coastal Effects		32				What's New, 3rd bullet, 3rd sub-bullet: Tradeoffs between short- and long-term decision-making timeframes is another important challenge. For example, municipalities might worry about home buyouts and acquisitions eroding the local tax base (a tangible short-term cost), when benefits may not be realized until years in the future.	We appreciate the reviewers comment. We have revised the text to discuss these challenges and tradeoffs.
Juanita	Constible	Whole Page	09. Coastal Effects		33				Key Topic 2: Glad to see this discussion of compound and multiple hazards. Of course, though, coastal hazards are not just related to flooding. In the examples or figures, it would be great to see connections made to other hazards and the potential or observed impacts to communities. (E.g., what if an area experiences extreme heat after a hurricane, when the storm has knocked out power?)	We appreciate the reviewers comment. The chapter text has been revised to include cascading impacts, including the example suggested of a power outage after an extreme storm event. The National Climate Assessment will also include a Compound Event Cross-Cutting Box to allow additional cross-chapter content and collaboration related to compound events.
Juanita	Constible	Whole Page	09. Coastal Effects		34				Key Topic 4: Recommend incorporating equity and environmental justice issues into the list of barriers and challenges. The current list focuses heavily on technical issues and excludes community impacts. In addition, while listing the barriers and challenges is helpful, it would also be useful to include examples of successes, advances, or useful tools.	We thank the reviewer for the comment. We have revised the test to include equity and environmental justice issues, and the importance of including disadvantaged communities within adaptation planning across all scales. Due to space limitations, the chapter will not include a thorough list of examples; however, we have reviewed the scientific literature and selected citations for inclusion in the chapter that include successes and suggestions to advance and improve adaptation efforts.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Sarah	Reiter	Whole Chapter	09. Coastal Effects						February 20, 2022 Dear Lead Author May, On behalf of the New England Aquarium (NEAq), I am writing to provide comment on the Annotated Outlines of the Fifth National Climate Assessment, in particular, Chapter 9: Coastal Effects. This Chapter is directly relevant to NEAq‚Äôs mission to protect the blue planet by holding the growing blue economy accountable for ocean protection and sustainable practices. We are deeply concerned about the climate crisis. As an ocean conservation organization, waterfront steward, and scientific research institute, we respectfully request the authors consider NEAq‚Äôs input. Chapter 9: Coastal Effects: NEAq supports resilient, inclusive and accessible waterfronts ‚Äč‚Äč Key Topic 1: Impacts are already happening: A cultural institution based on the Boston waterfront, NEAq has a front row seat to the rapidly accelerating impacts of climate change, both along our stretch of waterfront and extending into the rapidly warming Gulf of Maine. NEAq can speak directly to the impact of ‚Äúchronic coastal stressors (SLR, rising groundwater, ocean acidification, etc.) that impact infrastructure and buildings along the coast,‚Äù (NCA Annotated Outline at 32). In 2018, flooding shut down the Aquarium MBTA station and the Aquarium for two days (https://www.neaq.org/blog/weathering-the-noreaster/). Since then, NEAq has closed its doors several times in anticipation of extreme weather events, most recently in January of 2022 due to hurricane force winds and flooding (https://www.bostonglobe.com/2022/01/29/metro/massive-storm-pelts-region-cutting-power-hundreds-thousands-people/). Organizations like NEAq rely on updated SLR projections to adapt, and in a way that aligns with our mission to protect the blue planet, and the animals within our care. ‚Äč‚Äč Key Topic 3: Natural versus built ecosystems: A resilient coastline requires the best available science on nature-based solutions. The latest scientific literature on United States (US) blue carbon habitats and their potential to safeguard the climate, communities and biodiversity can provide a solid basis for adapting both natural and built environments (https://doi.org/10.1016/j.gloenvcha.2020.102206). NEAq facilities are primarily located along a	We appreciate the reviewers comments. The impacts your organization is experiencing provide an excellent example of the importance of clearly communicating the best available science so that decision makers can take appropriate actions. The Coastal Chapter is relying on the latest SLR information released by the Federal SLR Task Force in February 2022 (https://oceanservice.noaa.gov/hazards/sealevelrise/sealevelrise-tech-report.html). The author team has also revised the chapter to include the latest literature on natural and nature based features. The author team agrees on the importance of the blue economy, and the National Climate Assessment has created a new Blue Carbon Cross-Cutting Box so that this topic can benefit from cross-chapter collaboration.
Michael	Wright	Whole Chapter	09. Coastal Effects						What's New IIIII Add that, despite the evidence based warnings that sea level rise, or SLR, is increasing and will continue throughout this century, public and policymakers' concerns remain lacking while coastal development has increased in many high risk areas. Also noted under Built Environment.	We appreciate the reviewers comment. We agree that the evidence base is clear. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations; therefore, it is outside the scope of this report recommend curtailing coastal development.
Michael	Wright	Whole Chapter	09. Coastal Effects						What's New IIIII Move ''Barriers to adaptation'' to a separate top level bullet, since this issue is important enough to highlight outside of availability of scientific information.	We appreciate the reviewers comment. The chapter team has reviewed the literature base and devoted additional space to the barriers to adaptation.
Michael	Wright	Whole Chapter	09. Coastal Effects						What's New IIIII Change ''misinformation'' to ''disinformation,'' since the latter is intentionally misleading or false.	We appreciate the reviewers comment. The chapter has been revised and does not give space to misinformation or disinformation. The intent of the National Climate Assessment is to remains fact based on the best available scientific literature.
Michael	Wright	Whole Chapter	09. Coastal Effects						Key Topic 1 IIIII Mention climate induced flooding of, and resultant pollution from, coastal industries like oil refineries.	We appreciate the reviewers comment. We have selected a case study for inclusion relative to coastal flooding and the potential for contaminant mobilization.
Michael	Wright	Whole Chapter	09. Coastal Effects						Key Topic 1 IIIII Add that coastal erosion due to SLR not only impacts animal habitat, natural vegetation, and built environment, but also induces more emissions involved in restoration and reactive mitigation, e.g., beach restoration, levy construction, structure relocation, etc. Also noted under Built Environment.	We thank the review for the comment. Although we agree with the point that adaptation efforts, like all construction efforts, can involve carbon emissions, this topic is outside the scope of the Coastal Effects chapter.
Michael	Wright	Whole Chapter	09. Coastal Effects						Key Topic 1 IIIII Add climate induced flooding, including downpours and more and stronger hurricanes that cause more contaminated runoff from urban areas, as well as failures and overflow of untreated sewage, e.g., NYC. This introduces even more pollution in coastal areas than they experience normally, and exacerbates erosion.	We appreciate the reviewers comment. The chapter text has been revised to include cascading and compound impacts. The National Climate Assessment will also include a Compound Event Cross-Cutting Box to allow additional cross-chapter content and collaboration related to compound events.
Michael	Wright	Whole Chapter	09. Coastal Effects						Key Topic 1 IIIII SLR induced migration will result in more development on inland forests, grasslands, and farmland. This significant increase in development on land with natural cover decreases carbon sequestration capacity, while also increasing risk of climate change impacts in these areas. Also noted under Land Cover, Forests, Built Environment, Human Social Systems.	We thank the review for the comment. Although the Coastal Effects chapter includes discussion on managed retreat (which can be considered SLR induced migration), due to limited space the full ramifications of climate migration on changing land use and emissions and/or sequestration is beyond the scope of this chapter.
Michael	Wright	Whole Chapter	09. Coastal Effects						Key Topic 1 IIIII Identify likely consequences to coasts by mid century, if no significant emissions reductions are effected by 2030.	We thank the review for the comment. The chapter has been revised to include the likely impacts that could occur by 2050, regardless of the emission trajectory the global community follows.
Michael	Wright	Whole Chapter	09. Coastal Effects						Key Topic 2 IIIII Include potential figure showing sequence of forecasted SLR at varying heights, e.g., 1, 6, 12 inches, with zoomed insets showing impact to high risk coastal regions. For online report, consider including a time lapse video.	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. Many coastal flooding and sea level rise viewers are readily available to provide this purpose. We suggest reviewing: https://coast.noaa.gov/slr/
Michael	Wright	Whole Chapter	09. Coastal Effects						Key Topic 4 IIIII Under ''Barriers,'' include need for additional funding for federal rainfall data to support effective flooding assessment and mitigation planning at the state level, per Ref.9. Also noted under Water.	We than the review for the suggestion. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.
Michael	Wright	Whole Chapter	09. Coastal Effects						Key Topic 4 IIIII Under ''Barriers,'' reiterate the challenges associated with disinformation regarding climate change and SLR.	We appreciate the reviewers comment. The chapter has been revised and does not give space to misinformation or disinformation. The intent of the National Climate Assessment is to remains fact based on the best available scientific literature.
Michael	Wright	Whole Chapter	09. Coastal Effects						Key Topic 4 IIIII Under ''Barriers,'' mention that science community's estimates of potential SLR height, e.g., in inches or worse cm, does not adequately convey to the American public the amount of land that could be consumed at even those seemingly modest values. A figure and map showing sequence of forecasted SLR at varying heights would be informative.	We appreciate the reviewers comments. 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. Many coastal flooding and sea level rise viewers are readily available to provide this purpose. We suggest reviewing: https://coast.noaa.gov/slr/
Michael	Wright	Whole Chapter	09. Coastal Effects						Key Topic 5 IIIII Include potential figure showing locations of low income and minority populations in high risk coastal areas.	We appreciate the reviewers comment. 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. Detailed maps including this information is beyond the scope of this report. However, most states and local governments provide maps and tools for assessing vulnerable communities.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Jhoset	Burgos	Whole Chapter	09. Coastal Effects						Comment: The chapter should discuss actions needed to face coastal effects such as adaptation, planned retreat, innovation, relocation, changes in building codes, limitation of development on coastal areas, among others. One of the coastal effects should include projected and potential multimeter sea level rise plus short-term flooding events and coastal erosion. It is important to recognize our inability to precisely predict long-term sea level rise.	We appreciate the reviewers comments. The chapter has been revised to address many of the comments (including information on adaptation, managed retreat, etc.). The chapter also relies on the best available SLR science released by the Federal Sea Level Rise Task Force in February 2022: https://oceanservice.noaa.gov/hazards/sealevelrise/sealevelrise-tech-report.html
Jhoset	Burgos	Whole Page	09. Coastal Effects			31			Under What's New; Under Increased understanding of the exposure and consequences to communities, ecosystems, and infrastructure in coastal areas from compound flooding/multiple hazards. Add: economy Suggested Language: Increased understanding of the exposure and consequences to communities, ecosystems, economy, and infrastructure in coastal areas from compound flooding/multiple hazards.	We thank the reviewer for the comment. The chapter has been revised to include the economy.
Jhoset	Burgos	Whole Page	09. Coastal Effects			31			Under What's New; Under Increased understanding of the exposure and consequences to communities, ecosystems, and infrastructure in coastal areas from compound flooding/multiple hazards. Under Impact thresholds for built infrastructure and natural environments are better defined, including the nonlinear impacts that can occur; vulnerabilities and consequences consider multiple stressors (e.g., aging infrastructure, vulnerable communities, disaster response and recovery capabilities). Add: sea level rise as one of the examples Suggested Language: ... (e.g., aging infrastructure, vulnerable communities, sea level rise, disaster response and recovery capabilities).	We thank the reviewer for the comment. The chapter has evolved to better address this comment.
Jhoset	Burgos	Whole Page	09. Coastal Effects			32			Under What's New; Under More recognition and research on the inequities of climate change impacts within and among coastal communities; risk and consequences vary because of systemic environmental justice issues, in particular the disproportionate risk to Black, Indigenous, and people of color, and rural and urban poor demographics; Add: insular communities. Suggested Language: More recognition and research on the inequities of climate change impacts within and among coastal communities; risk and consequences vary because of systemic environmental justice issues, in particular the disproportionate risk to Black, Indigenous, insular communities, and people of color, and rural and urban poor demographics	We thank the reviewer for the comment. The author team agrees that the US territories (insular areas) are on the front lines of climate change impacts. However, coverage of US territories is better addressed in the regional chapters: Caribbean Islands and Hawai'i and US-Affiliated Pacific Islands.
Jhoset	Burgos	Whole Page	09. Coastal Effects			32			Under Key Topic 1: Impacts are already happening; Under Updated SLR projections based on observation data set a new lower bound for 21st century SLR and coastal flood risk; because the lower bound is based on observed change, uncertainty around future ice sheet melt does not influence this projection. Comment: Models are an important tool but must be understood to be quite inadequate as a quantifiable basis to plan for the new coastline that is now committed, regardless of efforts to slow the rise in greenhouse gas levels in the atmosphere. The models are not accurate because they do not account for certain elements (e.g. feedback loops). Our improving sophistication to measure GMSL at the submillimeter level has created a sense of false precision for the long term. Many ‚Äúauthorities‚Äù now frame future sea level this century as ‚Äúup to 1.15 meters‚Äù just as one example of the erroneous impressions that are being described. Not only can we not predict it to two decimal places, we don‚Äôt know how many meters it will rise. Discussions about sea level rise (SLR) typically focus on ‚Äúthe models.‚Äù Yet even the latest models are prone to overlook huge factors because of the inability to capture all of the known processes into algorithms. Yet we know that none of the models is remotely capable of hind-casting the dramatic increases in sea level such as the ‚Äúmeltwater pulses‚Äù some 14,000 years ago, when global SLR rose more than four meters a century for approximately four centuries. Though there was more ice to melt back then, the rate of warming was a fraction of the present-day. The observation referred on this statement cannot determined the lower bound of sea level rise for two main reasons: 1) the geological records show that sea level rise rose up to 1 feet a decade; and 2) the rate of sea level rise has been almost doubling (non-lineal geometric increase). The nonlinear increase is recognized on the next section of the one-zero draft. Erase: because the lower bound is based on observed change, uncertainty around future ice sheet melt does not influence this projection. Suggested Language: Updated SLR projections based on observation data set a new lower bound for 21st century SLR and coastal flood risk	We appreciate the reviewers comments. This comment is inconsistent with the current state of the science on this topic. The chapter also relies on the best available SLR science released by the Federal Sea Level Rise Task Force in February 2022: https://oceanservice.noaa.gov/hazards/sealevelrise/sealevelrise-tech-report.html
Jhoset	Burgos	Whole Page	09. Coastal Effects			32			Under: Key Topic 1: Impacts are already happening; Under: Impacts are already happening and will worsen over time and persist irrespective of the greenhouse gas (GHG) trajectory: Under: The rate of SLR from 2006‚Äì2018 has approximately tripled compared to the rate from 1901‚Äì1971, leading to nonlinear increases in flood risk from large events (e.g., Florence, Dorian, Henri, Ida) and small events (e.g., impacts from more common storms and high tide flooding are increasing). Comment: This subsection considers the nonlinear increase in flood risk from large events. This is also true for sea level rise and thus reinforces the idea that uncertainty around future ice sheet melt does in fact influence projections.	We appreciate the reviewers comments. This comment is inconsistent with the current state of the science on this topic. The chapter also relies on the best available SLR science released by the Federal Sea Level Rise Task Force in February 2022: https://oceanservice.noaa.gov/hazards/sealevelrise/sealevelrise-tech-report.html
Jhoset	Burgos	Whole Page	09. Coastal Effects			32			Under: Key Topic 1: Impacts are already happening; Under: Impacts are already happening and will worsen over time and persist irrespective of the greenhouse gas (GHG) trajectory: Under: Chronic coastal stressors (SLR, rising groundwater, ocean acidification, etc.) that impact infrastructure and buildings along the coast (e.g., Miami, Gulfport, Dauphin Island, Ocracoke, Western Alaska, etc.). Add: Add: Puerto Rico and various Caribbean islands. Suggested Language: Chronic coastal stressors (SLR, rising groundwater, ocean acidification, etc.) that impact infrastructure and buildings along the coast (e.g., Miami, Gulfport, Puerto Rico and various Caribbean islands, Dauphin Island, Ocracoke, Western Alaska, etc.)	We thank the reviewer for the comment. The author team agrees that the US territories are on the front lines of climate change impacts. However, coverage of US territories is better addressed in the regional chapters: Caribbean Islands and Hawai'i and US-Affiliated Pacific Islands.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Jhoset	Burgos	Whole Page	09. Coastal Effects		33				Under: Key Topic 2: Compound flooding and multiple flood hazards Under: Flooding in coastal communities is complex, with multiple sources and variables (e.g., storm surge, waves, rivers, rising groundwater, rainfall, runoff); this suggests the need for holistic adaptation planning. Add: Sea Level Rise Proposed Language: ... (e.g., storm surge, waves, rivers, rising groundwater, rainfall, runoff, sea level rise); ...	We thank the reviewer for the comment. The chapter has evolved to better address this comment.
Jhoset	Burgos	Whole Page	09. Coastal Effects		33				Under: Key Topic 3: Natural versus built ecosystems Comment: Include under this key topic the coastal built environment.	We thank the reviewer for the comment. The chapter has evolved to better address this comment.
Jhoset	Burgos	Whole Page	09. Coastal Effects		34				Under: Key Topic 4: Adaptation success, challenges, and barriers Comment: The section does not discuss adaptation success. We encourage the authors to include successes.	We thank the reviewer for the comment. The chapter has evolved to better address this comment, and the author team has sleeted case study to highlight adaptation success. We have also reviewed the latest literature to include information on strategies to achieve adaptation access.
Jhoset	Burgos	Whole Page	09. Coastal Effects		34				Under: Key Topic 4: Adaptation success, challenges, and barriers Under: Barriers, inefficiencies, and challenges to adaptation implementation exist: Add a a subsection the phycological and sociological effects of relocation, removal, or restructuring of coastal communities.	We thank the reviewer for the comment. The chapter has evolved to better address this comment. The author team has reviewed the latest literature to include information on managed retreat.
Jhoset	Burgos	Whole Page	09. Coastal Effects		34				Under: Key Topic 4: Adaptation success, challenges, and barriers Under: Barriers, inefficiencies, and challenges to adaptation implementation exist: Under: Observational data can be insufficient for engineering design and community planning. Engineering design must account for future impacts of climate change as well as the uncertainty in these predictions (e.g., flood risk, marsh migration/degradation, etc.). Add: Sea Level Rise Suggested Language: Observational data can be insufficient for engineering design and community planning. Engineering design must account and anticipate (because of long durability and economical usefulness of coastal assets) for future impacts of climate change and sea level rise as well as the uncertainty in these predictions (e.g., flood risk, marsh migration/degradation, etc.).	We appreciate the reviewers comments. This comment is inconsistent with the current state of the science on this topic. The chapter also relies on the best available SLR science released by the Federal Sea Level Rise Task Force in February 2022: https://oceanservice.noaa.gov/hazards/sealevelrise/sealevelrise-tech-report.html. The current state of the science is actionable for engineering decisions and design to support climate adaptation. We agree that all future projections include uncertainty.
Whitney	Berry	Whole Chapter	09. Coastal Effects	1	31	1	35	1	In general - the words "abandonment" and "managed retreat" should appear here with greater emphasis	We thank the reviewer for the comment. The chapter has evolved to better address this comment. The author team has reviewed the latest literature to include information on managed retreat.
Whitney	Berry	Whole Chapter	09. Coastal Effects	1	31	1	35	1	Harmful Algal Blooms are discussed elsewhere, but should they also be discussed here? There is a nexus of water quality and climate that needs to be underscored.	We thank for the reviewer for the comment. The author team deliberated with other relevant chapters and decided not to include harmful algal blooms in the Coastal Effects chapter.
Whitney	Berry	Whole Chapter	09. Coastal Effects	1	32	1	35	1	Would like to see additional points on impacts to extant infrastructure and on coastal animals (i.e. loss of habitat for coastal ground-dwelling birds, storm surge uncovering/exhuming benthic organisms).	We thank for the reviewer for the comment. The author team deliberated with other relevant chapters and decided that treatment of these points is best covered under the Ecosystems chapter and Regional chapters.
Whitney	Berry	Whole Chapter	09. Coastal effects	1	32	1	35	1	Key topic 5 has a section o diversity, equity, enmviornmental justice and access. this is commendable. Access to public beaches is an equity consideration for many states.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful.
Whitney	Berry	Whole Chapter	09. Coastal Effects	1	32	1	32	1	Key Topic 1: There should be a bullet on SLR impacts on national security. An example is flooding on Norfolk Naval. There should also be a bullet on port infrastrucure impacts	We thank the reviewer for the comment. Climate related impacts on national security are covered under Chapter 17: Climate Effects on US International Interests. Due to space limitations, the Coastal Effects chapter cannot cover all coastal impacts associated with built infrastructure (such as ports); however, regional chapters that include significant port assets may provide this content.
Whitney	Berry	Whole Chapter	09. Coastal Effects	1	33	1	33	1	Key Topic 1 figures: Rafeed Hussain from Ocean Conservancy may have images that depict flooded buildings caused by SLR, and other images of vulernable infrastruce	We thank the review for this comment. The author team is still deliberating on the relevant images to include, and we appreciate the suggestion.
Whitney	Berry	Whole Chapter	09. Coastal Effects	1	33	1	33	1	Key Topic 1 figures: There should be images of flooded military bases, as well as flooding surrounding critical infrastrucure. There should also be images of infrastrucure at risk for flooding.	We thank the review for this comment. The author team is still deliberating on the relevant images to include, and we appreciate the suggestion.
Whitney	Berry	Whole Chapter	09. Coastal Effects	1	33	1	33	1	Key Topic 2: Include infromation on how Regional Ocean Partnerships already have the infrastrucure to coordinate on holistic resilience planning	We thank the review for this comment. This partnership is likely more relevant for Chapter 8: Oceans, but we appreciate this reference.
Whitney	Berry	Whole Chapter	09. Coastal Effects	1	34	1	34	1	Key Topic 5: Include a bullet highlighting how frontline communities need to be better engaged so decision makers can better understand and address their concerns	We thank the reviewer for the comment. We agree with the comment and have reviewed the latest literature and included content on the importance of engaging frontline communities in adaptation efforts.
Catherine	Buchanan	Whole Chapter	10. Oceans						Will there be an educational component added to addressing the issues of climate change? For example: People need to understand how ocean acidification is occurring from the increase in carbon gases in the atmosphere. The greater concentration of carbon gases in the atmosphere results in a higher concentration that can be dissolved into the ocean and creates greater concentrations of carbonic acid. The carbonic acid is the cause of the bleaching of the corals. The acidification of the shallower waters will have a detrimental effect on the fishing communities. The massive deforestation of the Amazon, Australia, Indonesia, and other forests, is a major contributor to the increase in carbonic acid because the trees are not there to take in the carbon dioxide for photosynthesis and use the carbon for building more tissue for the wood. In addition, the trees being gone from the landscape leads to creating water shortages and deserts because the other byproduct from photosynthesis is water. No trees equals desert.	We appreciate this comment. The Oceans and Marine Resources chapter is charged with explaining the impacts of climate change on marine ecosystems and people connected to those ecosystems. We expect the physico-chemical changes and processes driving them to be covered in Chapters 2 and 3.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Katie	Inderbitzen	Whole Chapter	10. Oceans						The United States' EEZ comprises a wide range of depths, the majority of which are considered the "deep ocean." However, this deep component of the ocean does not appear to be reflected in the chapter, which has a heavy topical overlap with the "Coastal" chapter. I was able to find one reference to "deep corals" in the vulnerable habitats bullet point (key topic 1). Unfortunately, the deep ocean, simply owing to its inaccessibility and lack of characterization (via imaging and/or mapping), remains largely unknown, even within our own EEZ. However, we do know that the deep ocean is highly susceptible to the effects of climate change; not only deep coral communities, but also sedimented and hard ground environments that host a variety of macro- and microbiological communities. Unfortunately, the "Oceans" chapter summary currently reads as more of a "Coastal Oceans" summary. The EEZ extends 200 nautical miles offshore and encompasses much more than coastal issues. There is little inclusion of the unique and varied effects of climate change on the deep ocean and how those effects transfer not only to those who live along the coast, but around the globe. Excluding the deep ocean from this climate assessment gives an inaccurate picture of the changing climate in the ocean. The deep ocean could easily be added to most of the existing topics/bullet points, but is also deserving of its own topic that addresses both the lack of characterization (which limits our understanding) and its unique response(s) to climate change.	We thank the reviewer for this comment. We have noted in Key Message 1 that the deep ocean is relatively understudied compared to shelf and nearshore areas, but that it is also being affected by climate change.
David	Koweek	Whole Page	10. Oceans		37				May want to include "surfing" under Ocean-based tourism > Activities. Small changes in sea level rise can have major impacts on surfing due to erosion and changing wave dynamics	We appreciate this suggestion. Although not reflected in the ZOD outline, surfing is mentioned briefly in Key Message 2 of our first order draft.
David	Koweek	Whole Page	10. Oceans		38				Under "Ocean-based mitigation measures", may want to add a bullet point for aquaculture, which can serve as a low-carbon source of animal protein and may provide an additional ocean-based mitigation pathway	We appreciate this suggestion. We mention ocean-based carbon dioxide removal generally but do not have space to outline specific examples. Aquaculture is being covered more broadly the Agriculture chapter.
David	Koweek	Whole Page	10. Oceans		38				Under "Ocean-based mitigation measures" - I recommend splitting the bullet point "Carbon dioxide removal and blue carbon sequestration" into two bullet points to distinguish between traditional blue carbon mitigation work (restoration of submerged aquatic vegetative habitat such as seagrasses, salt marshes, and mangroves) and the newer, less-developed technologies for ocean-based carbon dioxide removal considered in the recently released NASEM report. These include technologies such as ocean fertilization, seaweed cultivation, and ocean alkalinity enhancement (I also acknowledge that the report discusses the "traditional" blue carbon pathways as well).	We appreciate this suggestion. We briefly mention the importance of protection and restoration of blue carbon habitats in our first order draft (Key Message 3), and blue carbon will be further covered by a cross-chapter box.
Joseph	Zajac	Whole Page	10. Oceans		36				use of politically correct terminology has no place in this report: Justice and equity considerations	We appreciate the reviewer's comment but the NCA5 mandate includes consideration of justice and equity, as do other review comments received for the chapter.
Llsa	Levin	Whole Chapter	10. Oceans						The chapter on oceans needs representation of the deep ocean in all key topics. At present, the deep ocean is mentioned only once in the context of deep-sea corals. The deep sea contains a vast array of ecosystems (pelagic and benthic) that experience climate impacts, contribute to climate mitigation, and hold massive amounts of carbon. People are tied to the deep ocean via resources and cultural traditions. Ocean-based mitigation (CO2 removal methods) will impact the deep sea.	We thank the reviewer for this comment. We have noted in Key Message 1 that the deep ocean is relatively understudied compared to shelf and nearshore areas, but that it is also being affected by climate change.
Llsa	Levin	Whole Page	10. Oceans		36				Key topic 1 (chapter 10) mentions oxygen and hypoxia. It will be important to distinguish and discuss open ocean deoxygenation, nutrient-based hypoxia in coastal waters and the role of warming in exacerbating both of these, as well as the feedbacks to climate that result from oxygen loss. Oxygen issues are relevant to the blue economy and to climate intervention (mitigation) as many will act to reduce oxygen. New papers show oxygen loss in the ocean is too important to dismiss, and that adaptation and solutions need to address oxygen loss.	We appreciate this comment. The Oceans and Marine Resources chapter is charged with explaining the impacts of climate change on marine ecosystems and people connected to those ecosystems. We mention a few of the physical changes, including deoxygenation, but expect the physio-chemical changes to be covered in greater detail in Chapters 2 and 3.
Llsa	Levin	Whole Page	10. Oceans		38				Key topic 3 (Ch. 10) needs to include carbon conservation - the preservation of ocean-based carbon storage, transport and sequestration. This is not quite adaptation and not quite mitigation, but involves the maintenance of critical carbon cycle processes performed by the ocean. Many aspects of the blue economy (resource extraction) or continued climate change can disrupt these processes.	Thank you for this important comment. We agree that ocean-based carbon storage/sequestration is an important topic for the NCA5. While there might not be extensive coverage of this topic in our chapter, there will be a special "Cross Cutting Box" on Blue Carbon and the mitigation and adaptation chapters will also touch on this topic.
Llsa	Levin	Whole Page	10. Oceans		36				Key topic one may wish to add a new bullet for "Connectivity" (enabling population exchange) as a key topic affected by climate change. Connectivity is affected by many climate-related factors; changing circulation patterns, changing development times in warmer waters, altered larval success, or settlement cues affected by OA. Similarly - there is mention of energy flow but more explicit mention of altered food webs and trophic structure seems appropriate in this section.	We appreciate this suggestion. While connectivity is not specifically mentioned, changes in habitats, distribution and seasonal timing are all components that impact connectivity and population exchange, and those topics are included. In addition, specific references are given to changes in food webs and energy transfer.
Joseph	Robertson	Whole Page	10. Oceans		36				Under ‚Àòcascading impacts‚Äô and ‚Äòcomplex responses‚Äô, and relating to the proposed infographic of climate impacts: the degree to which marine ecosystems are positioned to maintain health, build biomass, and provide global heating mitigation and food security services, is affected by activities happening far upstream on land, in apparently unrelated sectors and industries. Can these upstream-downstream connections be carefully traced and their interactions assessed, to provide insight into related ecological, biodiversity, biomass, mitigation, adaptation, resilience, and human health and wellbeing impacts? And, can the resulting acceleration or deceleration effects of those dynamics be included?	This is an insightful comment. However, due to the structure of the National Climate Assessment and the tight word limits, we do not have space or scope in this chapter to convey these interactions fully. We have a few examples in the Oceans chapter where we point to upstream impacts (e.g., freshwater inflow, estuaries), but lack space to fully build out land to sea connections.
Doug	Robbins	Whole Page	10. Oceans		37				Please note ecosystem risks and political opposition as barriers to aquaculture development. Ecosystem risks from aquaculture include proliferation and transmission of disease and parasites to wild stocks, pollution from aquaculture wastes, escape of farmed species, introduction of invasive species, and genetic alteration of wild stocks.	We appreciate this comment. Aquaculture will be primarily covered by the Agriculture and Food Systems chapter, and these details may be relevant there. However, all chapters are subject to tight word limits; as these topics extend beyond a direct focus on climate change, it may be difficult to note all of these things in the space available.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
George Christopher	Thomas	Whole Chapter	10. Oceans						I am writing to request the United States federal government adopt the provisions of UNCLOS. We have signed the agreement, but not ratified the language of UNCLOS. For background, this is a description of UNCLOS: ‚ÄúIntroduction -- The United Nations Convention on the Law of the Sea, often referred to by the English acronym UNCLOS, is a multilateral treaty concluded under the auspices of the United Nations and resulted from the third United Nations Conference on the Law of the Sea (UNCLOS III), which took place between 1973 and 1982. The convention was opened for signature on 10 December 1982 in Montego Bay and entered into force on 16 November 1994 upon deposition of the 60th instrument of ratification. The Convention defines and codifies the standards and principles of international maritime law, inherited from customary international law relating to maritime affairs and are expressed to a great extent in the United Nations Charter and current international maritime law norms, such as the Geneva Conventions of 1958. A large portion of these requirements were further strengthened and expanded. The Convention also created the International Court of the Law of the Sea, competent to hear disputes relating to the interpretation and application of that treaty. The convention has been ratified by 168 parties, which includes 167 states (164 United Nations member states plus the UN Observer state Palestine, as well as the Cook Islands and Niue) and the European Union. An additional 14 UN member states have signed, but not ratified the convention. Subsequently, the "Agreement relating to the implementation of Part XI of the United Nations Convention on the Law of the Sea" was signed in 1994, amending the original Convention. The agreement has been ratified by 151 parties (all of which are parties to the Convention), which includes 150 states (147 United Nations member states plus the UN Observer state Palestine, as well as the Cook Islands and Niue) and the European Union. An additional three UN member states (Egypt, Sudan, USA) have signed, but not ratified the agreement‚Äù. I believe ratifying UNCLOS will allow the United States more leverage internationally. And through global cooperation, and working together as an international community, we can fight climate change and reverse the effects of global warming	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. As such, we cannot explicity make policy recommendations, such as one to ratify UNCLOS.
Michael	Wright	Whole Chapter	10. Oceans						What's New IIIII Mention advanced space based observatories, e.g., PACE, data processing systems, and information systems that make ocean data widely available. Also noted under Land Cover, Forests. Built Environment.	Thank you for this comment. We plan to address ocean data access (inclusive of observations, data processing, and information systems) more directly in our chapter draft, however we don't plan to name specific programs to avoid exclusion.
Michael	Wright	Whole Chapter	10. Oceans						Key Topic 1IIIII Include loss of sealife due to warming temperatures that lead to algol blooms.	We thank the reviewer for this comment. Harmful algal blooms and their effects on sea life and human activiites are noted in the first order draft.
Michael	Wright	Whole Chapter	10. Oceans						Key Topic 1IIIII Under ''Ecosystem impacts,'' add that changes in ocean temperatures, stratification, flow patterns, desalinity, and acidification will impact sealife, from small species, e.g., krill to large, e.g., whales.. This will increase the risk of global food chain collapse.	We thank the reviewer for this comment. Key Message 1 of the first order draft focuses on climate impacts across all levels of the ecosystem, including through food webs and to people.
Michael	Wright	Whole Chapter	10. Oceans						Key Topic 1IIIII Identify likely consequences to oceans and marine resources by mid century, if no significant emissions reductions are effected by 2030.	We appreciate this comment. Key Message 3 discusses consequences of emission trajectory decisions we are making now on future ocean conditions and ocean uses.
Michael	Wright	Whole Chapter	10. Oceans						Key Topic 2 IIIII Mention that large scale industrial fishing, e.g., shrimping that results in more than 80% of catch going to waste, per Ref.10, compounds the threats to species that are already impacted by climate change, e.g., warming, acidification, etc. and pollution, e.g., oil spills, plastic waste.	We appreciate this comment. The first order draft notes the importance of reducing non-climate stressors, including overfishing, for enhancing resilience to climate change.
Sarah	Reiter	Whole Chapter	10. Oceans						February 20, 2022 Dear Lead Author Mills, On behalf of the New England Aquarium (NEAq), I am writing to provide comment on the Annotated Outlines of the Fifth National Climate Assessment, in particular, Chapter 10: Oceans. This Chapter is directly relevant to NEAq‚Äôs mission to protect the blue planet by holding the growing blue economy accountable for ocean protection and sustainable practices. We are deeply concerned about the climate crisis. As an ocean conservation organization, waterfront steward, and scientific research institute, we respectfully request the authors consider NEAq‚Äôs science-based input. Chapter 10: Oceans: NEAq supports coexistence in a crowded ocean ‚Ä¢Key Topic 1: Marine social-ecological systems are experiencing unprecedented climate-related disruptions. The story of the large and highly mobile North Atlantic right whale (NARW) reflects the manner in which marine social-ecological systems are experiencing extraordinary climate-related disruptions. Critically endangered NARW face extinction (https://www.narwc.org/uploads/1/1/6/6/116623219/2020narwcreport_cardfinal.pdf). While the primary causes of NARW mortality are due to entanglement in fishing gear and vessel strikes, the species‚Äô recovery is also threatened by low reproduction, habitat loss, disease, environmental contaminants, and intersecting impacts associated with climate change. In parallel with NEAq‚Äôs work to protect NARW from entanglements (https://doi.org/10.1016/j.marpol.2019.103587; https://conbio.onlinelibrary.wiley.com/doi/10.1111/cobi.12590) and vessel strikes, NEAq is acutely aware that the NARW is, and will likely continue to be on the move under future climate scenarios (https://doi.org/10.1525/elementa.2020.20.00058). In turn, conservation practice will require identifying new habitats and protecting those habitats from human threats (e.g., fixed fishing gear, shipping) (https://doi.org/10.1111/gcb.15191). According to Pershing and Pendleton, the story of the NARW is both simple and specifically complex, ‚ÄúWarming has now reduced the biomass of C. finmarchicus in the Gulf of Maine, and the whales have done the expected thing: move to the north where their cold-water prey are presumably more abundant. So far, this has not been a successful	We appreciate this suggestion. The first key message of the Oceans chapter (in first order draft) discusses climate impacts across multiple levels of the ecosystem, as we are seeing in the case of right whales. We incorporated right whales as an example into our figure for this key message, and we are coordinating with the Northeast Chapter to provide greater coverage of climate impacts on right whales. The text also includes references to whale entanglements on the West coast in Box 1.
Whitney	Berry	Whole Chapter	10. Oceans	1	36	1	38	1	Add surfing, snorkeling, paddling to list of Ocean based activities	We thank the reviewer for this comment. We mention surfing and coral reef tourism (which often involves snorkeling) as activities that will be affected by climate change. We are currently unaware of studies of how ocean-based paddling will be affected by climate change.
Whitney	Berry	Whole Chapter	10. Oceans	1	36	1	38	1	Key Topic 1 - Mention somewhere the impact of warming water on coral bleaching events, on severity of algal events on reefs, on the impact of disease (e.g. Stony Coral Tissue Loss Disease) on coral	We thank the reviewer for this comment. We have mentioned the unique vulnerabilities of coral reefs and the synergetic impacts of climate change on them. Unfortunately, we do not have space to discuss many details in the text.
Whitney	Berry	Whole Chapter	10. Oceans	1	36	1	38	1	Under key topic 1, add in changes to species distribution/home ranges, and synergistic impacts of climate change with other stressors (i.e. chemical and plastic pollution, invasive species etc.)	We appreciate this comment, and these topics have been covered in Key Message 1 of the first order draft.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Whitney	Berry	Whole Chapter	10. Oceans	1	37	1	38	1	Under Marine Fisheries Adaptation measures at different scales, include subsistence fishers, including those that rely on delineated "usual & accustomed" fishing grounds	We thank the reviewer for this comment and have used 'usual and accustomed' fishing grounds as one example of a management approach that was grounded in expectations that historical states will remain the same in the future--an assumption that is creating many challenges with climate change.
Whitney	Berry	Whole Chapter	10. Oceans	1	37	1	38	1	Under Economic costs, include disproportionate impacts to fishing communities	We appreciate this comment. Fishing communities factor into all of our key messages, but we do not have data to quantify economic impacts at a community scales.
Whitney	Berry	Whole Chapter	10. Oceans	1	38	1	38	1	Under limits of adaptation, add in: difficulty in predicting unknowns, i.e. exactly how ecosystems and communities will react	Thank you for this comment. Due to word limitations, we are unable to address this topic fully in the chapter text, but our traceable accounts discuss increasing uncertainties in predictions as we move from physical conditions to ecosystem conditions to human impacts. Not only are human impacts shaped by complex interactions with the ecosystem, but they are also shaped by human reactions and decisions, which cannot be anticipated with certainty.
Whitney	Berry	Whole Chapter	10. Oceans	1	38	1	38	1	their key topic 1 includes Justice and Equity considerations. I wish all the chapters that this front and center as a must section	We appreciate this comment.
Whitney	Berry	Whole Chapter	10. Oceans	1	36	1	37	1	Key Topic 2: I would be careful here to ensure that the text reflected about the blue economy focuses on the need for healthy and resilient ecosystems. It is not economy at expense of environment. You need both. Also note that we are not planning/future-casting climate impacts and what those do in a mgmt context	We thank the reviewer for the comment. We recognize the importance of healthy ecosystems underpinning a healthy blue economy and have focused much of Key Message 1 on climate change impacts to marine ecosystems and associated social systems.
Whitney	Berry	Whole Chapter	10. Oceans	1	37	1	37	1	Key Topic 2: Under the aquaculture bullet, include detials on algal aquaculture impacts. Kelp, for example	We appreciate this comment. We have noted that macroalgal (e.g., kelp) aquaculture offers carbon dioxide removal capacity in Key Message 3 of our first order draft.
Whitney	Berry	Whole Chapter	10. Oceans	1	37	1	37	1	Key Topic 2: Under the aquaculture bullet, include a bullet on potential risk of spatial conflic with other ocean users, like recreational anglers, caused by shifting stocks	We thank the reviewer for the comment. Aquaculture is being covered in the Agriculture chapter, but we generally note new interactions and trade-offs emerging among ocean uses in Key Message 3.
Whitney	Berry	Whole Chapter	10. Oceans	1	37	1	37	1	Key Topic 2: Under ocean based tourism, include bullets on sightseeing tours like lighthouse tours and offshore wind turbine viewings	We appreciate this suggestion. Unfortunately, we have not found data or studies of these tourism opportunities and how they are being impacted by climate change. We may identify sources for these topics during later stages of the review process.
Whitney	Berry	Whole Chapter	10. Oceans	1	37	1	37	1	Key Topic 2: Under economic costs, include a bullet on the economic cost on underserved communites like Tribes	We appreicate this suggestion. We note impacts to Indigenous Peoples but do not have data to quantify economic costs at highly-resolved community or group scales.
Whitney	Berry	Whole Chapter	10. Oceans	1	37	1	37	1	Key Topic 2: There should be a bullet on National Defense Impacts including, effect of SLR on coastal bases, effect of weather on USGS and Naval bases, increase in rescues at sea, effect of weather and SLR on defense industry	We appreciate this comment. The Oceans chapter is covering topics from the shoreline towards the offshore. Issues related to sea level rise and land-based facilities will be covered by the Coasts chapter.
Whitney	Berry	Whole Chapter	10. Oceans	1	37	1	37	1	Key Topic 2: There should be a bullet on ports/maritime impacts	We appreciate this suggestion. We cover marine transportation as part of Key Message 2 and expect ports to be covered by the Coasts chapter.
Whitney	Berry	Whole Chapter	10. Oceans	1	38	1	38	1	Key Topic 3: Under the "Human adaptation" bullet, make a connection to the utility and effectiveness of Regional Ocean Partnerships (ROPs) and publically accessible data portals, as well as the White House Ocean Policy Committee (OPC) governance strucutre. It can also be tied to the US joining the Ocean Panel and committing to create a National Sustainable Ocean Plan by 2027	We appreciate this comment. Although we do not have space to list examples, we do note the importance of cross-sector and cross-scale coordinating mechanisms and governance arrangements for supporting climate adaptation in the 'issues and opportunities' section at the end of the chapter.
Whitney	Berry	Whole Chapter	10. Oceans	1	38	1	38	1	Key Topic 3: Under the limits of adaptation bullet, include a bullet on the lack of access to data from a lack of interagency collaboration and data sharing initiatives with ocean users	Thank you for this suggestion. We have incorporated this point into the 'Issues and Opportunities' section at the end of the chapter.
Whitney	Berry	Whole Chapter	10. Oceans	1	38	1	38	1	Key Topic 3: Under the "Interactions between adaptation and mitigation efforts", "there should be a bullet on conflicts between offshore wind and other sectors like commercial fishing and ports and maritime."	We appreciate this comment. The potential for new ocean uses (e.g., offshore wind) to interact with and affect existing activities is noted in Key Message 2 of our first order draft.
Whitney	Berry	Whole Chapter	10. Oceans	1	38	1	38	1	Key Topic 3 Figures: Potentially include a list offshore wind projects. Good example here: https://www.northeastoceandata.org/offshore-wind-projects/	We appreciate this suggestion. We plan to incorporate proposed offshore wind locations into a figure in Key Message 2. Due to word limits, we cannot devote text to providing very many details but hope the figure will convey the message appropriately.
Whitney	Berry	Whole Chapter	10. Oceans	1	36	1	37	1	Under Key topic 1, for the bullet on complex responses, there is an opportunity to mention challenges across scales and across jurisdictional boundaries. This is a central challenge for U.S. federal fishery management, where the system does not yet have adequate mechanisms to deal with stocks that shift across boundaries and scales.	We appreciate this comment. We note cross-sector and cross-scale jurisdictional challenges in the 'Issues and Opportunities' section of our first order draft.
Whitney	Berry	Whole Chapter	10. Oceans	1	37	1	37	1	Under Key topic 2, sub-bullet on marine fisheries, it is worth noting that another key barrier at the federal level is that there are not discrete insertion points to bring climate information into management and have it influence decision-making. As such, whether any climate information is used to inform management is determined by the interest of a council and their existing processes.	We appreciate this suggestion. In our first order draft, Key Message 2 notes the value of considering climate information in the fishery management process. Unfortunately, we do not have space to expand on these comments to speak about insertion points or cross-region consistency.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Bill	Mayben	Whole Chapter	11. Agriculture						Dear Chapter Authors; Your comments are all foundational. I want to make a few observations; some of which may seen simplistic or apparent, but our success is implementation. We need food to live. Food security is fundamental to our function as a society. The way in which we have operated to this point, regarding our food supply, takes elements for granted which are suddenly, broadly, not reliable to sustain us. You have spoken of the sustainability and resilience of our rural community cultures. I would consider these cultures as a knowledge base, a base of expertise, and a key US industry. Corporations are answerable to their stockholders, and may be construed as extractive. Can we enjoy the diversity of agricultural products as corporate farming focuses on those crops with the greatest economic potential with the smallest investment? Can we afford, going forward, to expend our soils, transportation systems, to grow crops for transportation fuels? This is a political and economic construct in a world without enough food already. It can be described as wasteful. This conversation shades into transportation and complex systems. While we somehow have the ability to grow corn for fuel, we seemingly do not have the ability to construct rural community economic and finance systems to keep this vital resource in place. To have reliable food security going forward, we need to employ plant genetics, GIS, nutritional and yield information, direct involvement in micro climatic data sharing, in a changing climate. There are several immediate issues threatening our food supply; the depletion of our prime pollinators, bee colony collapse. Another seldom recognized phenomena is that even thought increased CO2 should accelerate plant growth, it also appears to reduce the protein content of grains. This is occurring alarmingly quickly. Failed adaptation to climate change in agricultural communities endangers all of us. Optimal success of our food supply rests in rural communities having access to the services and informational resources, the economic resources enjoyed in the densest urban environment. We all need to be engaged. While it is true that we need to pivot to solar and wind energy; our needs for energy are so great that it	We thank the reviewer for the comments. The author team will take these comments into consideration in future revisions.
Catherine	Buchanan	Whole Chapter	11. Agriculture						Regarding food security, has there been discussion on alternative methods for growing food? For example, garden towers and permaculture that use less land and less water. https://www.gardentowerproject.com/ Cattle grazing has a massive environmental impact on the indigenous plants and wildlife. There are no more native grasses in the United States due to the introduction of cheatgrass by the ranchers, which has crowded out the native grasses. Also, the overgrazing with as much as 10 million head of livestock on the public lands have devastated the native vegetation and allowed for toxic invasive plant species to take their place. All of the wildlife are now faced with greater competition for the drastically reduced food sources. The cattle ranchers and BLM are intensively attempting to exterminate the wild horses and burros that are federally protected from our public lands. How will the models be used to encourage the restoration of the native plant species and reduce the livestock numbers to stop and prevent further environmental of the native wildlife food resources, and, to stop the extermination of our wild horses and burros? Agricultural activities need to be properly categorized into appropriate classifications because there can be no equitable water sharing if the truth about the disparities in agricultural practices are not outlined. BigAg, flood irrigation, laboratory modified food farms, exporters, small organic farms, public land ranchers, small family ranches, wineries, and etc.	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.
Sara	Delaney	Whole Page	11. Agriculture		39				In the line: Socially vulnerable populations are prevalent in rural communities. Examples include racial/ethnic minorities, the aging and disabled, the poor, persons with a mental illness, and other vulnerable populations that are often concentrated in economically distressed rural areas. I suggest adding 'less-educated' to the list of vulnerabilities here.	The chapter text has been revised to address the resiliency and capacity of rural communities.
Sara	Delaney	Whole Page	11. Agriculture		40				In the line: Ability of traditional ecological knowledge, as well as local knowledge, to inform resilient agroecosystem implementation I would suggest highlighting the fact that traditional and particularly indigenous knowledge is often separated from the knowledge of other farmers in most regions and states. Many farmers groups and social networks do not include indigenous farmers, who tend to more so talk to each other. This makes it harder to use their knowledge to inform land management, and is a challenge that could be actively addressed.	The chapter text has been revised to incorporate this perspective as much as feasible given the constraints of chapter length.
Sara	Delaney	Whole Page	11. Agriculture		42				In the Key Topic 3: Agricultural Sustainability area, I would suggest adding, somewhere, a discussion on the social science insights related to agricultural or farmer adoption of climate adaptation activities, as in the rural communities section. This could include incentives, barriers, link between farmers and advisory services and other influences on farm manager decision-making.	The chapter text has been revised to incorporate this perspective as much as feasible given the constraints of chapter length.
Ben	Lilliston	Whole Page	11. Agriculture		40				Rural economies are particularly natural resource-based. Beyond agriculture, they depend on sectors like forestry, tourism and mining. Climate change is already affecting these sectors. For example, in Minnesota the types of trees that can grow in the northern part of the state has shifted, forcing changes in the paper industry there. As water temperatures have risen, the types of fish (like the walleye) that can be caught in the state has shifted. In other parts of the country, the loss of snow has affected skiing and other snow-based recreation and tourism. And while rural communities are increasingly a source of renewable energy, whether for solar or wind generation, much of that renewable infrastructure is extractive for urban centers. Rural communities with large wind turbines supply the larger energy grid, often don‚Äôt have access to that wind energy in their own community. Rural residents are also vulnerable to climate-related disruptions. The steady loss of rural hospitals over the last several decades, means health care is further away and less accessible. The loss of rural grocery stores means access to food is further away.	The chapter text has been revised to incorporate economic diversity of rural communities, the extractive nature of resources, and some of the various infrastructure challenges and constraints as much as feasible given the constraints of chapter length.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Ben	Lilliston	Whole Page	11. Agriculture		41				Topic 2 ‚Äì Food systems, security and justice When considering the impact of climate change on the food system in the U.S., it is important to recognize that the U.S. is deeply embedded within a global food system. The U.S. now imports much of its fruit and vegetable supply. U.S. meat and poultry production is largely controlled by a small number of global corporations, with operations around the world that are both exporting and importing. Food animals like cattle or hogs may be born in one country and processed whole or in part in another one. This global nature of the U.S. food supply creates some risks, as we saw during the Covid-19 pandemic. The longer the supply chain, the more vulnerable to climate disruption whether in the U.S. or elsewhere in the world. Through a series of policy decisions, including farm and trade policy, the U.S. food system is both dependent on imports (for certain foods) and exports (because of excess domestic production of certain crops and foods). The consideration of climate risk to the nation‚Äôs food supply was not part of those previous policy decisions. Climate risk for agriculture rises with less diversity, whether in the supply chain, or on the farm. A farm growing only one crop is more vulnerable to being wiped out by disease, pest or weather event. More diverse cropping systems, including the integration of animals, provide more resilience to potential climate disruptions. The same is true for concentrated supply chains. The U.S. has shifted over the last several decades toward fewer, but much larger, meatpacking plants. When one is forced to close, the reverberations hit both farmers selling to the plant and consumers purchasing meat.	The authors have addressed many of these comments in the most recent draft including local to global food system vulnerability and supply chain issues. Some of these comments are policy related and beyond the scope of the assessment.
Ben	Lilliston	Whole Page	11. Agriculture		43				Topic #3 Agricultural Sustainability Over the last 30 years, the U.S. has dramatically shifted the way it raises animals. This shift toward concentrated animal feeding operations (CAFOs) has placed large numbers of animals, often thousands, in a tightly confined space. The result has been increased acreage devoted to growing corn and soybeans to feed these animals. CAFOs also rely on giant manure lagoons to store waste. These manure lagoons pose a climate risk to rural communities. North Carolina has experienced multiple hurricanes that have resulted in the overflow and breach of hog manure lagoons, ultimately polluting local water ways. Other Midwest states, including Iowa, have had similar experiences with major storms. The EPA Greenhouse Gas Inventory is clear that the rise in agriculture-related methane emissions (and to a lesser extent nitrous oxide emissions) is linked to the dairy and hog CAFO model of liquifying its manure in lagoons, and then spraying that liquified manure on surrounding fields. The CAFO system of dairy production has been identified in California as a major source of methane emissions and is a target of the state‚Äôs climate policy. The CAFO system of production continues to expand in the U.S. with much of the new hog and dairy production geared toward exports, not the U.S. market. The CAFO system not only undercuts more climate resilient, and less emitting, systems of livestock production in the marketplace, it also locks in land for animal feed (such as corn) that rely heavily on fertilizers, a major source of nitrous oxide emissions. Land currently being used for feed is an obstacle to expanding more sustainably-managed, scale-appropriate pasture based systems. U.S. conservation programs that help support farmers in a variety of ways, from perennial grasses, to buffer strips and cover crops, to fencing for sustainably managed grazing, are extremely popular. From 2010 to 2020 only 31 percent of farmers who applied for Environmental Quality Incentives Program contracts were approved, and only 42 percent of farmers who applied for Conservation Stewardship Program contracts were approved. Expanding these programs, and improving them with a clear climate lens, is low hanging fruit to aid farmers seeking to increase resilience on their farm.	We thank the reviewer for the comment. We have included information on the role of conservation programs on resilience. However, 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.
Sydney	Heck	Whole Page	11. Agriculture		39				It's interesting to think about the morality of agriculture in relation to the environment. What exactly would a non socially acceptable method of preserving agriculture be? There may be some good in incentivising individuals to start their own gardens to ease some strain from struggling farms.	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac	Whole Chapter	11. Agriculture						use of politically correct terminology has no place in this report: Key Topic 1: Sustainability of rural communities	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac	Whole Page	11. Agriculture		41				the cost of fuel for transportation because of green government policies is the biggest driver of increases in food prices, NOT: Significant costs and increases in food prices expected with changing climate	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac	Whole Chapter	11. Agriculture						this chapter falsely gives the impression of widespread starvations, poverty and helplessness outside of urban areas	In our most recent draft, we have carefully worded the document to avoid giving the reader this impression of rural communities.
Joseph	Zajac	Whole Chapter	11. Agriculture						needs to cover the huge negative economic impact on rural areas from green state and federal government policies	Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Roy	Clark	Whole Chapter	11. Agriculture						Comment on Chapter 11, NCA5, Agriculture, Food Systems and Rural Communities Roy Clark PhD President Ventura Photonics Thousand Oaks CA 91360 The first step for Chapter 11 is the quantitative determination of the effects of the observed increases in the atmospheric concentration of so called ‚Äògreenhouse gases‚Äô, particularly CO2 on US Agriculture, Food Systems and Rural Communities. This then provides the foundation for any actions that need to be taken. Over the past 200 years, the atmospheric concentration of CO2 has increased by approximately 130 parts per million (ppm), from 280 to 410 ppm [Keeling, 2021]. The concentration is still increasing and is now approaching 420 ppm. This has produced a decrease near 2 W m-2 in the longwave IR (LWIR) flux emitted to space within the CO2 emission bands. There has also been a similar increase in the downward LWIR flux from the lower troposphere to the surface [Harde, 2017]. At present, the annual average increase in CO2 concentration is about 2.4 ppm. This produces an annual increase in the downward LWIR flux to the surface of approximately 0.034 W m-2. A quantitative thermal engineering analysis of the effects of these CO2 induced LWIR flux changes on temperatures in the troposphere, and on land and ocean thermal reservoirs shows that there can be no measurable effect on the earth‚Äôs climate [Clark, 2013]. The results from climate models such as the CMIP5/6 ‚Äòensembles‚Äô are fraudulent and should not be used for climate assessment. The fundamental error is the assumption of an equilibrium average climate that can be perturbed by CO2 [Knutti and Hegerl, 2008]. This is discussed in more detail the general comment and the comments on Chapters 2 and 3 submitted by Roy Clark PhD. Detailed technical comments were submitted as e mail attachments. Please consult these for further information, figures and references. The ID Numbers of the online	This comment is inconsistent with the current state of the science on this topic.
Niamh	Fitzpatrick	Whole Chapter	11. Agriculture						This chapter got my attention because globalization, overpopulation, overconsumption, poverty, and inequality are highlighting the severity of global hunger. The reality of food insecurity is daunting, and cliamte change is only exascerbating the threat of food insecurity and food shortages around the world. Something I appreciate that this chapter addresses is the ways hunger and food insecurity are experienced differently between rich and poor, or urban and rural people. We know that climate change is a threat multiplier for hungry and undernourished people. And, we know that rural communities tend to be poorer and more vulnerable. So, how can we cater to the specific needs of rural, vulnerable, poor communities to help them prepare for climate change threats? Also, what limitations or inequalities are in place that maintain poverty, lack healthcare, and make these communities unable to prevent or recover from climate disasters? Reducing threats will require large-scale action and radical transformation. Some broad, basic steps include better preparedness for and response to disasters, support with resilience and adaptation among the most vulnerable groups and regions, addressing global inequalities, mitigating climate change without compromising food and nutrition security, make financing for climate action fair and effective, and radically transform food systems around the world.	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.
Richard	McNider	Whole Chapter	11. Agriculture						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‚Äôs agricultural production that occurred in the last century that threaten agriculture in the coming decades. In the last century the geography of the Nation‚Äôs 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	We thank the reviewer for the comments. The author team will take these comments into consideration in future revisions.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Elizabeth	Rowe	Whole Chapter	11. Agriculture						February 20, 2022 Re: Comments on Zero Order Draft, Chapter 11: Agriculture Dear Carl Bolster ‚Äì My name is Elizabeth Rowe and I work as an environmental management consultant to environmental non-profits on climate change public opinion and policy. The majority of my research and work centers around the climate change attitudes of rural communities. I am excited to have this opportunity to provide comments on the Zero Order Draft for Chapter 11: Agriculture. Based on a review of the chapter outline, I would like to commend you and your team for capturing so many of the concerns I have heard from rural communities on the impacts they are facing from climate change. As a graduate student at Duke University, I worked on a research team to study how rural Americans feel about the environment, environmental regulation, and climate change. I hope the results of this study will prove useful to you and your team in completing this chapter for the Fifth National Climate Assessment. Based on the results of this research, there is one matter I would like to flag for your consideration. During the stakeholder engagement session, it was mentioned that it is mandated that the chapter authors for Agriculture all be representatives from federal agencies. Our research found, that despite rural America‚Äôs risk from climate change, climate change attitudes are highly polarized along the urban-rural divide. Even when accounting for partisanship and other demographics, rural voters were less supportive of climate action. It is well documented that attitudes towards the government are a fundamental driver of the urban-rural divide on both environmental issues broadly and climate change specifically. Among rural voters there is often a reticence to openly discuss the topic of climate change, and there is often a lack of access to climate science. There is a profound need for the science provided in the National Climate Assessment to be accessible to rural communities, and I am concerned that a federal agency team may bias these communities away from the results of your research. I thank you and your team for your impressive work to date, and look forward to continuing to engage in the development of NCA5.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful. One of the tasks for the writing team is to provide a clear and accurate assessment of the state of agriculture with respect to climate change. Despite our present positions, the authors of this chapter come from both urban and rural backgrounds and are mindful of how perspectives differ across the many divides in the U.S. It will be our task to do this effectively.
Madeline	Cohen	Whole Page	11. Agriculture		43				The Good Food Institute (GFI) submits the following comment. Alternative proteins are an innovative climate solution that target a number of sustainability problems in our current food system. Alternative proteins include plant-based, cultivated, and fermentation-derived meat, seafood, eggs, and dairy. Compared to animal-based proteins, they emit fewer greenhouse gases, use less land and water, contribute less to erosion, biodiversity loss, eutrophication, acidification, and deforestation, and add robust diversity to our food supply in the face of increasing extreme weather events. Given the urgency of the climate crisis and the potential for alternative proteins to make our food system more sustainable and resilient, GFI urges the authors to include alternative proteins in the chapter on Agriculture, Food Systems, and Rural Communities. Background Globally, food systems cause approximately a third of all anthropogenic greenhouse gas emissions (Crippa et al., 2021). Conventional animal-based food production is responsible for more than half of those emissions (Xu et al., 2020). In addition, the opportunity cost of current methods of meat production is roughly 26 Gt CO2eq per year (Hayek et al., 2020). Animal-based food production is the single largest anthropogenic use of land (Cassidy et al., 2013) and is responsible for about 30 percent of global agricultural water requirements (Mekonnen and Hoekstra, 2012). In the United States, livestock production is responsible for more than half of soil erosion on agricultural lands and the resulting sediment pollution, and a third of the nitrogen and phosphorus polluting freshwater sources (FAO, 2006). Livestock runoff can lead to eutrophication in both freshwater and marine ecosystems, threatening native species and increasing risks for rural and coastal communities (FAO, 2006). Increases in global population and demand for animal products are only going to make these problems worse in coming years. According to Springmann et al. (2018), ‚Äúas a result of expected changes in population and income levels, the environmental effects of the food system could increase by 50-90 percent in the absence of technological changes and dedicated mitigation measures, reaching levels that are	We thank the reviewer for these comments. For the comments directly relevant to our chapter, we will take them into consideration in future drafts. The points that the commenter raises that are beyond the scope of this chapter/report we will refer to the approriate chapters within the Assesment that directly address these issues.
DAnn	Williams	Whole Chapter	11. Agriculture						From: D‚ÄôAnn Williams, Johns Hopkins School of Public Health, Center for a Livable Future To: USGCRP ‚Äì NCA5 Chapter Authors Re: USGCRP NCA5 Chapter Outline Comment Disclaimer: The opinions expressed herein are our own and do not necessarily reflect the views of The Johns Hopkins University. February 19, 2022 Dear Chapter Authors, Thank you for the opportunity to comment on the United States Global Change Research Program Strategic Plan (2022-2031) Prospectus and Chapter Outlines. We are researchers at the Johns Hopkins Center for a Livable Future (CLF), an interdisciplinary research center based at the Johns Hopkins Bloomberg School of Public Health. CLF applies science and systems thinking to help build healthy, just, equitable, resilient, and sustainable food systems. We have reviewed the USGCRP strategic plan prospectus (SPP), reviewed the chapter outlines and have attended many of the NCA5 Public Engagement Workshops held by USGCRP and chapter authors. These virtual sessions have been informative, as well as interactive and inclusive. We strongly support the vison and mission of this multi-agency cooperative program to fully ‚Äúunderstand the forces shaping the global environment, both human and natural and their impacts on society.‚Äù There are four pillars for this work as stated in the USGCRP SPP: 1. advancing science, 2. informing decisions, 3. engaging the nation and 4. collaborating internationally. Under these four pillars are cross-cutting themes, diversity and inclusion, risk-based approaches, enhanced social science integration, communication, and workforce development. To adequately advance science and inform the development and implementation of climate change solutions, we urge you to stress the importance of developing multi-agency research and programs that improve our understanding of the public health implications of climate change and pathways to address agriculture and food systems contribution to climate change while protecting public health and environmental justice. Currently there are numerous gaps in our knowledge around current policies and practices and climate change and even fewer	We do discuss where agriculutre, health, and food systems interface with climate change. We will acknowledge the existence of important data and research gaps in future drafts. Any policy of funding recommendtaions are beyond the scope of the Assessment.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Mark	Chopping	Whole Page	11. Agriculture		39				At "Improved understanding of greenhouse gas (GHG) emissions in the food system, of factors that can be managed to reduce uncertainties in predicting emissions, and mitigation potential of various agricultural practices (e.g., soil carbon dynamics and sequestration potential; agroforestry; and the use of GWP100 vs GWP* metrics to measure warming-equivalence of methane in agriculture, a complex emerging topic for the general public for which a science-based summary could be informative)." I agree strongly with this. While "meat-as-major-climate-villain" has recently become accepted conventional wisdom among the general public - and while there is indeed some climate impact from ruminant livestock emissions and forest conversion to pasture - I do not believe that the demonization of meat is supported by science. Livestock carbon is part of the short-term carbon cycle (carbon that was recently in the air); this is very different from fossil carbon combustion that entails a massive and rapid transfer of geological carbon into the atmosphere. However, the drawdown of carbon by the terrestrial biosphere - the carbon used by livestock - seems to be ignored rather consistently in published analyses. In contrast, burning fossil fuels is a reckless planetary scale geophysical experiment: an humongous and effectively irrevocable disruption of the long-term carbon cycle. Furthermore, land use statistics for livestock production are often cited as global averages that naively ignore the constraints imposed by climate and soils. The focus on promoting veganism is therefore a dangerous distraction from the primary task of re-engineering our civilization to run on energy obtained without combustion of fossil carbon fuels; and one that is unlikely to be widely adopted, or effective.	We thank the reviewer for the comment. The authors are working hard to focus on solutions and paths forward which are both practical and responsible. This comment does not appear to raise a question or suggest a revision.
Michael	Wright	Whole Chapter	11. Agriculture						What's New IIIII Recent proliferation of climate disinformation and relatively vocal conservative opinions, which are most prevalent in rural communities, generate a lack of understanding and concern regarding climate change, its causes and impacts. These opinions, in turn, move rural voters to elect policymakers who generally oppose climate action and perpetuate disinformation, thus creating a vicious cycle of climate inaction and opposition. Also noted under Sector Interactions, Human Social Systems.	This comment does not appear to raise a question or suggest a revision.
Michael	Wright	Whole Chapter	11. Agriculture						Key Topic 1IIIII Mention how climate induced drought, flooding, and disease reduces availability of some produce and meats, thereby increasing costs and contributing to closure of smaller farms and businesses.	We thank the reviewer for the comment. The most recent draft addresses these comments with discussion on extreme events.
Michael	Wright	Whole Chapter	11. Agriculture						Key Topic 1IIIII Under ''Barriers,'' mention proliferation of disinformation and conservative policies that oppose climate action and adaptation.	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 or make statements related to politics. Discussion of policy options is beyond its defined scope.
Michael	Wright	Whole Chapter	11. Agriculture						Key Topic 1IIIII Under ''Barriers,'' include fact that much of U.S. farmland is owned and operated by large corporations, many from overseas. This creates challenges to rural communites when it comes to taking climate action, whether it be mitigation or adaptation.	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 or make statements related to politics. Discussion of policy options is beyond its defined scope.
Michael	Wright	Whole Chapter	11. Agriculture						Key Topic 1IIIII Under potential figures, include map of rural communities that are predominately Republican and are therefore either underinformed or misinformed about climate change, or oppose climate action. Cross correlate these with climate vulnerability or having plans for adaptation.	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 or make statements related to politics. Discussion of policy options is beyond its defined scope.
Michael	Wright	Whole Chapter	11. Agriculture						Key Topic 1IIIII Under potential figures, include map of farmland that is owned and and or operated by non community organizations, e.g., out of state corporations. This can highlight how even increased climate awareness of rural communities may not be enough to either mitigate or adapt.	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.
Michael	Wright	Whole Chapter	11. Agriculture						Key Topic 2 IIIII Under ''Climate change impacts,'' cite risk of food chain collapse.	Vulnerabilities in the food supply chain are addressed.
Michael	Wright	Whole Chapter	11. Agriculture						Key Topic 2 IIIII There are few market based incentive to conserve forested or other natural land cover that sequesters carbon, compared to profits gleaned through development, or in some cases agriculture. Also noted under Land Cover, Forests, Economics	In the most recent draft we include government programs that address agricultural sustainability.
Michael	Wright	Whole Chapter	11. Agriculture						Key Topic 2 IIIII Identify likely consequences to food and agriculture by mid century, if no significant emissions reductions are effected by 2030.	We address these comments in the most recent draft.
Michael	Wright	Whole Chapter	11. Agriculture						Key Topic 3 IIIII Address the emissions associated with corn production, processing, and distribution for high carbon products like ethanol and beef.	Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples.
Michael	Wright	Whole Chapter	11. Agriculture						Key Topic 3 IIIII Address demand for high carbon foods, like palm oil, beef, tropical fruits, etc., which exacerbate climate change that in turn impacts agricultural yields, food systems, and rural communities.	Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples.
Jhoset	Burgos	Whole Chapter	11. Agriculture						Comment: Consider the effects of permanent flooding and saltwater intrusion due to sea level rise on agriculture and food systems. In addition, consider the effect on insular communities.	We thank the reviewer for the comments. The author team will take these comments into consideration in future revisions
Clare	Cannon	Whole Chapter	12. Built Environment						This is excellent and clearly spells out the advancements of the field. One comment, and it may relate to the first point regarding processes of urbanization and suburbanization etc., is the Wildland Urban Interface (WUI). WUI is increasingly important for multiple environmental hazards, particularly wild fire in the Western U.S. and is an important area and avenue for research. It may not belong in this chapter and potentially could fit in the rural communities chapter (did not see it there either), but is something to be considered. Thank you for the hard work! This is a very exciting chapter.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful. The point about WUI is well-taken. The BE chapter will include some assessment of WUI issues, but the bulk of it will occur in the Southwest and Forests chapters. We intend to cross-reference as appropriate.
Melissa	Tier	Whole Page	12. Built Environment		47				Under Key Topic 3 (and elsewhere), it would be nice to see more with regard to multi-level governance systems (municipal, regional, state, federal, etc.).	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Sharon	Gourdji	Whole Chapter	12. Built Environment						Who would the authors like to influence with this chapter? It seems that there is a general education element for the public but also a persuasive element for decision-makers, at least in terms of laying out options and tradeoffs. Should this chapter (and the whole report more generally) be targeted mostly towards Congress, federal agencies, state/ local governments or practitioners (e.g. urban planners/ architects/ real estate professionals/ transportation planners) or all of the above? It would be great to identify a few key audiences and then outline how this chapter might be useful to each constituency.	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. The Built Environment chapter seeks to assess evidence of ongoing climate actions in cities, so the audience is likely local leaders, community groups, as well as citizens who are interested in learning about how climate change poses risks to cities and also how cities are working to plan to such risks. The comment's reference to urban planners, architects, real estate professionals, etc. are all part of our intended audience.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Joyce	Coffee	Whole Chapter	12. Built Environment						Hello, You might find it useful to review: KEEP SAFE MIAMI FUNDING AND FINANCE GUIDE https://www.climateresilienceconsulting.com/reports#:~:text=KEEP%20SAFE%20MIAMI%20FUNDING%20AND%20FINANCE%20GUIDE Affordable housing is fundamental to resilient communities. Working with a national advisory board, Enterprise Community Partners and the Institute for Building Technology and Safety we created a funding and finance guide to help affordable housing developers and owners locate resources for resilience measures that protect residents. Through the Keep Safe Miami process, the City of Miami identified additional funding to shore up multifamily low and moderate income housing resilience.	We thank the reviewer for the comment. The Built Environment chapter includes a section on funding and financing. Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples.
Joseph	Zajac	Whole Chapter	12. Built Environment						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	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Joseph	Zajac	Whole Chapter	12. Built Environment						fails to mention and gives no reason why the CO2 level continued to rise under COVID when the world's economy was basically shut down for over a year	We thank the reviewer for the comment, but the suggestion is outside the scope of our Built Environment chapter. Assessments of carbon emissions can be found elsewhere in the Assessment.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	12. Built Environment						‚óèRural is important. Landscape fragmentation due to sprawl. Keeping rural places rural. ‚óèGuess that the general audience is other scientists. ‚óèData and tools exist. How to transfer/communicate the data and where you can focus. Is the data transferable into action? Where is the data? What to do with it? A community hub for climate change information. ‚óèThe Fourth National Climate Assessment is the latest data and provides an overview but not a call to action. ‚óèHow can we have input to make it more useful for our Wisconsin community? ‚óèNeed action steps to take once we understand the data. What can we do? ‚óèThe report is likely not a venue for action. ‚óèWhat about the idea of addressing how we approach infrastructure development. More specifically, have the development be more flexible with a shorter life span that the way it has been historically done. ‚óèCreating layers of infrastructure. Tier project approach. ‚óèAble to share the information more widely so people can chose to do something. ‚óèNot only the risk burden but also the ability to recover from climate change adverse event. How can you make those communities at risk more resilient. Can do small things like putting in a sump pump or placing basement items in plastic bins and off the floor. ‚óèData needs to be presented so the average person can understand it. Same for action steps. Education is crucial. The average person doesn‚Äôt know this stuff. Comes back to the idea of community resource center. ‚óèRealtors are a good group to help in education. Lenders could possibly be another source of education. A federal backed loan might have a floodplain assessment to purchase. Tighter market seems to have created federal housing loans being given for home that have significant issues. ‚óèOffice of Rural Prosperity page is focused on lending for business - but there are transferable topics https://drc.wisconsin.gov/topic/SmallBusiness/LenderInfo.html	We thank the reviewer for the comment. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. As such, any reference to future actions is outside of the scope of this report. In the Built Environment chapter, we assess past and ongoing actions at the city-level, with the intention of synthesizing key examples and opportunities for action. We are also grateful for the reviewer for the extensive comments on our chapter content. To respond, we include a definition of urban and built environment systems, while recognizing the potential cross-overs with the transportation, energy, rural communities, coasts, water, and other sector chapters. Issues such as urban flooding is covered in the Water chapter while human mobility and migration is covered in the Human Social Sciences chapter. There is a need to delineate topics given the word count limitations. The Built Environment chapter does assess science on building codes and standards.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	12. Built Environment						Page 44 to 48 1. Relationship to rural and landscape fragmentation due to a sprawl - inability to keep rural areas rural which impacts resilience... 2. Data exists - question if the need is availability or understanding the data and what it means/implies; staff capacity and transferable to action; one stop shop to understand vulnerability; actions are necessary immediately 3. Where are realtor in all of this? Realtor education is needed and need examples for new homeowners (e.g., rain gardens) 4. Federally backed loans need a review of flooding, but normal bank loans do not, suggest a fix 5. Assuming that green infrastructure is embedded here in addition to innovations with energy creation at waste water treatment facilities - reducing GHGs, etc. 6. Need information to get out to the average person and action steps; example: ability to assess FEMA maps when buying a house. 7. Education is crucial - at a basic level and giving people simple tools and examples for what to do. 8. For US, where can federal government assist communities in moving forward (from where they are at). Not sure in a federal system that unevenness isn't inevitable, but what advantages are there within that context? 9. Infrastructure development; lifetime; definitive timeline or standards; insert flexibility; traditional risk management is key to applying to CC. Secondary and tertiatary such as green infrastructure. Layered approach. 10. Vulnerability/health risks/ bring to action and address environmental justice issues 11. Ability to recover; how can feds/states assist? target services to reduce risk - could be as easy as a sump pump risk is everywhere some places higher risk 12. Assume this chapter is talking about both temperature and precipitation. Flooding is a real risk to many communities	We greatly appreciate the reviewer's comment. The text has been revised to incorporate this suggestion/information on climate impacts/risks on property, green infrastructure, local financing strategies, and building/infrastructure standards. We now also include a revised definition of the urban. Given space constraints, many of the commenter's points about energy, health, migration, and regional land use change are slightly beyond on the scope of this chapter. There are also separate chapters that tackle flooding (in the Water chapter) and sea level rise (in the Coasts chapter). There may be opportunities to cross-reference discussions of these points in other chapters. Additionally, consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations. Therefore, the commenter's points about the role of federal government policies is beyond the scope of this report.
Lauren	Day	Whole Chapter	12. Built Environment						As more countries begin to go through development, it is nice to see that officials are evaluating how to do this in the most efficient, affordable, low-impact manner. Cities are crucial economic drivers, but the development and production of a city can also have negative impacts on the environment. I also like how the article mentions marginalized communities and the effects on these communities as cities develop further. With cities on the coasts, I wonder what will happen as sea levels rise. Some cities, like New York and Miami, will have the funds to deal with the issues that arise. What will happen to the cities that do not have the money to properly mitigate issues related to sea-level rise? In small coastal towns, people's property is essentially becoming worthless, and they do not typically have the money to relocate. I wonder how this will be dealt with.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful. Our chapter is revised a bit to incorporate more assessments of sea level rise, especially in terms of property and infrastructure implications. However, the majority of assessment on sea level rise will be located in the Coasts chapter. The Adaptation chapter also devotes a significant amount of text on it. Given word count limitations, it will be impossible to include detailed assessments in all chapters. The author team has deliberated and prioritized the information and illustrations to include.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Joseph	Sollod	Whole Page	12. Built Environment		47				This chapter should consider including discussion on the important role of building codes, for both climate mitigation and adaptation. 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. This will ultimately enhance energy system, social, and infrastructural resilience. Energy codes are an important policy tool in both climate mitigation and adaptation. Energy codes are 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. It will be important to touch on the impact of building codes, and their proper implementation and enforcement, as a solution to "hardening" energy systems and building function. Increasing levels of energy efficiency in buildings can lead to less energy demand,Äîthus decreasing reliance on fossil fuels and enhancing the ability to achieve zero energy goals through increased renewable energy deployment. Additional buildings policies including incentives to drive retrofits or ongoing performance requirements should be coordinated with building energy codes to assure a holistic policy approach aligned with overall energy and GHG reduction goals. In addition to protecting residents from the impacts of hazard events, buildings use energy to support occupant comfort and health, and the important functions they house. Assuring buildings use energy efficiently is essential for protecting human health, economic prosperity and reducing the impacts of climate change. Other building codes beyond energy codes protect building occupants from hazards,Äîincluding those driven by climactic conditions. As climate change influences the intensity and frequency of disasters, building codes must adjust to address the changing risks buildings and infrastructure will face over their lifetime (sometimes 50 to 100 years). The availability of climate science in a format and level of granularity necessary to support the design, construction and operations process will be essential	We thank the reviewer for the comment. The chapter text has been revised to incorporate assessments of building energy codes. We recognize that this is an important point. The chapter includes assessments of building standards and codes, although with limited space, we focused on broad trends rather than specific examples. We thank the commenter for the suggested information and references. The Built Environment chapter will also endeavor to cross-reference assessments of energy security found in the Energy chapter and Mitigation chapter.
Joseph	Sollod	Whole Chapter	12. Built Environment						Energy codes are highly effective in reducing energy use and greenhouse gas emissions while also saving building owners and tenants money and enhancing their resilience. Implementation of energy codes also results in job creation. 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 CO2 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 2021 IECC also includes an appendix for achievement of zero energy buildings. DOE has also found that use of the 2021 IECC will save U.S. homeowners an average of $2,320 over the lifetime of a typical mortgage (30 years) and, if implemented nationally, would create over 22,000 jobs in the first year and 632,000 jobs cumulatively over 30 years.	We thank the reviewer for the comment. The chapter text has been revised to incorporate some suggested text on building energy efficiency and energy codes. We recognize that this is an important point. The chapter includes assessments of building standards and codes, although with limited space, we focused on broad trends rather than specific examples. We thank the commenter for the suggested information and references. The Built Environment chapter will also endeavor to cross-reference assessments of energy security found in the Energy chapter and Mitigation chapter.
Joseph	Sollod	Whole Page	12. Built Environment		46				This chapter should discuss the social and economic resiliency benefits associated with energy efficiency measures in buildings, including the effective implementation of building energy codes. Energy insecurity, fuel poverty or high energy burdens impact the social resilience of low- and moderate-income populations. Energy insecurity intersects with other hardships, compounding the severity of the others, contributing to detrimental health consequences. Competing needs and hardships, such as food insecurity, water insecurity, and housing insecurity, result in tradeoffs where basic needs are prioritized and sometimes foregone. The stress from having to make trade-offs between basic needs for food, water, housing, and energy profoundly affects adult and child mental health, exacerbating many kinds of physical health and social issues. High-energy burdens can also mean that households have limited capacity to prepare for and respond to adverse events. They may also stress low-income residents, impacting their long-term health and well-being (in addition to the physical effects of inadequate housing). In the U.S. for example, low-income households face energy burdens two to three times that of median households. Of all U.S. households, 25% (30.6 million) face a high energy burden (i.e., pay more than 6% of income on energy bills) and 13% (15.9 million) of U.S. households face a severe energy burden (i.e., pay more than 10% of income on energy). Building codes and weatherization or retrofit programs provide important mechanisms for reducing energy burdens. Importantly, such efforts can improve quality of life and health outcomes while providing economic stimulus and job creation. Reducing the energy burden through energy efficiency measures provided in energy codes can help reduce one potential source of vulnerability.	We thank the reviewer for the comment. The chapter text has been revised to incorporate some suggested text on building energy efficiency. The issue of energy burden is important, although it needs to be assessed specifically in the context of climate change. As the commenter suggested, the chapter includes assessment of housing/building retrofits and weatherization, in particular, and their connections of health and social vulnerability. The chapter includes assessments of building standards and codes, although with limited space, we focused on broad trends rather than specific examples. The Built Environment chapter will also endeavor to cross-reference assessments of energy security found in the Energy chapter and Mitigation chapter.
Joseph	Sollod	Whole Page	12. Built Environment		46				This chapter should include off-site construction as a growing solution to address cost burdens and enhance 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. Such building elements may be prefabricated at a different location and transported to the site or prefabricated on the construction site and then transported to their final location. 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. 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.	We thank the reviewer for the comment. 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 may not be able to extensively cover topics of off-site construction.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Joseph	Sollod	Whole Page	12. Built Environment		47				This chapter should discuss the growing opportunity and need for the integration of forward-looking climate data/science in decision-relevant mechanisms, such as building codes and standards, to adapt to the increasing risks the built environment and society are faced with considering climate change and associated hazard events. The Global Resiliency Dialogue, an initiative launched in late 2019, is a collaboration between building code development and research organizations in Australia, New Zealand, Canada and the United States, to develop a pathway to integration of forward-looking climate science into building codes, which have traditionally relied on historical data to construct hazard maps. Through two survey reports, the Global Resiliency Dialogue has found that the greatest climate data need is for more localized models that utilize baselines that climate and building scientists can agree upon; climate data needs to be easily available to architects, engineers, planners and regulators from an authoritative source, and presented or cited with some measurement of reliability; climate science data needs to be somehow ‚Äútranslated‚Äù into data that can be used by building professionals for future code development; different types of climate data are used to determine risks caused by different types of hazards and along different time intervals throughout the process; and there is urgency to act now as the climate crisis is both complex and urgent. These reports will be submitted as relevant resources to the NCA committees.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion of assessing recent scientific insights on building codes. Many thanks also for submitting these references for consideration.
Joseph	Sollod	Whole Page	12. Built Environment		47				This chapter should discuss building codes, which are an important policy tool in climate adaptation. Building codes and standards provide a common language and requirements for the design, construction, and operation of buildings aimed at supporting the building industry construct safe, resilient, and sustainable structures. They have long served as the main tool of governments in setting agreed-upon norms. Building codes are a fundamental contributor to community resilience. A community cannot be resilient without resilient buildings and the codes that support their development. Resilience in the built environment starts with strong, regularly adopted, and properly administered building codes. To date, energy codes have primarily been focused on reducing energy costs, energy use, and greenhouse gas emissions. However, as climate adaptation becomes a priority, energy codes are also being recognized for their contributions to resilience. Climate change is expected to result in an increase in extreme temperature events. Through provisions for efficient building envelopes and heating, ventilation, air-conditioning and refrigeration equipment plus guidance on shading and reducing solar heat gain, energy codes can reduce the impacts of such extreme events. Additionally, during these extreme events, the energy grid may become strained. Reduced energy demand to obtain comfortable temperatures through increased building efficiency can also enhance resilience of the energy grid. In addition to energy efficiency, building codes address multiple other important climate factors including water use, materials and waste, indoor air quality including ventilation and filtration, and sustainable economic growth and job creation. They also help protect occupants from the devastating impacts of climate change. While the perils covered by building codes can vary, they generally address climate-based risks including flooding, tropical cyclone/hurricane, wildfire/bushfire, and extreme snow through the provision of either performance or prescriptive requirements for structural loads, material properties, enclosure characteristics, and other design requirements.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion of assessing recent scientific insights on building codes. The assessments of energy may land in the Energy chapter given word count limitations.
Joseph	Sollod	Whole Page	12. Built Environment		47				The built environment is central to both enhancing resilience and mitigating greenhouse gas (GHG) emissions. Buildings are our shelter against the storm, the homes of our governments and institutions, drivers of economies, and symbols of our ideals. At the same time, buildings are significant users of energy and materials ‚Äì accounting for approximately 40% of global greenhouse gas emissions. Building energy codes are an important policy tool in climate mitigation. To date, energy codes have primarily been focused on reducing energy costs, energy use, and GHG emissions. However, as climate adaptation becomes a priority, energy codes are also being recognized for their contributions to resilience. Climate change is expected to result in an increase in extreme temperature events. Through provisions for efficient building envelopes and heating, ventilation, air-conditioning and refrigeration equipment plus guidance on shading and reducing solar heat gain, energy codes can reduce the impacts of such extreme events. Additionally, during these extreme events, the energy grid may become strained. Reduced energy demand to obtain comfortable temperatures through increased building efficiency can also enhance resilience of the energy grid. 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 CO2 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 2021 IECC also includes an appendix for achievement of zero energy buildings. DOE has also found that use of the 2021 IECC will save U.S. homeowners an average of $2,320 over the lifetime of a typical mortgage (30 years) and, if implemented nationally, would create over 22,000 jobs in the first year and 632,000 jobs cumulatively over 30 years. According to DOE, from 2010 to 2040, if consistently implemented and regularly updated, the model	We greatly appreciate the reviewer's comment. Many thanks for the suggested reference. The text has been revised to incorporate this suggestion/information. More detailed coverage of the points on energy may be assessed in the Energy chapter given word count limitations.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Joseph	Sollod	Whole Page	12. Built Environment		47				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. Building codes and standards provide a common language and requirements for the design, construction, and operation of buildings aimed at supporting the building industry construct safe, resilient, and sustainable structures. Building codes are a fundamental contributor to community resilience. A community cannot be resilient without resilient buildings and the codes that support their development. Resilience in the built environment starts with strong, regularly adopted, and properly administered building codes They also help protect occupants from the devastating impacts of climate change. While the perils covered by building codes can vary, they generally address climate-based risks including flooding, tropical cyclone/hurricane, wildfire/bushfire, and extreme snow through the provision of either performance or prescriptive requirements for structural loads, material properties, enclosure characteristics, and other design requirements. 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. The NIBS report also found that retrofitting structures to current codes,Äô flood mitigation requirements can provide $6 in mitigation benefits for every $1 invested and that retrofitting structures to the Code Council,Äôs International Wildland-Urban Interface Code (IWUIC) could provide $2 to as much as $8 in mitigation benefits for each $1 invested. The U.S. Federal Emergency Management Agency (FEMA) in its Building Codes Save: A Nationwide Study found that the International Residential Code (IRC) and International Building Code (IBC) provided more than $27 billion in cumulative mitigation benefits against flood, hurricane wind, and earthquake	We greatly appreciate the reviewer's comment. Many thanks for the suggested reference. The text has been revised to incorporate this suggestion/information.
Elizabeth	Rowe	Whole Chapter	12. Built Environment						February 20, 2022 Re: Comments on Zero Order Draft, Chapter 12: Built Environment Dear Eric Chu ,Äì On behalf of the Joint Implementation Task Force of the Climate Resilience Plan for Agnes Scott College and the City of Decatur, we are pleased to submit the following comments focused on the Zero Order Draft for Chapter 12: Built Environment. In February 2021 Agnes Scott College and the City of Decatur, Georgia completed a joint Climate Resilience Plan (CRP). The purpose of the CRP was to identify together the most pressing impacts of climate change anticipated in this region and outline the strategies for addressing these impacts, both in terms of preparation and response. The CRP is meant to give the college and the city the ability to work together, move beyond limited funding and incentives for climate response in Georgia, create new solutions, and jointly find funding support when needed. The implementation of the CRP is managed by a Joint Implementation Task Force from Agnes Scott College and the City of Decatur fire and emergency services, public works, city planning, and residents serving on the city,Äôs Environmental Sustainability Board. Below is a link to the CRP which outlines specific strategies for energy, water, and public safety, while also addressing concerns about communications, equity, and community involvement. As stated in the Built Environment outline, implementation of climate mitigation and resilience measures can be uneven and uncoordinated within cities. The primary goal of our joint CRP is to build community partnership to ensure coordinated response to key climate scenarios. Within our first year of implementation, we have facilitated a joint meeting with every emergency management official for the City of Decatur, Agnes Scott College, City Schools of Decatur, and Dekalb County Emergency Management, to begin to coordinate our response to the most pressing climate scenarios for this region. Through this partnership, our community of staff, students, and residents who will be impacted by climate change locally in the months and years to come are now more organized to face these challenges	We greatly appreciate the reviewer's comment. Many thanks for highlighting the example of the City of Decatur and their ongoing work in this area. The Built Environment chapter will endeavor to assess broad trends of local/urban climate action across the country, with the intention that examples from Decatur and other localities will be represented in the chapter. We very much appreciate this suggestion, but space is limited. The author team has deliberated and prioritized the information and illustrations to include.
Daniel	Brown	Whole Chapter	12. Built Environment						Key Topic 2 Re:Re: The need for extensive evaluation of the vulnerability of dams to climate change As the probability of damaging storms continues to increase, many communities struggle to accurately assess the future vulnerability of dams and other in-stream infrastructure. The catastrophic failure of the Edenville and Sanford Dams in Michigan in 2020 highlight the need to consider precipitation projections in future dam maintenance, repair, construction and removal decisions. During the summer of 2021, the Huron River watershed in southeast Michigan experienced 3 storms that fit the criteria of a 50-year storm as described by NOAA Atlas 14. The flood that broke the Edenville and Sanford dams near Midland, Michigan, was characterized as a 500-year year flood event. In 1986, the same area experienced a 100-year flood. Three such storms of similar magnitude have hit the area of Michigan in the past 34-years. These types of events and precipitation patterns have reinvigorated discussion of dam safety and dam removal in the Midwest. Of note: the following study should be reviewed by authors as they consider future precipitation recurrence intervals, flood risk, and vulnerable infrastructure. Kirchmeier-Young, M. C. and Zhang, X.: Human influence has intensified extreme precipitation in North America, P. Natl. Acad. Sci. USA, 117, 13308,Äì13313, 2020.	We greatly appreciate the reviewer's comment. We have taken note of the suggested citation. The points the commenter raised are linked to/cited in this chapter, although the main assessments will be in the Water and Climate Trends chapters. The Built Environment chapter will endeavor to include references to dams while taking into consideration word count limitations.
Juanita	Constible	Whole Chapter	12. Built Environment						Please consider including a brief discussion or some case studies of how the COVID-19 pandemic has advanced or set back emissions mitigation and adaptation activities, particularly in smaller, less well resourced cities. One place to do this might be under Key Topic 3.	We greatly appreciate the reviewer's comment. The report now includes a cross-chapter box on COVID-19. The Built Environment chapter will endeavor to incorporate some of this assessment with word count limitations in mind.
Evan	Mills	Whole Page	12. Built Environment		44				Re: What,Äôs New, bullet 5 Glad to see focus on maladaptations, as well as co-benefits. I trust this will extend beyond the relatively well-documented examples for the energy sector to include water, forest management, agriculture, and other sectors., etc.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Megan	Susman	Whole Chapter	12. Built Environment						In this chapter, I suggest being clear with your language and definitions. Many non-specialists interpret ‚Äúurban‚Äù to mean only large cities. More than half the U.S. population lives in suburbs; suburban areas must be part of the discussion. You could use ‚Äúmetropolitan‚Äù instead of ‚Äúurban‚Äù, ‚Äúbuilt environment‚Äù and/or ‚Äúinfrastructure‚Äù or similar terms instead of ‚Äúurban systems‚Äù, and ‚Äúdevelopment‚Äù instead of ‚Äúurbanization.‚Äù ‚ÄúUrban‚Äù could be removed entirely from phrases like ‚Äúurban heat island‚Äù (U.S. EPA uses the term ‚Äúheat island‚Äù). It is important to be clear that these issues affect developed areas generally, not just large cities, and to avoid possible misunderstanding.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. We give a clearer definition of urban systems that not only include large cities but also small/medium-sized towns and suburbs.
Megan	Susman	Whole Page	12. Built Environment			45			The outline suggests that Key Topic 1 will treat cities as a problem because they generate large amounts of GHG emissions. Cities are a solution to the climate crisis, not a problem. Cities and other compact development generate lower GHG emissions per capita than more spread-out development. I suggest including an explicit statement to this effect to make it clear that this chapter is not anti-city, as well as research showing the climate benefits of more compact development (lower GHG emissions from transportation, per capita home energy use, etc.).	We thank the reviewer for the comment. Key Message 3 of the Built Environment chapter is about climate mitigation and adaptation opportunities in cities, including discussions of urban design, governance, and nature-based solutions. There is a focus on co-benefits as well. The chapter assesses science showing how cities can be spaces of opportunity, however efforts may not be coordinated or at scale.
Megan	Susman	Whole Page	12. Built Environment			46			In the opening paragraph under Key Topic 2, I suggest revising ‚Äúsocial vulnerability within cities‚Äù to ‚Äúsocial vulnerability in metropolitan areas.‚Äù Many low-income and socially vulnerable areas are in suburbs, and this chapter should be inclusive of those as well.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Megan	Susman	Whole Page	12. Built Environment			46			In Key Topic 2, it would be good to highlight the benefits as well as the risks of living in metropolitan areas. Socially vulnerable people are likely to have more and easier access to resources in a compactly developed place (e.g., being able to walk to a cooling center during a heat wave if they don‚Äôt have a car or can‚Äôt drive, having more neighbors nearby who might check on them).	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Michael	Wright	Whole Chapter	12. Built Environment						What's New IIIII Add that, despite the evidence based warnings that sea level rise, or SLR, is increasing and will continue throughout this century, coastal development has increased in many high risk areas. Also noted under Coastal Effects.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Much of the assessments of SLR and coastal risks will be in the Coasts and Adaptation chapters give word count limitations.
Michael	Wright	Whole Chapter	12. Built Environment						What's New IIIII Add that significant increase in impervious surfaces impairs ground water supplies, increases contaminated runoff, and eliminates land cover's carbon uptake capacity. This in turn exacerbates climate change. Also noted under Water, Land Cover.	We thank the reviewer for the comment. We will endeavor to incorporate this suggestion into our chapter text.
Michael	Wright	Whole Chapter	12. Built Environment						What's New IIIII Add that the recently reported shortage of housing and increased housing prices, along with Trump era tax incentives for developers, incentivizes development of forested land, farmland and other open spaces, including coastlines.	We thank the reviewer for the comment. We will endeavor to incorporate this suggestion into our chapter text. The Built Environment chapter assesses science behind urban/housing growth patterns, although it does not refer to specific past/ongoing policies.
Michael	Wright	Whole Chapter	12. Built Environment						What's New IIIII Mention advanced space based observatories, e.g., LandSat 9, data processing systems, and information systems that make land use data widely available. Also noted under Land Cover, Forests, Oceans.	We thank the reviewer for the comment. We will endeavor to incorporate this suggestion into our chapter text.
Michael	Wright	Whole Chapter	12. Built Environment						What's New IIIII Mention new low carbon construction materials, e.g., ''green'' cement.	We thank the reviewer for the comment. We will endeavor to incorporate this suggestion into our chapter text.
Michael	Wright	Whole Chapter	12. Built Environment						Key Topic 1 IIIII Add that construction of highways on previously undeveloped land induces additional land development along the corridor, such as housing, retail, office buildings, and freight distribution warehouses. This further exacerbates climate change by increasing emissions for construction and building operations, and by eliminating carbon sequestration afforded by natural land cover. Also noted under Land Cover, Transportation.	We thank the reviewer for the comment. We will endeavor to incorporate this suggestion into our chapter text. Much of the assessment of transportation infrastructure will be in the Transportation chapter given word count limitations.
Michael	Wright	Whole Chapter	12. Built Environment						Key Topic 2 IIIII Include coastal erosion due to SLR not only impacts animal habitat, natural vegetation, and built environment, but also induces more emissions involved in restoration and reactive mitigation, e.g., beach restoration, levy construction, structure relocation, etc. Also noted under Coastal Effects.	We thank the reviewer for the comment. We will endeavor to incorporate this suggestion into our chapter text. Much of the assessment of coastal erosion, SLR, and ecosystems will be in the Coastal and Ecosystems chapters given word count limitations. We endeavor to cross-reference as appropriate.
Michael	Wright	Whole Chapter	12. Built Environment						Key Topic 2 IIIII Future migration from coastal areas due to sea level rise will result in even more development on inland forests, grasslands, and farmland. This signficant increase in development on land with natural cover decreases carbon sequestration capacity, while also increasing risk of climate change impacts in these areas. Also noted under Land Cover, Forests, Coastal Effects, Human Social Systems.	We thank the reviewer for the comment. We will endeavor to incorporate this suggestion into our chapter text. Much of the assessment of human mobility and migration will be in the Human Social Systems and Adaptation chapters given word count limitations.
Michael	Wright	Whole Chapter	12. Built Environment						Key Topic 2 IIIII Identify likely consequences to cities and infrastructure by mid century, if no significant emissions reductions are effected by 2030.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Michael	Wright	Whole Chapter	12. Built Environment						Key Topic 3 IIIII Mention increasing use of high carbon construction materials, e.g., steel, concrete that exacerbate climate change and induce more impacts to built environments.	We thank the reviewer for the comment. We will endeavor to incorporate this suggestion into our chapter text.
Michael	Wright	Whole Chapter	12. Built Environment						Key Topic 3 IIIII Add that elevated, flood resistant transportation systems, proven in decades of operation around the world, will be key to enabling climate resistant transportation. Public systems like monorail and elevated high speed magnetic levitation, or maglev. are more climate resistant and sustainable than highways to reduce emissions and impervious surface runoff, and thereby also help reduce flooding. Also noted under Transportation.	We thank the reviewer for the comment, but the suggestion is outside the scope of this chapter. Assessments of transportation infrastructure will be in the Infrastructure chapter given word count limitations.
Michael	Wright	Whole Chapter	12. Built Environment						Key Topic 3 IIIII Mention conservation measures, both lacking and possible, including A. building insulation, B. incentives to use less rather than more power, B. technology to deactivate lighting, HVAC, etc., when areas are unoccupied, C. energy saving equipment. Also noted under Energy.	We thank the reviewer for the comment. We will endeavor to incorporate this suggestion into our chapter text.
Michael	Wright	Whole Chapter	12. Built Environment						Key Topic 3 IIIII Include barrier and challenge to greenhouse gas mitigation and climate change adaptation includes lack of awareness, including disinformation about climate change, impacts, and potential local mitigation strategies. The latter includes regional public awareness campaigns, training for planning officials, effective zoning and regulations, and federal and state support for municipalities whose policymakers are often uninformed about climate change and environmental issues in general.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion on the role of awareness building and community. However this chapter is not to be policy prescriptive.
Michael	Wright	Whole Chapter	12. Built Environment						New Key Topic IIIII Add a potential figure comparing carbon emissions and footprint of various transportation modes, including high speed intercity rail and urban monorail.	We thank the reviewer for the comment, but the suggestion is outside the scope of this chapter. Assessments of transportation infrastructure will be in the Infrastructure chapter given word count limitations.
Jhoset	Burgos	Whole Chapter	12. Built Environment						Comment: Overall, the infrastructure design, built environment, and urban systems planning discussed in this chapter should also account for projected and potential multimeter SLR for this century and beyond. It is important to recognize our inability to precisely predict long-term sea level rise.	We thank the reviewer for the comment. We will endeavor to incorporate this suggestion into our chapter text. However, assessments of SLR will be in the Climate Trends and Coasts chapters given word count limitations.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Jhoset	Burgos	Whole Page	12. Built Environment		45				Under Key Topic 1: Emerging physical and natural scientific understandings of the role of cities and urbanization in influencing local, regional, and global climate Under: Characterization and assessment of current observations, forecasts, and future scenarios concerning urban development, land cover/land use, and urban form change as relevant to the physical drivers of climate across multiple scales. Highlight developments in assessing the carbon footprint and carbon cycle impacts of urban systems. Cross-cutting theme: application of geospatial mapping techniques to understand variation in urban climates and urban influence on climates within and between cities/regions (coordinate with Ch. 2: Earth Systems, Ch. 3: Climate Trends, Ch. 6: Land, and Ch. 8: Ecosystems). Comment: This should take into consideration the effects of cities and urbanization on the ability of coastal communities to adapt to future SLR.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Additional assessments of SLR will be in the Climate Trends and Coasts chapters given word count limitations.
Jhoset	Burgos	Whole Page	12. Built Environment		46				Under: Key Topic 2: Key impacts, risks, and vulnerabilities associated with climate change and the built environment. Under: Assess vulnerability of the built environment and its users/inhabitants to climate-attributable impacts and global change. Build on messages from NCA4 and the Third National Climate Assessment on social vulnerability within cities and the built environment (coordinate with Ch. 20: Social Systems]. Identify key risks and uncertainties in the built environment. Add: Sea Level Rise Suggested Language: Assess vulnerability of the built environment and its users/inhabitants to climate-attributable impacts, sea level rise, and global change. Build on messages from NCA4 and the Third National Climate Assessment on social vulnerability within cities and the built environment (coordinate with Ch. 20: Social Systems]. Identify key risks and uncertainties in the built environment	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Jhoset	Burgos	Whole Page	12. Built Environment		46				Under: Key Topic 2: Key impacts, risks, and vulnerabilities associated with climate change and the built environment. Under: Typology of key impacts and risks: Provide a more nuanced framing that includes different risks and uncertainties, including those associated with direct and indirect hazard impacts/stressors and compound/interacting events. Under: Direct: Key hazard drivers/stressors and their indicators. Analysis of geographic distribution and characterize unequal exposure within and across urban systems, including indoor and outdoor environments, critical/essential services, and supply chains; Indirect: Quantify and qualify the human/social and financial implications of key physical and transition risks to the built environment, including ways to appraise and value built/human assets; Immediate observations: Examples of where immediate/near-term climate impacts on cities and urban environments have been dramatically realized since NCA4, including incidences of unequal exposure and effects on critical/essential services and supply chains; Long-term trends: Discuss uncertainties associated with mid/late-century scenarios, especially given the life spans of physical infrastructure; Existential threats: Potential for system failure, cascading risks, and uneven distribution of socioeconomic impacts. Comment: This should include sea level rise considerations	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Jhoset	Burgos	Whole Page	12. Built Environment		46				Under: Key Topic 2: Key impacts, risks, and vulnerabilities associated with climate change and the built environment. Under: Vulnerabilities: Assess how connections and interdependencies between built environment systems (including infrastructure systems), urban economies, institutions, social organizations, and even households contribute to or amplify both climate-driven and contextual vulnerabilities over time. Highlight emerging analyses of systemic vulnerability (coordinate with Ch. 20: Social Systems). Comment: Cultural aspects should be considered. Add: cultures. Suggested Language: Vulnerabilities: Assess how connections and interdependencies between built environment systems (including infrastructure systems), urban economies, institutions, social organizations, cultures, and even households contribute to or amplify both climate-driven and contextual vulnerabilities over time. Highlight emerging analyses of systemic vulnerability (coordinate with Ch. 20: Social Systems).	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Jhoset	Burgos	Whole Page	12. Built Environment		46				Under: Key Topic 2: Key impacts, risks, and vulnerabilities associated with climate change and the built environment. Under: Vulnerabilities: Assess how connections and interdependencies between built environment systems (including infrastructure systems), urban economies, institutions, social organizations, and even households contribute to or amplify both climate-driven and contextual vulnerabilities over time. Highlight emerging analyses of systemic vulnerability (coordinate with Ch. 20: Social Systems). Under: Highlight new research on urban form, land use, and zoning relative to exposure and sensitivity reduction, as well as advances in forward-looking design and engineering. Comment: When discussing zoning, please consider including projected and potential multimeter sea level rise plus short-term flooding events and coastal erosion. It is important to recognize our inability to precisely predict long-term sea level rise.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Additional assessments of SLR will be in the Climate Trends and Coasts chapters given word count limitations.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Jhoset	Burgos	Whole Page	12. Built Environment		47				Under: Key Topic 3: Assessment on the state of urban greenhouse gas mitigation, climate adaptation, and risk-reduction options and opportunities, including enablers and barriers to implementation. Under: Measurement and evaluation of city-scale and building-scale emissions mitigation, vulnerability reduction, hazard exposure reduction, climate adaptation, and resilience actions in support of planning, decision-making, and implementation of a range of climate commitments and action plans. Add: Sea Level Rise Suggested Language: Measurement and evaluation of city-scale and building-scale emissions mitigation, vulnerability reduction, hazard exposure reduction, sea level rise and climate adaptation, and resilience actions in support of planning, decision-making, and implementation of a range of climate commitments and action plans.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Whitney	Berry	Whole Chapter	12. Built Environment	1	47	1	48	1	Under Key Topic 3, another sector to consider that impacts the built environment: waste management/ recycling	We thank the reviewer for the comment. We will endeavor to incorporate this suggestion into our chapter text.
Whitney	Berry	Whole Chapter	12. Built Environment	1	47	1	48	1	Under Key Topic 3, exploring potential co-benefits: two examples worth exploring, 1) investing in the circular economy and reduced land requirements for landfilling, 2) increasing composting infrastructure and decreased methane emissions from food waste in landfills	We thank the reviewer for the comment. We will endeavor to incorporate this suggestion into our chapter text.
Bill	Mayben	Whole Chapter	13. Transportation						Dear Chapter authors; Excellent outline. Based on the exponential nature of climate change verses the historic basis of many transportation planning episodes; we are falling behind the curve in this critical climate change mitigation component. This is a ponderous, culturally embedded sector, in which all of us have benefited from the explosive power of fossil fuels, for so long, that our expectations are hard to match with sustainable alternatives. This is the heavy lifting; cultural change. California prevailed in moving the conventions for vehicle emissions; because of our coastal fog, our large coastal basin cities were quickly becoming uninhabitable. We were successful at carving out more stringent vehicle emission standards; which are now being adapted whole in many other states. I believe we can do the same with jet aircraft emissions. Inroads have been made regarding aircraft noise. Emissions are no different for jet aircraft, just more so. California was told when we demanded more stringent vehicle emissions that we could not change the rules, because they were National, or International. The same argument is being made for jet aircraft. The existential threat posed by jet aircraft is global; far beyond a few California cities. The greatest GHG emissions of jet aircraft are on takeoff, to 5000' or thereabouts. Internationally the total flights per 24 hour day top 200,000. Passenger flights account for 100,000 per day. Aviation, including ground support, production and transportation, account for 5% of our global GHG emissions. Aircraft are the greatest contributors to ozone. There are clear mitigation measures, some of which have been successfully implemented. There are climate adaptation alternatives, studies of which need to be funded. It is hard to imagine jet aircraft in our post 2050 future, if we are truly adapted to a sustainable and resilient world. Ocean-going freight is right behind aviation in atmospheric pollution, as the ships use the lowest grade of fuel. In the short term, if they simply slowed down, we could save significant levels of pollution. In the long range, alternatives must be found. The rationing of gasoline would drive home the fact that our atmosphere cannot tolerate infinite, expanding levels of truck and auto emissions. In WWII, we rationed gas, successfully, based on a	We appreciate the reviewer's comment on the outline and thoughtful discussion of the topic and California's influence on air quality improvements in the United States. We have incorporated some of the ideas here that recognize the complexity of the task of addresing climate change.
Joseph	Zajac	Whole Page	13. Transportation		51				use of politically correct terminology has no place in this report: Key Topic 4: Emerging issues: adaptation for equity, justice, and innovation	We thank the reviewer for the comment. Successful approaches require inclusive processes. This comment is inconsistent with the author team's thorough assessment of the science, and will not be used.
Joseph	Zajac	Whole Chapter	13. Transportation						fails to cover cost increases to consumers due to the drop in road tax revenue from EVs being promoted by government	We appreciate the reviewer's comment and have addressed this under Key Message #4. The issue of differentiated road user fees is a complex one for governments at multiple levels.
Joseph	Zajac	Whole Chapter	13. Transportation						fails to cover the cost to consumers of government electric vehicle rebates - money diverted, tax increases to cover the cost of the rebates, funding the Chinese military, etc.	We appreciate the reviewer's comment and have addressed the issue of preferential registration fees under Key Message #4.
Juanita	Constible	Whole Page	13. Transportation		49				1st bullet: Consider touching on the potential for increases in GHG emissions and maladaptive outcomes with the historic increases in transportation spending.	This is a good point and the author team will consider in subsection 1.
Juanita	Constible	Whole Page	13. Transportation		50				Key Topic 1, 3rd main bullet: Please ensure heat risks are included in this discussion of risk. Heat doesn't get as much attention as sea level rise and other forms of extreme weather, even though it can be extremely disruptive (e.g., in the Pacific Northwest during the 2021 heat dome.)	We appreciate the comment. Risks posed by higher temperatures are recognized/discussed under KM1.
Juanita	Constible	Whole Page	13. Transportation		50				Key Topic 2, 2nd main bullet: Please also include the need to invest in worker health and safety with regards to climate impacts such as extreme heat.	The author team is actively considering how best to address this comment in the document.
Juanita	Constible	Whole Page	13. Transportation		51				Key Topic 3, 2nd main bullet: Should increased reliability also be in this list of co-benefits, or is that captured by the others?	We appreciate this comment, and have addressed it in KM3.
Juanita	Constible	Whole Page	13. Transportation		51				Key Topic 4, 2nd sub-bullet: Safe access to transportation should also be considered in this discussion of centering community needs. This should include traffic safety (e.g., pedestrian access to transit stops) and safety from climate-related harms such as extreme heat (e.g., shade structures at transit stops).	We appreciate this comment and its recognition of the importance of public safety as it relates to climate. We have addressed this comment under KM1, and KM3.
Juanita	Constible	Whole Page	13. Transportation		52				If you use this case study (bioretention doubling as greenspace), please include a discussion of the equity dimensions as well. E.g., the potential for gentrification.	Thank you for the comment. We will consider this comment as we draft the report.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Mark	Chopping	Whole Page	13. Transportation		49				Regarding "1) During the first year of the pandemic: improved air quality/reduced emissions due to lockdown with reduced traffic from people working from home and reduced operations;" Suggest change to: 1) During the first year of the pandemic: improved air quality/reduced emissions due to lockdown with reduced traffic from people working from home and reduced motorized transportation operations; and particularly from modes that use internal combustion engines. Regarding "3) Current conditions: Different life and work patterns (including telecommuting)" Suggest change to: 3) Current conditions: Different life and work patterns (including telecommuting and bicycle use) Regarding "Possible figure and callout box: modal impacts from COVID-19, including increases in transportation costs, congestion, and, in some cases, long-term improvements in air quality and significant supply chain slowdowns." Suggest change to: Possible figure and callout box: modal impacts from COVID-19, including increases in transportation costs, congestion, and, in some cases, long-term improvements in air quality, improved health outcomes from increased bicycle use, including electrically-powered bicycles; and significant supply chain slowdowns.	We thank the reviewer for the comment, and have incorporated some of this content in the document.
Mark	Chopping	Whole Page	13. Transportation		51				Regarding "Transportation sector mitigation actions that achieve co-benefits o Technological innovation (e.g., alternative fuels, zero-emission vehicles, data-driven traffic management)" Comment on the use of "alternative fuels": The use of "alternative fuels" implies we are still waiting for the development of liquid fuels for use in combustion engines. Please dispense with ambiguity in this respect. The only feasible "alternative fuel" is H2 and this is only appropriate for large vehicles (semi trucks, rail); otherwise, we should speak about electrification of the cars and light duty pickups sector that is already under way, albeit all too slowly. Insert another bullet point, with mitigation action: - Initiatives to disincentivize the inappropriate use of large vehicles for everyday transportation applications (e.g., large SUVs and pickups for the moving of a single person). This need not apply to bona fide business uses. Insert bullet points with the associated co-benifits: - Decreasing the average size and weight of motorized vehicles would result in increased public safety: while heavier vehicles are safer for the occupants, they are invariably more dangerous for everyone else (pedestrians, people on bicycles, users of other motorized vehicles). - Decreasing the average size and weight of motorized vehicles would also reduce the nation's reliance on fuels whose supply and price are subject to unpredictable, shifting geopolitical forces. - Decreasing the average size and weight of motorized vehicles would also reduce wear and tear on road infrastructure, reducing community maintenance costs.	We appreciate the reviewers ideas and concerns. Some of these comments are policy prescriptive and cannot be addressed in this type of document.
Michael	Wright	Whole Chapter	13. Transportation						General Comments IIIII Transportation in the U.S. involves primarily high emission modes: cars, buses, trucks, and planes. Regional travel is highly inefficient by air and is rarely available via rail. Thus in 21st century, America has no transportation alternatives that are efficient, sustainable, affordable, and available to non drivers, e.g., phandicapped, young, elderly, and those who simply choose not to drive, such as high speed rail or monorail. See Ref.2.	We appreciate the comment. This comment does not appear to raise a question or suggest a revision.
Michael	Wright	Whole Chapter	13. Transportation						General Comments IIIII The Renewable Fuel Standard, or RFS, mandates that ethanol from corn be blended into gasoline to reduce pollution. This, however, ignores the life cycle carbon emissions from corn based ethanol, including: high upstream emissions for production, processing, and distribution; less energy content per unit volume than pure gasoline (lower mpg; requiring even more fuel to drive the same distance, thus effectively increasing carbon emissions.	We appreciate the comment. This comment does not appear to raise a question or suggest a revision.
Michael	Wright	Whole Chapter	13. Transportation						General Comments IIIII The wording contained in this chapter underscores the underlying, philosophical problem regarding transportation in the U.S., that transportation generally refers to highway travel, and technology refers only to information systems that enhance primarily century old internal combustion engine, or ICE, vehicles. Rarely are more sustainable, non-highway modes of transportation, e.g., high speed intercity rail, urban monorail, etc. considered viable transportation alternatives. Further, innovative applications of technologies, such as linear induction motors or LIM's, and inductive power transfer or IPT, are not being considered to reduce emissions from either highway vehicles, trains, or aircraft.	We appreciate the comment and the recognition that transportation is multi-modal and the focus ultimately is on moving people and goods (not vehicles). The author team has made a concerted effort in subsection 1 to include all modes of transportation, in subsection 2 in re-imagining transportation to address all modes of transportation other than hways, and in section 3 to recognize the health benefits of reduced use of fossil fuels and active transportation options.
Michael	Wright	Whole Chapter	13. Transportation						General Comments IIIII This chapter seems to focus only on mitigation and adaptation strategies for transportation with regards to climate change impacts. What's missing is a detailed treatment of how transportation, which accounts for the majority of carbon emissions in the U.S., can be signficantly vs. incrementally less carbon intensive, in order to reach emission reduction goals.	We appreciate the comment and the awareness of the need to reduce greenhouse gas emissions from transportation. Transportation is a key component of efforts to reduce GHG emmissions, which is reflected across the chapter's key messages.
Michael	Wright	Whole Chapter	13. Transportation						What's New IIIII Under ''increases in transportation funding,'' change ''new transport technologies'' to ''new transport information technologies,'' since autonomous vehicles, AI, and cybersecurity still apply primarily to century old ICE technology.	Thank you for the comment, but we will likely keep the reference as is as this is how these ideas are referenced by the transportation community.
Michael	Wright	Whole Chapter	13. Transportation						What's New IIIII Add that, despite recent warnings, e.g., COP26, regarding the need to significantly reduce emissions before mid century to alleviate the worst climate impacts, highway planning, development and improvements continue unabated. This not only facilities continued use of a high carbon mode of transportation, but also creates more emissions during construction and also clearcuts and paves over land that would otherwise sequester carbon and mitigate runoff.	We thank the reviewer for the comment. One goal of this assessment is to provide information to support decision-makers, but not to make policy in this document. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.
Michael	Wright	Whole Chapter	13. Transportation						What's New IIIII Mention new applications of existing technologies that can reduce emissions from transportation, particularly highway and air travel, as well as incentivize deployment of electric vehicles, or EV's, and reduce need for long range batteries. Technologies include linear induction motors, or LIM's, and inductive power transfer, or IPT. See Ref.11.	We thank the reviewer for the comment. One goal of this assessment is to provide information to support decision-makers, but not to make policy in this document. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	Wright	Whole Chapter	13. Transportation						What's New IIIII Mention recent mainstream proposals for sustainable transportation sytems like monorail, which enable zero emission public transportation having low runoff, small right of way requirements, i.e., land cover continuity, and flood resistance. See Ref.2.	We thank the reviewer for the comment. One goal of this assessment is to provide information to support decision-makers, but not to make policy in this document. Consistent with its Congressional mandate, this assessment is a technical report and does not advocate for specific transportation modes/policies.
Michael	Wright	Whole Chapter	13. Transportation						What's New IIIII Mention increased proliferation of EV's and charging stations that make potentially zero emission highway transportation more feasible. Conversely, EV deployment has slowed down recently due to supply chain issues.	We thank the reviewer for the comment. The report addresses multiple aspects of vehicle electrification in each of the key messages.
Michael	Wright	Whole Chapter	13. Transportation						What's New IIIII Add increased emissions from highway transport due to A. vehicular idling, e.g., for smart phone use and drive throughs, B. greater proliferation of higher ethanol gasoline that yields lower mpg, C. inherently more vehicles on the road, i.e, a multigeneral pyramid scheme, D. increased shipping of goods ordered online and returned, with concomitant use of resources for packaging, E. post COVID reductions in mass transit ridership resulting in higher overall vehicle miles travelled, or VMT, H. proliferation of EV's that induce increased demand for electricity, regardless of source. Also noted under Energy, Land Cover, Economics.	We thank the reviewer for the comment. We appreciate this suggestion, but space is limited so we cannot address all of these points. Several of these points are addressed in one form or another, for example the concerns with shiping are addressed in Key Messages 1 and 2.
Michael	Wright	Whole Chapter	13. Transportation						Key Topic 1 IIIII Add that elevated, flood resistant transportation systems, proven in decades of operation around the world, will be key to enabling climate resistant transportation. Public systems like monorail and elevated high speed magnetic levitation, or maglev, are more climate resistant and sustainable than highways to reduce emissions and impervious surface runoff, and thereby also help reduce flooding. Also noted under Built Environment.	We thank the reviewer for the comment. One goal of this assessment is to provide information to support decision-makers, but not to make policy in this document. Consistent with its Congressional mandate, this assessment is a technical report and does not advocate for specific transportation modes.
Michael	Wright	Whole Chapter	13. Transportation						Key Topic 1 IIIII Add that high speed intercity systems like maglev can be alternative to regional air travel, with even shorter door-to-door travel times. Conversely, building and expanding existing highways and runways will only increase emissions and exacerbate climate induced flooding. Also noted under Water.	We thank the reviewer for the comment. One goal of this assessment is to provide information to support decision-makers, but not to make policy in this document. Consistent with its Congressional mandate, this assessment is a technical report and does not advocate for specific transportation modes/policies.
Michael	Wright	Whole Chapter	13. Transportation						Key Topic 4 IIIII Mention that existing highway transportation is not easily used by the poor, disabled, young and elderly. In most areas of the country, these populations either can't afford or are unable to drive, and thus have to rely on either limited and inefficient bus service or high expense taxi service. Thus, a more equitable and just nationwide transportation system is necessary, one that is efficient and affordable while also being sustainable. For local transportation, this includes monorail; for regional transportation, this includes high speed rail, and for national, i.e., coast to coast transportation, this includes maglev.	We appreciate the comment. Social justice and equity have been addressed in several of the key messages. Given space concerns, it is not possible in this short document to cover all the items raised here.
Michael	Wright	Whole Chapter	13. Transportation						New Key Topic IIIII Add new key topic addressing implementation strategies for a zero emission transportation system.	We appreciate this comment. Work in this area is discussed in Key Message 1.
Michael	Wright	Whole Chapter	13. Transportation						New Key Topic IIIII Mention that the U.S.'s overemphasis on highway travel for passengers and freight has paved over 60,000 sq. miles of land for roads and parking lots (Ref. 8). This has been at the expense of more sustainable modes like intercity rail. Thus, less intrusive, small footprint transportation systems such as elevated monorail (Ref. 2) can reduce A. impervious surfaces and runoff, B. carbon emissions, C. habitat loss and fragmentation, D. susceptibility to flooding, E. nonenvironmental problems associated with highway travel, e.g., at grade accidents, congestion, individual user costs, etc. Also noted under Land Cover.	We appreciate the comment. The chapter recognizes and discusses some of the benefits of alternative transportation modes, particularly under key messages 3.
Michael	Wright	Whole Chapter	13. Transportation						New Key Topic IIIII Mention that the construction of highways on previously undeveloped land induces additional land development along the corridor, such as housing, retail, office buildings, and freight distribution warehouses. This further exacerbates climate change by increasing emissions for construction and building operations, and by eliminating carbon sequestration afforded by natural land cover. Also noted under Land Cover, Built Environment.	We appreciate the comment. The concern raised here involves not just transportation but the built environment more broadly, and may better be addressed in other chapters. In this chapter, there is recognition of the lower carbon footprint of some transportation modes (i.e., transit, bike-ped) as compared to others in KM1, and construction of infrastructure as a source of emissions in KM2.
Michael	Wright	Whole Chapter	13. Transportation						New Key Topic IIIII Address land use requirements for the two primary modes of transportation in the U.S.. i.e., highway and air. Also estimate the amount of carbon sequestration capacity, e.g., forest, topsoil, etc., that is lost to impervious surfaces, including roads, runways, and sevice facilities.	We appreciate the comment. Land use needs related to use of alternative enrgy sources, and the tradeoffs involved, are addressed in KM4. Sequestration issues are beyond the scope of the chapter.
Michael	Wright	Whole Chapter	13. Transportation						New Key Topic IIIII Mention that infrastructure to date for autonomous vehicles, electric vehicles, and alternative fuel vehicles is primarily focused on anticollision systems, charging stations, and alternative fuels, respectively. True innovation for moving both fueled and electric vehicles can instead be provided by an external force, in the form of linear induction motors, or LIM's. See Ref.11. LIM's installed on interstate highways could conceivable enable a coast to coast drive on a single charge, or in the case of ICE vehicles, one tank of gas. This would not only enable zero emission individual transportation, assuming renewable power generation, but would also obviate the need for charging stations.	We thank the reviewer for the comment. We appreciate this suggestion, but space is limited so we cannot address all of these points.
Michael	Wright	Whole Chapter	13. Transportation						New Key Topic IIIII The increasing popularity and deployment of EV's can be facilitated by making them easier and safer to charge through inductive power transfer, or IPT. This includes wireless charging stations that are already being offered by several U.S. manufacturers, and have been used in Europe for decades to charge electric buses. IPT can also be installed at airports to power aircraft on the ground, both at the terminal and on taxiway hold points. Thus, IPT can also help reduce aviation emissions and noise, while increasing flight range by reducing fuel consumption prior to takeoff. See Ref.11.	We thank the reviewer for the comment. We appreciate this suggestion, but space is limited so we cannot address all of these points at this level of detail. However, electric vehicle technology is addressed. Please keep in mind that this document is not meant to advocate particular policies or technologies.
Michael	Wright	Whole Chapter	13. Transportation						New Key Topic IIIII The increasing popularity and deployment of EV's can be facilitated by making them easier and safer to charge through inductive power transfer, or IPT. This includes wireless charging stations that are already being offered by several U.S. manufacturers, and have been used in Europe for decades to charge electric buses. IPT can also be installed at airports to power aircraft on the ground, both at the terminal and on taxiway hold points. Thus, IPT can also help reduce aviation emissions and noise, while increasing flight range by reducing fuel consumption prior to takeoff. See Ref.11, 12.	We thank the reviewer for the comment. We appreciate this suggestion, but space is limited so we cannot address all of these points at this level of detail. However, electric vehicle technology is addressed. Please keep in mind that this document is not meant to advocate particular policies or technologies.
Michael	Wright	Whole Chapter	13. Transportation						New Key Topic IIIII Identify likely consequences and imposed constraints to transportation by mid century, if no significant emissions reductions are effected by 2030.	We thank the reviewer for this comment. The chapter notes that transportation is the main contributor of GHGs, that plans for reducing emissions include large reductions from transportation, and that transportation is vulnerable to climate change.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Jhoset	Burgos	Whole Page	13. Transportation		51				Under: Key Topic 4: Emerging issues: adaptation for equity, justice, and innovation Under: Possible graphic: What is adaptive management in transportation mitigation and adaptation? Comment: Include Considerations of projected and potential multimeter SLR plus short-term flooding events and coastal erosion as part of the graphic.	We thank the reviewer for the comment, and will consider this in development of graphics.
Bill	Mayben	Whole Chapter	14. Air Quality						Dear Air Quality authors; Functionally, time is not our friend with exponential decreases in air quality. It is said that mitigation measures will never be less expensive than today, until we are forced to fall back to desperate adaptation measures in the face of unrelenting climate change. What we face underneath it all is no less than replacing our fossil fuel based economy. Presently, our dollar could have oil well pumps in all four corners. With that said, the human body is about 2/3 oxygen. Current CO2 levels, approaching 419 ppm and rising, have changed our long standing, per-industrial 280 ppm CO2 content faster than we can adapt, so this is, even now, affecting our thinking. Adding to this, when we congregate in offices and schools for instance, the CO2 levels becomes more concentrated, at times reaching 1000 ppm. So that our air quality is as good as reasonably possible, air exchange and filtration systems need to be rethought. During California fires I replaced our HVAC filters with hyper allergenic filters, and placed the system on "fan only". This had to do with family health, and so I could think. In our research and learning institutions, our places of employment; this should be our first priority. California was effective, based on our intolerance of increasing smog levels in our major cities; lead an ultimately successful initiative to carve out a California Model for vehicle smog control equipment; and we improved our air. Other states had vehicles referred to a s "49 state" models. Now, as the effects of vehicle GHG emissions have become intolerable outside our state; many states have essentially adopted the California codes. Their vehicle emissions standards are ours. I am suggesting that the emissions from jet aircraft are no different. The most concentrated emissions are on take-off, where a huge percentage of the emissions of the whole flight are released below 5000'. I have told the President of Southwest Airlines that, while they do a great job, the only thing that makes them profitable is they aren't obligated to clean up after themselves. I am urging our state to adopt jet aircraft emissions criteria. We have been informed that we cannot do this, because the standards are national, and international. I point out that vehicle emissions were national, and international, and now they are not.	Thank you for this comment. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations that endorse specific actions. Nonetheless, under our Key Message 5 in this chapter, we address several of the specific mitigation measures that you suggest, with discussion of how those actions affect both greenhouse gas emissions (climate change) and air pollutant emissions. While we do not endorse policies, the text suggests that there are many important actions that would both reduce emissions of greenhouse gases, and alleviate air pollution problems.
Catherine	Garoupa White	Whole Chapter	14. Air Quality						Please consider featuring the air pollution challenges and solutions happening in California's San Joaquin Valley, as the most polluted air basin for fine particles, one of the most polluted for ozone, and with extreme environmental inequality. So much important work is being done. Also this process of providing comments was difficult to navigate and time intensive. Please consider how to make this process more accessible and engaging. I appreciated the virtual workshop format but was not able to attend breakout sessions due to lack of information like meeting passcode. I would like to be a resource but have limited time because I am also on the ground advocating for improvements and protections. Thank you for your consideration of these comments and to everyone who worked on synthesizing such important research.	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. Because of space constraints, we have limited discussion of air quality in specific regions of the United States, though we agree that San Joaquin Valley faces important air quality challenges. We have for example highlighted the impact of wildfires in the Western US generally. Rather, because many aspects of the impacts of climate change on air quality are shared across US regions, much of the discussion in this chapter concerns the US generally.
Joseph	Zajac	Whole Page	14. Air Quality		56				use of politically correct terminology has no place in this report: Key Topic 4: Impacts of climate change on air pollution exposure/health inequities	We thank the reviewer for this comment. The author team has discussed this point and we think that the language we use is appropriate for this report. We have selected language that highlights the disparities experienced by certain communities and groups, that is in some cases a result of systemic racism. The language we use is consistent with that used in the scientific literature and elsewhere in the assessment to highlight environmental justice issues.
Joseph	Zajac	Whole Chapter	14. Air Quality						looks OK but needs more detail, the overview is general	Thank you for this comment. We have revised the chapter to include as much detail as we can in the length limit provided.
Kenneth	Pickering	Whole Page	14. Air Quality		54				Key Topic 1: Impacts of climate change on air quality Trends in lighting flash occurrence will be incorporated in Chapter 3 on Climate Trends. Lightning flashes produce NO, a key precursor for tropospheric O3. It is expected that lightning NOx emissions may increase or decrease in tune with lightning frequency. Several air quality modeling papers have discussed the impact of lightning NOx emissions on surface air quality (Allen et al., 2012; Kang et al. 2019a; Kang et al., 2019b; Murray et al., 2016). Lightning contributes approximately 3 -4 ppbv to policy-relevant background surface O3 over the US (~10% of total background), and as much as 18 ppbv to surface O3 related to specific individual thunderstorm events. Largest contributions by lightning occur in the higher terrain of the western US. This amount of surface O3 can make the difference between attainment and nonattainment of the National Ambient Air Quality Standard for O3 for some regions. Lightning trends with changing climate will be useful in estimating lightning NOx emission increases or decreases. References: Allen, D. J., K. E. Pickering, R. W. Pinder, B. H. Henderson, K. W. Appel, and A. Prados, Impact of lightning-NO on eastern United States photochemistry during the summer of 2006 as determined using the CMAQ model, Atmos. Chem. Phys., 12, 1737-1758, 2012. Kang, D., K. Pickering, D. Allen, K. Foley, D. Wong, R. Mathur, and S. Roselle, Simulating lightning NOx production in CMAQ: Evolution of scientific updates, Geosci. Model Devel., 12, 3071,Äi3083, https://doi.org/10.5194/gmd-12-3071-2019, 2019a. Kang, D., K. Foley, R. Mathur, S. Roselle, K. Pickering, and D. Allen, Lightning NOX Production in CMAQ Part II ,Äi Performance Evaluations, Geosci. Model Devel., 12, 4409,Äi4424, https://doi.org/10.5194/gmd-12-4409-2019, 2019b. Murray, L. T., Lightning NOx and impacts on air quality, (2016) Curr. Poll. Reports, 2:115,Äi133 DOI 10.1007/s40726-016-0031-7	Thank you for this comment. How climate change will affect flash rates is uncertain, and we are considering including this as a process that may change with climate in Figure 14.1.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Kenneth	Pickering	Whole Page	14. Air Quality		54				Key Topic 2: Impacts of climate change on wildland fire smoke Trends in lightning flash frequency will be included in Chapter 3 (Climate Trends), and impacts of changes in lightning frequency on forest fires will be discussed in the chapter on Forests. A large fraction of wildfires are ignited by lightning. Therefore, the impact of increasing or decreasing lightning occurrence will impact future frequency and size of wildfire smoke plumes. This topic needs to be addressed in the Air Quality chapter and tied to related comments in the Climate Trends and Forests chapters.	Thank you for this comment. In this chapter we do not explain the specific mechanisms for predicted trends in fires, and given our word limits, we plan to use our link to the Forests chapter to allow for readers to learn about these mechanisms.
Roy	Clark	Whole Chapter	14. Air Quality						Comment on NCA5 Chapter 14: Air Quality Roy Clark PhD President Ventura Photonics Thousand Oaks CA 91360 The assessment of the influence of ‚Äòclimate change‚Äô on the air quality of the United States requires the quantitative determination of the effects on air quality of the observed increase in the atmospheric concentration of CO2 and other ‚Äògreenhouse gases‚Äô. Over the past 200 years, the atmospheric concentration of CO2 has increased by approximately 130 parts per million (ppm), from 280 to 410 ppm. The concentration is now approaching 420 ppm. This has produced a decrease near 2 W m-2 in the longwave IR (LWIR) flux emitted to space within the CO2 emission bands. There has also been a similar increase in the downward LWIR flux from the lower troposphere to the surface [Harde, 2017]. At present, the annual average increase in CO2 concentration is about 2.4 ppm. This produces an annual increase in the downward LWIR flux to the surface of approximately 0.034 W m-2. Quantitative thermal engineering analysis of the effects of these CO2 induced LWIR flux changes on temperatures in the troposphere, and on land and ocean thermal reservoirs shows that there can be no measurable effect on the earth‚Äôs climate [Clark, 2013]. The results from equilibrium climate models such as the CMIP5/6 ‚Äòensembles‚Äô are fraudulent and should not be used for climate assessment. The fundamental climate modeling error is the assumption of an equilibrium average climate that can be perturbed by CO2 [Knutti and Hegerl, 2008]. Since there is no equilibrium, a change in flux produces a change in the rate of heating or cooling of a specific thermal reservoir. A change in LWIR flux cannot be used directly to calculate a change in ‚Äòsurface temperature‚Äô based on the Stefan Boltzmann equation. . A ‚Äòdoubling‚Äô of the CO2 concentration from 287 to 574 ppm at mid latitudes produces a maximum	Thank you for these comments. The science described here is addressed mainly in Chapters 2 and 3 of this assessment, and not in the air quality chapter. Nonetheless, we will comment that the comments made are not consistent with present-day scientific understanding of climate change. The comments include a recommendation that we not use climate models (such as in CMIP6) to address air quality changes. We have chosen to use such models as they are the best quantitative means of representing the relevant physical and chemical processes relevant for the impacts of climate change on air quality. In addition to results using global atmospheric models like those in CMIP6, we also present results for air quality data analysis and regional air quality models.
Kenneth	Okai	Whole Chapter	14. Air Quality						When it comes to problems like air pollution, we humans are the first to experience the direct effects. Exposure to poor air quality leads to respiratory illnesses such as lung cancer and heart diseases. Climate change can have negative impacts on different ecosystems but in the end, we humans as chief inhabitants of the Earth will experience the harm if such issue isn't taken seriously. As a society, believing in the adverse effects of air pollution and the harm it poses on our daily lives provokes the heart of we citizens to take action before the issue gets uncontrollable.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful. We have made an effort to include discussion of health impacts in all of the key messages included in this chapter.
Juanita	Constible	Whole Page	14. Air Quality		53				What's New: It is also worth mentioning improved understanding of toxics mobilized via wildfire smoke (beyond criteria pollutants), and potential health effects, as well as improved understanding of ways in which wildfire-derived PM2.5 is apparently more deadly than PM2.5 from traditional sources.	Thank you for this comment. We discuss many of these points in Key Message 2 and highlight which are new.
Juanita	Constible	Whole Page	14. Air Quality		53				On environmental justice issues, there's a need to explain with more specificity how these alternate modeling approaches are futher illuminating disparities and, more to the point, what policy actions can be derived to address the disparities. The chapter needs to acknowledge science pointing to the fact that most polluted census tracts in the country have largely remained the same since early 1980s and that new approaches are needed to address lingering disparities	We thank the reviewer for this comment. The draft chapter (Key Message 4) does highlight how new observational systems, including satellites and low-cost monitors, allow a finer-resolution estimate of concentrations, which supports analysis and conclusions about the differential exposure experienced by different communities and groups. In addition, it is beyond the scope of the assessment to make policy recommendations or endorse specific actions on how to reduce disparities, but we do mention a need for such actions.
Juanita	Constible	Whole Page	14. Air Quality		53				Do the epidemiology advances here specifically refer to the absence of a safe threshold for air pollution exposure? More specificity is needed in this statement.	We thank the reviewer for this comment. We are referring to new epidemiological studies on air pollution in general, and highlight some studies that suggest differential toxicity of the components of particulate matter. For lack of space, we have chosen not to comment on the presence or absence of a low-concentration threshold for health effects, focusing on the most important recent findings for understanding the health impacts of air pollutants associated with climate change.
Juanita	Constible	Whole Page	14. Air Quality		53				In What's New, it seems appropriate to mention the increasing ability to understand climate penalty effects of warmer conditions on higher summer ozone concentrations.	Thank you for this comment. We now include discussion of the climate penalty in the chapter.
Juanita	Constible	Whole Page	14. Air Quality		54				Key Topic 1: Should also mention potential interactive effects amongst coincident air pollution exposures (e.g., PM and ozone), as well as interactions between heat and air pollution to result in worse health effects than if these exposures were to be considered independently.	We thank the reviewer for this comment. We have revised the chapter to include short discussion of the possible interactions between heat and air pollutants. That discussion is limited by the space available in the chapter.
Juanita	Constible	Whole Page	14. Air Quality		54				Key Topic 2: Wildfire smoke is increasingly a problem for the entire country. This section should acknowledge how smoke exposures are now widespread and this is not just a problem for people in the West to worry about.	Thank you for this comment. We address this in our text, by highlighting studies showing that wildfires and smoke exposure have increased historically and are projected to continue to increase. A figure also illustrates the national scale of smoke impacts.
Juanita	Constible	Whole Page	14. Air Quality		57				Key Topic 5: These benefits of greenhouse gas mitigation should also discuss health-related financial savings from reduced morbidity and mortality linked to air pollution exposures.	Thank you for this comment. We have revised the chapter to ensure that this is discussed in Key Message 5, where we review recent literature on the monetized health co-benefits of reductions in greenhouse gas emissions via improvements in air quality, focused on the United States.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
William	Koshak	Whole Chapter	14. Air Quality						A Key Topic should be added to the chapter that provides highlights of advances in observation and modeling. For example, improved modeling techniques have recently been developed for estimating lightning nitrogen oxides (LNOx) production using flash optical energy and flash optical area observations derived from the GOES-16 and GOES-17 Geostationary Lightning Mapper (GLM). Additional examples exist, and references for some are provided below: Koshak, W. J., GLM estimates of LNOx over the continental US: ground and cloud flash differences, 101st American Meteorological Society (AMS) Meeting, Virtual due to COVID-19 pandemic, January 10-15, 2021. Allen, D. J., Pickering, K. E., Lamsal, L., Mach, D. M., Quick, M. G., Lapierre, J., et al. (2021). Observations of lightning NOx production from GOES-R post launch test field campaign flights. Journal of Geophysical Research: Atmospheres, 126, e2020JD033769. https://doi.org/10.1029/2020JD033769. Lapierre, J. L., Laughner, J. L., Geddes, J. A., Koshak, W. J., Cohen, R. C., & Pusede, S. E. (2020). Observing U.S. regional variability in lightning NO2 production rates. Journal of Geophysical Research: Atmospheres, 125, e2019JD031362. https://doi.org/10.1029/2019JD031362. Koshak, W. J., Lightning NOx estimates from space-based lightning imagers, 16th Annual Community Modeling and Analysis System (CMAS) Conference, Chapel Hill, NC, October 23-25, 2017.	We thank the reviewer for this comment. The author team has discussed, and chose not to add a new key topic on advances in observations and modeling. Rather such advances are incorporated and discussed within the context of each key topic. Most specifically for these comments, discussion of improvements in observations and modeling is discussed in Key Messages 1 and 2.
DAnn	Williams	Whole Chapter	14. Air Quality						From: D,ÃõAnn Williams, Johns Hopkins School of Public Health, Center for a Livable Future To: USGCRP ,Äi NCA5 Chapter Authors Re: USGCRP NCA5 Chapter Outline Comment Disclaimer: The opinions expressed herein are our own and do not necessarily reflect the views of The Johns Hopkins University. February 19, 2022 Dear Chapter Authors, Thank you for the opportunity to comment on the United States Global Change Research Program Strategic Plan (2022-2031) Prospectus and Chapter Outlines. We are researchers at the Johns Hopkins Center for a Livable Future (CLF), an interdisciplinary research center based at the Johns Hopkins Bloomberg School of Public Health. CLF applies science and systems thinking to help build healthy, just, equitable, resilient, and sustainable food systems. We have reviewed the USGCRP strategic plan prospectus (SPP), reviewed the chapter outlines and have attended many of the NCA5 Public Engagement Workshops held by USGCRP and chapter authors. These virtual sessions have been informative, as well as interactive and inclusive. We strongly support the vison and mission of this multi-agency cooperative program to fully ,Äúunderstand the forces shaping the global environment, both human and natural and their impacts on society.,Âù There are four pillars for this work as stated in the USGCRP SPP: 1. advancing science, 2. informing decisions, 3. engaging the nation and 4. collaborating internationally. Under these four pillars are cross-cutting themes, diversity and inclusion, risk-based approaches, enhanced social science integration, communication, and workforce development. To adequately advance science and inform the development and implementation of climate change solutions, we urge you to stress the importance of developing multi-agency research and programs that improve our understanding of the public health implications of climate change and pathways to address agriculture and food systems contribution to climate change while protecting public health and environmental justice. Currently there are numerous gaps in our knowledge around current policies and practices and climate change and even fewer	We thank the reviewers for this comment. Our chapter on Air Quality is motivated quite strongly by the health impacts of air pollution, and discussion of health impacts appears in all five Key Messages in the document. Fuller discussion of health impacts of climate change can be found in Chapter 15 (Health). Agriculture as a source of emissions is discussed in Key Message 5, thinking about opportunities to address emissions of both air pollutants and greenhouse gases from agricultural sources, including methane emissions. Fuller discussion of agricultural sources of emissions, and of policies to address those emissions is beyond the scope of our chapter, and can be found in Chapters 11 (Agriculture) and 32 (Mitigation).
Mark	Chopping	Whole Page	14. Air Quality			56			At "Will air quality disparities compound the impacts of climate and climate inequities (e.g., urban heat) in environmental justice (EJ) communities? Discuss some examples, both in urban and rural settings (including wildfires)." Suggest example: people of more limited incomes who live in areas close to major ports, for example, Elizabeth, New Jersey, suffer disproportionately from particulate, NOx, noise, and other emissions from large, diesel-powered trucks that are used to move imported goods. Encouraging the development and adoption of hydrogen fuel cell propulsion systems for these vehicles could make an important difference and should be made a priority (n.b., not for cars and light trucks, where electrification makes more sense) . At "Summarize how measurement advances (e.g., low-cost sensors, satellites, and mobile monitoring), higher spatial resolution air quality models, and community-engaged research have improved our understanding of air pollution disparities." Suggest to include a brief assessment of how inadequate current monitoring systems are. While we have made strides in modeling, ground and remote sensing approaches and in measurement precision, our sampling is still insufficiently fine to account for important spatial variation. For example, the State of New Jersey has a network of 30 (thirty) reliable, high precision monitoring stations - but these are unable to reflect the conditions experienced by residents living on a particular block, adjacent to a particular highway, business, or rail enterprise. There is thus a pressing need to improve the precision available from low-cost sensors and/or improve airborne or satellite monitoring capabilities, so that a clearer picture can be obtained of air quality issues that importantly impact urban and suburban communities.	We thank the reviewer for this comment. We include in the chapter a Text Box highlighting air pollution disparities in light of climate change in one particular location. We also include discussion of how new technologies for observing air pollution such as satellites and low-cost monitors enable a better understanding of exposure disparities. The assessment does not provide policy recommendations or endorse specific policies.
Ally	Beasley	Whole Page	14. Air Quality			56			Key Topic 4 and everything therein is very important to include and we look forward to further development of this topic, and of this chapter and report overall, with an equity and justice lens, including procedural justice.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful. We have made an effort to include discussion of health impacts in all of the key messages included in this chapter.
Michael	Wright	Whole Chapter	14. Air Quality						Key Topic 1 IIIII Identify likely impacts to air quality by mid century, if no significant emissions reductions are effected by 2030.	Thank you for this suggestion. Our assessment is restricted to the published literature, so we can only draw an assessment of particular projections based on available studies. We will continue to comb the literature to determine if we can make such an assessment. Proposed Figure 14.2 is our current best attempt to provide this type of information.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	Wright	Whole Chapter	14. Air Quality						New Key Topic IIIII Include new key topic addressing impacts of air quality on climate change. This topic can address how changes like increases in airborne particulates induce cooling. Thus, reducting particulates can actually exacerbate warming, necessitating a broad, systems level approach to carbon emission reductions.	We thank the reviewer for this comment. The author team has discussed, and chose not to add a new key topic on the impacts of air pollutants on climate change. Rather, Key Message 5 includes discussion of the effects of cooling aerosols on climate, as we discuss the effects of different actions for controlling greenhouse gas and air pollutant emissions, with emphasis on short-lived climate forcers. The chapter discusses how reducing cooling aerosols can exacerbate warming. Further discussion of the effects of aerosols on climate can be found in Chapter 2.
Nathaniel	Matthews-Trigg	Whole Page	15. Human Health			60			Section: Healthcare Access and Delivery Extreme weather can interfere with healthcare access to critical medical supplies and pharmaceuticals, such as methadone, blood supplies, etc. One solution is extending federal policy and insurance coverage for patients to take home extra doses of medication in case of emergencies. Additionally, Surges in patient demand can overwhelm healthcare. Examples, 2021 heatwave in the Pacific Northwest or wildfire smoke in Northern California. One solution is the implementation of Medical Operations Coordination Cells (MOCCs) that supports level-loading of patients across a region or state.	Thank you for your comment. We agree that weather can disrupt supply chains and overwhem healthcare. We will broadly include the full impact of weather on healthcare.
Nathaniel	Matthews-Trigg	Whole Page	15. Human Health			61			Section: Community-level resilience and adaptation strategies to build capacity Fostering community inclusion and empowerment in local preparedness and response activities. Example is FEMA,Âôs ‚Äúwhole community,Âù philosophy that encourages emergency managers to outreach and include families, community groups, and other community stakeholders in prepardness activities.	Thank you for your comment. We agree; health equity and inclusion will be a focus of the chapter.
Karen	Smoyer	Whole Chapter	15. Human Health						Very comprehensive and well thought out range of human health topics are covered here.	Thank you for your comment.
Joseph	Zajac	Whole Chapter	15. Human Health						continued focus on the FALSE premise that wildfires are the result of climate change	Thank you for your comment. This comment is inconsistent with the author team's thorough assessment of the science.
Joseph	Zajac	Whole Chapter	15. Human Health						continued focus on the FALSE premise that more people are dying or will die from climate change when FEWER people per capita are dying from anything related to climate.	Thank you for your comment. This comment is inconsistent with the author team's thorough assessment of the science.
Joseph	Zajac	Whole Chapter	15. Human Health						use of politically correct terminology has no place in this report: Key Topic 3: Climate change negatively affects community health, the health of, and health-care access and delivery to, those who have been marginalized and under-resourced.	Thank you for your comment. The terminology used is consistent with the author team's understanding of preferred terms for health equity. Please see https://www.cdc.gov/healthcommunication/Health_Equity.html for more information.
Joseph	Zajac	Whole Chapter	15. Human Health						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	Thank you for your comment. The terminology used is consistent with the author team's understanding of preferred terms for health equity. Please see https://www.cdc.gov/healthcommunication/Health_Equity.html for more information.
Roy	Clark	Whole Chapter	15. Human Health						Comment on NCA5 Chapter 15: Human Health Roy Clark PhD President Ventura Photonics Thousand Oaks CA 91360 The first step for Chapter 15 is the quantitative determination of the effects of the observed increases 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 on Human Health that need to be taken. Over the past 200 years, the atmospheric concentration of CO2 has increased by approximately 130 parts per million (ppm), from 280 to 410 ppm. The concentration still increasing and is now approaching 420 ppm. This has produced a decrease near 2 W m-2 in the longwave IR (LWIR) flux emitted to space within the CO2 emission bands. There has also been a similar increase in the downward LWIR flux from the lower troposphere to the surface. At present, the annual average increase in CO2 concentration is about 2.4 ppm. This produces an annual increase in the downward LWIR flux to the surface of approximately 0.034 W m-2. Quantitative thermal engineering analysis of the effects of these CO2 induced LWIR flux changes on temperatures in the troposphere and on the land and ocean thermal reservoirs shows that there can be no measurable effect on the earth,Âôs climate. The results from climate models such as the CMIP5/6 ‚Äòensembles,Âô are fraudulent and should not be used for climate assessment. The underlying modeling error is the assumption of an equilibrium average climate that can be perturbed by CO2. This is discussed in more detail in the general comment and the comments on Chapters 2 and 3 submitted by Roy Clark PhD. Detailed technical comments were submitted as e mail attachments. Please consult these for further information, figures and references. The ID Numbers of the online submissions and e mail attachment file names are:	Thank you for your comment. This comment is inconsistent with the author team's thorough assessment of the science.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	15. Human Health						Health section could consider adding content related to recreational site closures/losses due to climate change and the impact that has for health outcomes (i.e. trail washouts from flooding, park closures due to wildfire aftermath	Thank you for your comment. Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples.
Juanita	Constible	Whole Page	15. Human Health			58			Key Topic 1: This message should also discuss health-related financial costs from morbidity and mortality linked to climate-sensitive events.	Thank you for your comment. The Fifth National Climate Assessment also includes an Economics chapter; the Human Health chapter author team will coordinate on this topic area.
Juanita	Constible	Whole Page	15. Human Health			60			Key Topic 3: This message should also discuss inequitable burden of health-related financial costs from morbidity and mortality linked to climate-sensitive events that impact vulnerable communities.	Thank you for your comment. The Fifth National Climate Assessment also includes an Economics chapter; the Human Health chapter author team will coordinate on this topic area.
Juanita	Constible	Whole Page	15. Human Health			58			Key Topic 1: This section should acknowledge continuing data limitations on the health front that inhibit a more complete accounting of physical and mental health problems linked to climate-sensitive exposures.	Thank you for your comment. The report assesses existing and available information sources. The author team will consider including this important point in the "Traceable Accounts" section.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Juanita	Constible	Whole Page	15. Human Health		58				Key Topic 1: Air pollution-related health harms (apart from wildfire smoke) are missing from this list, but should be mentioned given links between fossil fuel combustion and primary and secondary formation of particulate matter and ozone. Even if this content is handled robustly in Chapter 14 on Air Quality, it should still be represented here as the health chapter should include all relevant climate-sensitive exposures relevant to health.	Thank you for your comment. We will coordinate closely with the Air Quality chapter and may include relevant information within the Human Health chapter.
Juanita	Constible	Whole Page	15. Human Health		62				Key Topic 3: Ramifications of underfunding public health include lack of staff capacity and technology infrastructure to adequately track, compile, share, and disseminate data on climate-sensitive health hazards in a timely way, much as the country is currently experiencing due to COVID-19. These obstacles merit a robust discussion in this section.	Thank you for your comment. Consistent with its Congressional mandate, this assessment is a technical report and does not include policy recommendations.
Juanita	Constible	Whole Page	15. Human Health		59				Key Topic 1: Wildfire-related health problems also include mental health problems caused by homelessness, loss of community, and other major disruptions and losses.	Thank you for your comment. We will coordinate closely with the Air Quality chapter on this topic. In addition, there is a proposed cross-cutting box on wildfires and human health.
Juanita	Constible	Whole Page	15. Human Health		59				Please address the expected net change in mortality and morbidity from extreme cold and heat. The idea that a reduction in cold-related deaths will somehow equal or outweigh the increase in heat-related deaths is still commonly used as an argument against action to reduce emissions.	Thank you for your comment. The authors will assess literature on cold related and heat related projected morbidity and mortality and consider including this information in the chapter.
Juanita	Constible	Whole Chapter	15. Human Health						It might be more effective to reverse the order of Key Topics 2 and 3. I.e., discuss disruptions to healthcare and community health first, and then creating climate-resilient healthcare systems.	Thank you for your comment. The author team agrees and will make this change.
Juanita	Constible	Whole Chapter	15. Human Health						Thank you for the strong focus on occupational health and safety throughout this chapter.	Thank you for your comment.
Juanita	Constible	Whole Page	15. Human Health		60				Bullet on healthcare access and delivery: Consider also adding a discussion of supply chain disruptions (e.g., Hurricane Maria's impact on Puerto Rico's manufacturing capabilities) and how those disruptions might manifest differently in well-resourced vs. less well-resourced communities.	Thank you for your comment. Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples. However the author team will consider this suggestion and may include relevant information from the peer-reviewed literature.
Jessica	Mengistab	Whole Chapter	15. Human Health						5th National Climate Assessment: Human Health The Alliance of Nurses for Healthy Environments (ANHE) is a national nursing organization whose efforts focus on the intersection of climate and health. ANHE strives to educate and empower nurses to recognize their unique perspective in the climate advocacy movement while also using personal stories to influence policy changes that will protect public health. Our organization consists of nurses across multiple specialties- from maternal child health and critical care, to school nurses, occupational health nurses, and nursing educators. A concerning overlap that all of our members are seeing are the impacts of climate change on our patient,Âôs and community health. As part of our advocacy work, ANHE members use personal stories of patients and community members who are negatively impacted by climate change and would directly benefit from policy changes provisions. Nurses in Arizona and California comment on how droughts increase incidences of wildfires which directly diminish air quality, in turn exacerbating acute and chronic cardiopulmonary diseases. ANHE nurses from urban locations like D.C. and Atlanta offer public comments on how rising temperatures lead to increases of ground level ozone, decreasing air quality and affecting children with asthma, elderly persons, pregnant individuals, and unborn babies. Most recently, ANHE submitted comments advocating for strengthened heat standards in anticipation of protecting vulnerable outdoor workers as continental temperatures continue to rise. Our organization,Âôs nurses provide countless testimonials of how their patients every day, in all geographical locations, during all seasons are now being negatively impacted by climate change. The general consensus among numerous health and environmental organizations is that climate change is a current and worsening threat to human health that must be addressed swiftly and strategically. Consistent temperature increases year after year are now dramatically impacting landscapes and weather patterns. Although the effects of manmade climate change are exhibited in different ways across the United States, these new climate ‚Äúnorms,Âù often negatively affect both physical and mental health, as our organization members personally outline. Forest fires, coastal flooding, and droughts are examples of severe weather events that have taken lives and caused billions	Thank you for your comment. Mental health, air quality, and health impacts of extreme events will be included in the Human Health chapter. We will coordinate with other chapters on these topic as well, including the Air Quality chapter, Mitigation chapter, and Adaptation chapter. We strive to make this chapter readable and accessible to a non-academic audience.
Emily	Wasley	Whole Chapter	15. Human Health						I recommend citing research related to the grief communities and people are facing with the loss of nature and natural habitats. This would fit nicely into Key Topic 3. If there is research related to the correlation between climate trauma and addiction / substance abuse as a way to cope with continuous trauma related to extreme weather events happening time and time again in the same, underserved communities, that would also align with Key Topic 3. Noting research related to the co-benefits of climate action and human health (e.g., GHG emissions reduction, switching to renewables, investing in community-led adaptation, creating more walkable communities with less cars and more trees) is very important.	Thank you for your comment. Mental health impacts from ecosystem changes will be addressed in the chapter and we will endeavor to include reference to lieturature that shows higher rates of substance abuse after disasters. (We have very limited space to include all the relevant topics on climate and health) We will coordinate with the Mitigation chapter and Adaptation chapter to consider including information on co-benefits.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
DAnn	Williams	Whole Chapter	15. Human Health						From: D,ÃôAnn Williams, Johns Hopkins School of Public Health, Center for a Livable Future To: USGCRP ,Äì NCA5 Chapter Authors Re: USGCRP NCA5 Chapter Outline Comment Disclaimer: The opinions expressed herein are our own and do not necessarily reflect the views of The Johns Hopkins University. February 19, 2022 Dear Chapter Authors, Thank you for the opportunity to comment on the United States Global Change Research Program Strategic Plan (2022-2031) Prospectus and Chapter Outlines. We are researchers at the Johns Hopkins Center for a Livable Future (CLF), an interdisciplinary research center based at the Johns Hopkins Bloomberg School of Public Health. CLF applies science and systems thinking to help build healthy, just, equitable, resilient, and sustainable food systems. We have reviewed the USGCRP strategic plan prospectus (SPP), reviewed the chapter outlines and have attended many of the NCA5 Public Engagement Workshops held by USGCRP and chapter authors. These virtual sessions have been informative, as well as interactive and inclusive. We strongly support the vison and mission of this multi-agency cooperative program to fully ,Äúunderstand the forces shaping the global environment, both human and natural and their impacts on society.,Äù There are four pillars for this work as stated in the USGCRP SPP: 1. advancing science, 2. informing decisions, 3. engaging the nation and 4. collaborating internationally. Under these four pillars are cross-cutting themes, diversity and inclusion, risk-based approaches, enhanced social science integration, communication, and workforce development. To adequately advance science and inform the development and implementation of climate change solutions, we urge you to stress the importance of developing multi-agency research and programs that improve our understanding of the public health implications of climate change and pathways to address agriculture and food systems contribution to climate change while protecting public health and environmental justice. Currently there are numerous gaps in our knowledge around current policies and practices and climate change and even fewer	Thank you for your comment. We will coordinate closely with the Agriculture and Water chapters on this topic. Environmental justice and health equity is a critical focus of the Human Health chapter, and is a key message. Thank you for the list of potential references; these will be considered by the author team.
Evan	Mills	Whole Chapter	15. Human Health						15. Human Health > General It is good to see adaptation/mitigation co-benefits discussed at various points in the outline, but the concept does not appear (at least using this term) in the Human Health chapter. There are multiple links, e.g., between heat stress and building energy efficiency and resilience. Other relevant aspects are picked up in the Air Quality chapter and may usefully be cross-referenced here. Some relevant topics are discussed in the following reference. Mills, E. 2006. "Synergisms between Climate Change Mitigation and Adaptation: An Insurance Perspective." Mitigation and Adaptation Strategies for Global Change, Special Issue on Challenges in Integration Mitigation and Adaptation Responses to Climate Change, Vol. 12, No. 5, pp. 809-842, https://drive.google.com/file/d/0B1s8219SGDlJT21uaUQzTThxbTg/view?resourcekey=0-GbymcbyohUMERG4nTgkF6Q	Thank you for your comment. The author team will address this topic in the chapter.
Skye	Wheeler	Whole Chapter	15. Human Health						Response to the US Global Change Research Program,Äôs Request for Public Comment Chapter 15: Human Health Thank you for seeking public feedback on the annotated outlines of each chapter for the Fifth National Climate Assessment (NCA5). We appreciate the opportunity to contribute. This submission focuses on the need for writers working on Chapter 15: Human Health to include research that recognizes and elucidates the harmful impacts of climate change on pregnancy health, and to do so within a reproductive justice context. Human Rights Watch is a nonprofit, independent organization that investigates allegations of human rights violations in more than 100 countries around the world, including in the United States, by interviewing victims and witnesses, gathering information from a variety of sources, and issuing detailed reports. Where human rights violations have been found, Human Rights Watch advocates for the enforcement of those rights with governments and international organizations and mobilizes public pressure for change. Access to sexual and reproductive healthcare for women in the US and closing the wide racial disparities in maternal health and birth outcomes are ongoing areas of concern for the women,Äôs rights division of Human Rights Watch. We appreciate that the human health chapter of the fourth National Climate Assessment noted: ,ÄúHigh temperatures in the summer are conclusively linked to an increased risk of a range of illnesses and death, particularly among older adults, pregnant women, and children,.Äù and that the link between extreme heat exposure and preterm birth was made. We further appreciate that the fourth National Climate Assessment recognized additional potential health and social vulnerabilities of pregnant people. Likewise, we noted that the US Global Change Research Program,Äôs report ,ÄúThe Impacts of Climate Change on Human Health in the United States: A Scientific Assessment,Äù (specifically Chapter 9: Populations of Concern) included mention of studies that show links between extreme heat exposure and adverse birth outcomes. This report also helpfully noted that the preterm birth rate in the US is high when compared to other industrialized countries, that preterm birth is linked with neonatal deaths	Thank you for your comment. We appreciate the resources that you have provided. We agree this is an important topic. Women's health and maternal and child health will be addressed in the chapter. We will consider and assess the peer-reviewed literature examples from your comment.
Ally	Beasley	Whole Chapter	15. Human Health						We appreciate the cross-disciplinary, equity and justice-oriented framework for analyzing and discussing human health and its intersection with climate change as outlined in this chapter. We also encourage the authors to include procedural justice and public participation (or lack thereof) in their consideration of how climate change and COVID 19 interact and how climate change exacerbates the pandemic. The COVID 19 pandemic has added to challenges and barriers to meaningful participtionin in agency planning and decision-making processes that directly, indirectly, and cumulatively affect the health of frontline people and communities, in particular----especially as many frontline communities have been hardest hit by the pandemic.	Thank you for your comment. There is a proposed cross-cutting box on the relationships between climate change and COVID-19 as a case study and lessons learned from the pandemic ; we will consider including procedural justice.
Michael	Wright	Whole Chapter	15. Human Health						For chapter authors, include at least one climate aware mental health clinician. A list of candidates can be provided upon request.	Thank you for your comment. We have mental health clinician expertise on the author team.
Michael	Wright	Whole Chapter	15. Human Health						General Comments IIIII Note that the health industry itself contributes to carbon emissions through facility operations and waste of resources and energy. See Ref.13.	Thank you for your comment. We will consider the peer-reviewed literature on this topic.
Michael	Wright	Whole Chapter	15. Human Health						General Comments IIIII Note that conservatives, who profess to be pro life, paradoxically oppose climate action. American children and grandchildren, and the poor and vulnerable worldwide, will bear the greatest impacts of climate change while having fewer natural and financial resources to cope. Thus, protecting life by protecting the climate is a moral imperative.	Thank you for your comment. The Human Health chapter has a health equity focus, and a key message on this topic.
Michael	Wright	Whole Chapter	15. Human Health						What's New IIIII Under ''Worry,'' note that climate related anxiety is not limited to only the young.	Thank you for your comment. The chapter will address mental health broadly.

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Michael	Wright	Whole Chapter	15. Human Health						What's New IIIII Change ''Newly introduced ticks pose disease threat,'' to ''Climate driven increases in vectorand tick borne diseases.''	Thank you for your comment. The author team will use wording backed by peer-reviewed literature. We will consider revision of this language.
Michael	Wright	Whole Chapter	15. Human Health						What's New IIIII Address increased risk of zoonotics due to proximity of human activity to wildlife (human wildlife interface. Also noted under Land Cover.	Thank you for your comment. Contributing factors to zoonotic disease spread will be considered for inclusion in the chapter, based on peer-reviewed literature.
Michael	Wright	Whole Chapter	15. Human Health						Key Topic 1 IIIII Under ''Food and water security,'' address risk of food chain collapse due to A. loss of habitat and pollinators, B. invasive pest and plant intrusions, C. animal and plant diseases, D. changes in seasonal timing, e.g., pollinators, migration patterns, E. unforeseen consequences of biodiversity loss.	Thank you for your comment. We will coordinate with the Agriculture chapter on this topic.
Michael	Wright	Whole Chapter	15. Human Health						Key Topic 2 IIIII Add that extreme weather can lead to power outtages that direclty impact patient care. Thus, deploying more solar power systems at health care facilites can not only reduce emissions, but also ensure continous power during extreme weather events.	Thank you for your comment. Cascading failures / compound hazards will be addressed in the chapter.
Michael	Wright	Whole Chapter	15. Human Health						Key Topic 2 IIIII Identify likely health consequences by mid century, if no significant emissions reductions are effected by 2030.	Thank you for your comment. Potential human health impacts of climate change are the focus of this chapter.
Michael	Wright	Whole Chapter	15. Human Health						New Key Topic IIIII Add new key topic addressing impacts of climate change on mental health.	Thank you for your comment. Mental health is an important topic and is included in the chapter.
Michael	Wright	Whole Chapter	15. Human Health						New Key Topic IIIII Address ecoanxiety, ecostress, and solastagia associated with climate induced impacts to community, or due to concern over climate change. (REF studies. Also noted under Land Cover.	Thank you for your comment. Mental health is an important topic and is included in the chapter.
Jhoset	Burgos	Whole Chapter	15. Human Health						Comment: The chapter should include a discussion on mental health impact of climate change and inexorable sea level rise.	Thank you for your comment. Mental health is an important topic and is included in the chapter.
Whitney	Berry	Whole Chapter	15. Human Health		1	60	1	62	1 Under Key Topic 3, community health: further explore the impact of locatio of high-pollution, high-emission facilites on health of communities, especially the connection between extraction/refining facilities and historic environmental injustice	Thank you for your comment. Environmental justice and health equity is a critical focus of the Human Health chapter, and is a key message.
Whitney	Berry	Whole Chapter	15. Human Health		1	60	1	62	1 Under Key Topic 3, food and water security, worth exploring the impact of plastic packaging as the main/only packaging material in low income grovery stores and the impacts of lack of access to less toxic packaging	Thank you for your comment. Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples. However the author team will consider this suggestion and may include relevant information from the peer-reviewed literature.
Joseph	Zajac	Whole Chapter	16. Tribes & Indigenous Peoples						missing the impact of Indian owned casinos and tax advantages selling goods impacting increased vehicle traffic and CO2 production on Indian owned land.	We will work to identify data and literature on this topic. We appreciate it being brought to our attention.
Ally	Beasley	Whole Chapter	16. Tribes & Indigenous Peoples						We encourage the authors to include a discussion of the importance and role of indigenous peoples' free, prior and informed consent (FPIC), as outlined in the UN Declaration on the Rights of Indigenous Peoples, in climate-related decision-making, planning, research, policy-making, adaptation, and mitigation.	We are currently working on revisions that would integrate, within the U.S. context, the roles and possibilities of UNDRIP. Excellent point.
Michael	Wright	Whole Chapter	16. Tribes & Indigenous Peoples						What's New IIIII Mention that more resource extraction is being conducted on federal and state lands, particularly under the Trump Administration, including those set aside for indigenous peoples such as Indian reservations. Some includes copper mines identified as required for technologies like computers and EV's that are tied to climate change mitigation, per Ref.7. Also noted under Land Cover.	We are currently working on integrating supply chain issues of the exact kind this good question referneces.
Michael	Wright	Whole Chapter	16. Tribes & Indigenous Peoples						Key Topic 1 IIIII Identify likely impacts to indigenous peoples by mid century, if no significant emissions reductions are effected by 2030.	This is an important point, and excellent questions. Other chapters in the NCA will cover such scenarios broadly. The literature specifically on Tribes and Indigenous peoples that we are charged with engaging does not present such information. However, we are referencing that Tribes themselves have engaged in climate change plannign efforts that have scenarios in them. We do not have the space in the chapter to provide that coverage.
Whitney	Berry	Whole Chapter	16. Tribes & Indigenous Peoples		1	63	1	64	1 Appreciative that they will be "honroing their knowledge and wisdom"	We appreciate the validating point in terms of a topic that is critical to the chapter content.
Melissa	Tier	Whole Page	17. U.S. International Interests			68			Key Topic 4: The name & text of this section seem to call out Agenda 2030/SDGs and the Sendai Framework on Disaster Risk Reduction -- which makes sense, by why leave out the Paris Agreement/UNFCCC? Seems like it should also be highlighted as a key multilateral body. Recommendation to also generalize this section title more, maybe to something like "multilateral climate diplomacy"? Content could also better consider the trickle-down effects on domestic interests/policy of the commitments that the US makes to these multilateral agreements.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. UNFCCC reference has been added.
Sydney	Heck	Whole Page	17. U.S. International Interests			67			With recent events it's concerning how much the people rely on the government's actions in regards to climate change. Given its severity it should be taken much more seriously, country wide mandates on energy and emissions should be out in place to mitigate future damage to the environment. Without the support of the government it will be difficult to facilitate any kind of change. This also goes for collaborations with other countries, once it's a world effort and countries hold others accountable, change will be made at a much greater pace.	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.
Joseph	Zajac	Whole Chapter	17. U.S. International Interests						looks OK but needs more detail, the overview is general. Looks to be an expansion outside the scope of the report and already covered by IPCC reports. No one from any US Intelligence agency is providing input.	We thank the reviewer for the comment. Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples. The chapter leadership has onboarded an author from the US intelligence community to balance the national security section.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Roy	Clark	Whole Chapter	17. U.S. International Interests						Comment on NCA5, Chapter17: Climate Effects on US International Interests Roy Clark PhD President Ventura Photonics Thousand Oaks CA 91360 The first step for Chapter 17 is the quantitative determination of the effects of the observed increases in the atmospheric concentration of so called ‚Äògreenhouse gases‚Äô, particularly CO2 on the earth‚Äôs climate. This then provides the foundation for any actions on US International Interests that need to be taken. Over the past 200 years, the atmospheric concentration of CO2 has increased by approximately 130 parts per million (ppm), from 280 to 410 ppm. The concentration still increasing and is now approaching 420 ppm. This has produced a decrease near 2 W m-2 in the longwave IR (LWIR) flux emitted to space within the CO2 emission bands. There has also been a similar increase in the downward LWIR flux from the lower troposphere to the surface. At present, the annual average increase in CO2 concentration is about 2.4 ppm. This produces an annual increase in the downward LWIR flux to the surface of approximately 0.034 W m-2. Quantitative thermal engineering analysis of the effects of these CO2 induced LWIR flux changes on temperatures in the troposphere, and on land and ocean thermal reservoirs shows that there can be no measurable effect on the earth‚Äôs climate. The results from climate models such as the CMIP5/6 ‚Äòensembles‚Äô are fraudulent and should not be used for climate assessment. The fundamental error is the assumption of an equilibrium average climate that can be perturbed by CO2. This is discussed in more detail in the general comment and the comments on Chapters 2 and 3 submitted by Roy Clark PhD. Detailed technical comments were submitted as e mail attachments. Please consult these for further information, figures and references. The ID Numbers of the online submissions and e mail attachment file names are:	We thank the reviewer for the comment, but the suggestions are outside the scope of this report. Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples.
Evin	Jacobs	Whole Page	17. U.S. International Interests			68			I think it is very interesting that climate change awareness stretches beyond the mainstream topics like solar energy and electric cars and into national security. To maintain the spot as the economic and military powerhouse of the world, all aspects of foreign, domestic, and environmental threats must be addressed. I think Key Topic 2 does a great job of describing the exact worries of the United States and how global changes will influence further defense, diplomacy, and development policies.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful.
Hunter	Wood	Whole Chapter	17. U.S. International Interests						I think this chapter does a good job of bringing up the potential threats to national security that climate change could pose. Two particular topics that stand out are how it will affect displacement/mobility/migration and geostrategic considerations. Perhaps specific examples of how different changes in the climate could influence these would be good to have.	We thank the reviewer for the comment. Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples.
Juanita	Constible	Whole Page	17. U.S. International Interests			67			The What's New section notes topics but unlike other chapters, gives no sense of direction of inquiry. Add more detail or verbiage to give better sense of interconnections among topics.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. The What's New Section has been expanded to include more detail on interconnections among topics.
Juanita	Constible	Whole Page	17. U.S. International Interests			67			Key Topic 1, second bullet: Add human health to the list of risks and impacts areas.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Human health has been added to KM 2 and KM4 supporting text.
Juanita	Constible	Whole Page	17. U.S. International Interests			68			Key Topic 3, Potential figures, first bullet, add human health to potential development of figure with economic and non-economic impacts of climate change. Estimates of health-related costs are available in the literature.	We thank the reviewer for the comment. The authors will consider adding human health to potential development of figure with economic and non-economic impacts of climate change.
Juanita	Constible	Whole Page	17. U.S. International Interests			69			Key Topic 4, fifth bullet, first subbullet: Add traditional knowledge to inform decisions. One example is traditional methods of avoiding heat related illness in India, including widespread dietary and behavioral practices.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. The value of different knowledge sources (climate science, local, indigenous) has been emphaised throughout the chapter.
Juanita	Constible	Whole Page	17. U.S. International Interests			69			Within Key Topic 5 on climate services, define and give examples relevant to civil society and community users.	We thank the reviewer for the comment. The chapter has been restructured with climate services examples interweaved throughout the chapter.
Juanita	Constible	Whole Page	17. U.S. International Interests			69			Key Topic 5, fourth bullet should discuss ways to assure sustained engagement of affected communities in the inception, co-development, and sustained assessment and iterative refinement of climate services. Mention of the disparities of time scaled in developing effective climate services and engagement would be helpful, i.e. data resource needs are urgent yet buildling trust in working relationships around co-development of climate services takes more time. What strategies might address this disparity?	We thank the reviewer for the comment. The chapter focuses on broad trends for the topic. We refer those interested in a deeper treatment of the topic to the provided citations.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Joseph	Robertson	Whole Chapter	17. U.S. International Interests						This comment pertains to various sections and subsections of Chapter 17. Noting the recognition of ‚Äúmutually reinforcing climate risks,‚Äù cascading impacts,‚Äù ‚Äúinterconnected systems,‚Äù and integrated ‚Äúgeostrategic considerations,‚Äù we wish to recommend exploring ways to integrate data across areas of consideration, including but not limited to: 1) Atmospheric concentrations of climate-forcing compounds; 2) Health and resilience of ecosystems and watersheds; 3) Adaptive capacity of nation states, including with specific attention to local distributed knowledge, capacity, and resources; 4) Climate emergency accelerants,‚Äîfactors like prolonged irreversible depletion of water resources, leading to ecological, social, and political instability, and mass migration,‚Äîand their corresponding costs across various dynamic cascading impact timelines; 5) Fiscal health and resilience connected to the above, including in light of the historic costs of COVID. Regarding ‚Äúvalues of at-risk global financial assets,‚Äù under Key Topic 3, we recommend using integrated multi-platform data analysis to gauge the marginal compounding risk affecting not only major segments of the financial value chain, but all areas of everyday economics, international trade, and investment. The recommended potential figures including both ‚Äúeconomic and non-economic impacts of climate-related natural disasters,‚Äù provides an important opportunity to visualize the complex interactions between areas of risk and resilience, investment, and value creation, and regional and international peace and security. As a network of stakeholders, the CCI position on such a visualization is: 1) It should be as detailed and inclusive as possible; 2) It should attempt to show interacting and compounding values; 3) It should recognize that everyday human experience, including in market measures, is enhanced or degraded by far more than market pricing indicates, when climate shocks or climate preparedness	We thank the reviewer for the comment. We appreciate this suggestion, but space is limited. Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples.
Michael	Wright	Whole Chapter	17. U.S. International Interests						What's New IIIII Mention that the actions of former president Trump in temporarily abrogated our commitment to the Paris Accord permanently compromised U.S. climate action credibility among the international community. Other nations were already viewing the U.S.. in its historical culpability, highest per capita emissions, and relatively meager climate action, as a primary cause for the climate impacts they are experiencing. These issues, as well as politically dependent commitments, makes international climate negotiations more difficult. This in turn makes collaboratively addressing climate change more challenging.	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.
Michael	Wright	Whole Chapter	17. U.S. International Interests						Key Topic 3 IIIII Mention that there is a need to establish international policies regarding climate change and emissions, i.e., to respond to nations that fail to meet emission reduction or forest conservation goals. For example, to discourage both illegal and legal destruction of rainforests for agriculture and timber, the U.S. should prohibit importing rainforest sourced products. This includes palm oil, tropical fruit, beef, lumber from nations that do not adequately protect rainforests. Also noted under Economics.	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.
Michael	Wright	Whole Chapter	17. U.S. International Interests						Key Topic 5 IIIII Add provision to rainforest host nations space based observations that can help identify and monitor deforestation.	We thank the reviewer for the comment. Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples.
Jhoset	Burgos	Whole Chapter	17. U.S. International Interests						Comment: Consider the effects of sea level rise in our international military installations as a potential issue of national security. In addition, consider the instability propelled by climate migration due to sea level rise. Authors could refer to the Periodic Global Trends Report published by the National Intelligence Council.	We thank the reviewer for the comment. The points the commenter raises were addressed in NCA4, which have been linked to this chapter.
Whitney	Berry	Whole Chapter	17. U.S. International Interests	1	68	1	68	1	Key Topic 3: In looking at risks and opportunities across sectors, maritime shipping and other transport of freight and cargo should be covered, including the development and deployment of zero-emission fuels and vessels.	We thnak the reviewer for the comment Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples.
Whitney	Berry	Whole Chapter	17. U.S. International Interests	1	68	1	68	1	Key Topic 3: Does it make sense to put anything in related to the role of the WTO in supporting or challenging ambitious country policies in the name of free trade?	We thank the reviewer for the comment. Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples.
Whitney	Berry	Whole Chapter	17. U.S. International Interests	1	68	1	68	1	Key Topic 4: In the assessment of response approaches, is there a way to ensure coverage of the use of revenues generated from policies like emissions fees and market-based measures? This is an issue in US policy discussions on shipping emissions fees, as well as at the international level. At issue is whether some of the revenue raised is channeled to developing countries or at-risk communitieis to build their resilience.	We thank the reviewer for the comment. Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples.
Melissa	Tier	Whole Page	18. Complex Systems		72				Under Key Topic 3: maybe add something more explicit about the often limited community capacity to navigate complex governance systems? (E.g., accessing disaster funds can be difficult because of time/staffing/knowledge constraints.)	This is a very important point on capacity to access funding, which has been included in 18.4 (that is focuses on governance).

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Bill	Mayben	Whole Chapter	18. Complex Systems						Dear Chapter Authors, Thank you for your depth of understanding. I am in favor of collaborating to understand synergistic effects, and propose associated, specific mitigation and adaptation projects in process. We are operating in an exponential context, wherein the fundamentals and their implications to human life are accelerating. We can accomplish more effective mitigation now, for less; when later we will be thrown back to adaptation measures with much greater urgency. Time is not our friend. There is no "they" to pick up the back end, only "we". You will continue to uncover linchpin processes; and unavoidable facts, which require action. Advocacy is involved in moving large, complex human systems. There will always be uncertainty in a dynamic situation. The difference between a problem and a predicament has been characterized as a man contemplating jumping off a bridge. Standing at the rail he has a problem, or problems. Once he jumps the rail he is in a predicament. Problems have solutions, predicaments have only managed outcomes. We are faced with solving our problems in parallel with managing the outcomes of our predicament. As in the example, effective solutions to the problems can prevent our being left with only managed outcomes. I am in favor of resilient and sustainable solutions. Spending our time and public dollars, our resources, toward lasting solutions to free up costs and energy toward emergencies. Many, if not most climate change disruptions are requiring us to drop our expectations, our conventions, our shared understandings of How Things Work. One example is characterized by 85% of our population living in proximity to oceans. Three weeks ago this was desirable, now, at least some of it is dangerous.It is one of our largest predicaments. How many times can we rebuild Houston, Miami, New Orleans, Jacksonville, Charleston, Savannah? The insurance industry will ultimately determine the answer. No insurance, no mortgages. We will face a tremendous loss in value. This will be destabilizing, and we should, now, build solutions, locations, processes. We cannot simply rebuild at locations which cannot endure unprecedented	Thank you very much for this feedback. We agree with the importance of many themes mentioned here, which are emphasized in our text: dynamic interactions evolving through time, the necessity of both mitigation and adaptation with synergies/trade-offs relevant in a complex-systems context, requirements for ongoing management and governance of complex systems processes and outcomes, limits to existing mechanisms of risk management, and the particular relevance of California examples. These themes are emphasized in sections 18.1 and 18.2, then with 18.3 indicating how the science of complex systems can be usable and accessible for related decision-making and 18.4 providing principles for such management and governance.
Joseph	Zajac	Whole Page	18. Complex Systems			70			use of politically correct terminology has no place in this report: Focus on social equity and justice at the front of many analysis frameworks	Social equity and justice are a mandated focus in this report. We have simplified language throughout and attempted to reduce jargon as much as possible.
Joseph	Zajac	Whole Chapter	18. Complex Systems						continued FALSE premise that wildfires are the result of climate change	This report carefully assesses the relationship between the changing climate, wildfires, and the multiple factors shaping their likelihood of occurrence. This chapter does not recapitulate the assessment found elsewhere in the report, but instead considers the complex systems dynamics resulting for people through disaster-induced displacement and climate-related migration
Juanita	Constible	Whole Chapter	18. Complex Systems						Whenever possible, give real-world examples of how climate responses and adaptation exists across sectors. For example in New York City, dozens of people who lived in basement apartments died in Hurricane Ida, making affordable housing policies that offer safer, accessible housing also climate adaptation policies.	As we have developed the text, we have focused on including examples that are meaningful and also timely. In the key message text, we include brief examples. We use the boxes to build out multiple examples more substantively. We agree the interactions across sectors mentioned in the example in this comment are fully relevant to our chapter and disaster/housing interconnections are considered directly in our box 18.2.
Juanita	Constible	Whole Page	18. Complex Systems			71			Key Topic 1, first bullet: Include specific examples of coordinated decision-making that is working and that is not, in the U.S. and beyond.	Examples and expanded discussion provided in KM18.3 and KM18.4
Juanita	Constible	Whole Page	18. Complex Systems			71			Key Topic 1, third bullet: Include discussion of disparate mental health impacts along with disparate perceptions of system complexity.	Length reduction requirements have required elimination of listed influences and impacts relative to the zero order draft
Juanita	Constible	Whole Page	18. Complex Systems			71			Key Topic 6, under potential case study, include coordination with Ch.15 Human Health.	As we developed this box, it did not end up having a strong focus on human health.
Juanita	Constible	Whole Page	18. Complex Systems			72			Key Topic 3, second bullet: Approaches for buildling trust from the ground up in codesign and coproduction of tools and approaches should be discussed, rather than making knowledge trusted post hoc.	Building trust through coproduction and inclusion of users in knowledge production is indeed a key tenet of co-production, and has now been added more explicitly in the sections that describe collaborative processes and their role in complex systems management.
Juanita	Constible	Whole Page	18. Complex Systems			72			Key Topic 3, fourth bullet: Potential case study should also coordinate with Ch.15 Human Health.	In the development of this box, we ended up focusing on coastal settlements and governance, not making health the primary focus
Juanita	Constible	Whole Page	18. Complex Systems			73			Key Topic 4, third bullet: Should speak to recognition of the inequitable distribution of risk.	Key message 18.2 is where we deeply consider themes of the distribution of vulnerability, impacts, and risks. Key message 18.4 builds from this essential starting point but does not repeat this assessment, instead considering its implications for effective and equitable governance of complex systems in climate responses.
Juanita	Constible	Whole Page	18. Complex Systems			73			Key Topic 4, sixth bullet: Should include coorindation with Ch.15 Human Health, and speak to modeling worst-case, cascading climate impacts across sectors, to assure that the most potentially damaging possibilities are assessed and discussed as a way to bound potential coordinated responses.	The governance principles considered within this key message are relevant to public health responses. However, given extreme space constraints, we do not play out the examples within the section sector by sector.
Emily	Wasley	Whole Chapter	18. Complex Systems						When discussing "social systems," it would be helpful to cite research related to the complexity of human behavior and how dependent we truly are on human behavior to change in order to significantly reduce our GHG emissions AND adapt in a transformative manner. The unknowns or uncertainties and knowns around historic and future behavior of how humans will take action on climate change v. how dependent we need to be on technology and the built systems would be important to include in this chapter.	Uncertainties relevant to human behavior are fully in scope of this chapter. We ensure mention of their importance in 18.1, and implications for ongoing decision-making and choices are outlined in 18.4. This focus includes the interactions between mitigation and adaptation, explored here from a complex systems and multi-sector interactions perspective.
Doug	Robbins	Whole Page	18. Complex Systems			72			Key Topic 3 could be improved by acknowledging that different tools address different aspects of complex systems (e.g. Monte Carlo modeling methods are best used to identify most likely outcomes, whereas scenario-based planning is best for appraising low-probability, high-impact events), or giving examples of the domains for application of those tools.	This is a great suggestion to include which types of tools are useful for addressing different aspects of he complex systems. Our concluding paragraph for this Key message includes a narrative on the same.
Michael	Wright	Whole Chapter	18. Complex Systems						For chapter authors, include at least one systems level expert on climate change, e.g., UArizona, NASA and JPL.	Our chapter team includes multiple complex-systems scientists who regularly incorporate systems-levels climate change data, model runs, and processes into their work. For example, one of our authors who had to step down did so because she was appointed chief scientist at NASA. Multiple authors with overlapping systems-level climate expertise remain on the chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	Wright	Whole Chapter	18. Complex Systems						What's New IIIII Add that recent proliferation of climate disinformation and relatively vocal conservative opinions generate a lack of understanding and concern regarding climate change, its causes and impacts. These opinions, in turn, move conservative voters to elect policymakers who generally oppose climate action and perpetuate disinformation, thus creating a vicious cycle of climate inaction and opposition. Also noted under Agriculture, Human Social Systems.	The role of information (and disinformation) has been emphasized in the chapter in its development since the ZOD stage. Interactions with politics, ideology, social and cultural dynamics, and decision-making are noted.
Jhoset	Burgos	Whole Page	18. Complex Systems			71			Under: Key Topic 1: Characteristics of complex human‚Äìenvironment systems; Under: This topic will draw from many new publications to discuss the complexity of systems, stressors, and interactions, as relevant to management and decisions across sectors and regions under climate change (see also Key Topic 4). This complexity includes interactions across contexts of governance and sectors, compounding stressors and cascading failures, unpredictability and thresholds/tipping points, synergies/tradeoffs, and the state of coordinated decision-making within and beyond the United States. Complexity within integrated systems also involves the connections and cascading dynamics introduced by climate change adaptation and emissions mitigation. Add: Sea Level Rise Suggested Language: ... Complexity within integrated systems also involves the connections and cascading dynamics introduced by climate change, sea level rise adaptation, and emissions mitigation.	Length reduction requirements have required elimination of listed influences and impacts relative to the zero-order draft
Jhoset	Burgos	Whole Page	18. Complex Systems			71			Under: Key Topic 1: Characteristics of complex human‚Äìenvironment systems Under: Examples will highlight how complex consequences emerge across interacting climate, ecological, built, and social systems in response to climate-related trends and shifting hazards (e.g., floods, droughts, heat waves, and wildfires) and in response to compounding influences and stressors (e.g., socioeconomic, demographic, technological, institutional, and resource-related shifts). We will consider the continuously evolving nature of social, economic, technological, and institutional systems and how the climate might influence these systems both at present and in the future as they coevolve. Further, we will explore implications, both benefits and disadvantages, for a broad range of stakeholders and affected populations. Add: Sea Level Rise as an example Suggested Language: ... (e.g., floods, sea level rise, droughts, heat waves, and wildfires)...	Length reduction requirements have required elimination of listed influences and impacts relative to the zero-order draft
Jhoset	Burgos	Whole Page	18. Complex Systems			72			Under Key Topic 2: Distribution of impacts and potential for responses in complex systems; Under: Potential case study (coordinated with Ch. 11: Agriculture, Ch. 12: Built Environment, Ch. 14: Air Quality, Ch. 15: Human Health, Ch. 16: Indigenous Peoples, Ch. 19: Economics, and Ch. 20: Human Social Systems): A comparison of compounding, cascading impacts and response potential for both urban and rural actors for similar stressors. Under: Social stressors: structural inequities amplifying stressors and resulting in disproportionate, accumulating impacts and reduced potential for enduring adaptive responses for some communities, e.g., for Black, Indigenous, and other people of color; politics, cultures, finance, economics, and cross-jurisdictional interactions as constraints and enablers Add: Islanders Suggested Language: Black, Islanders, Indigenous, and other people of color; politics, cultures, finance, economics, and cross-jurisdictional interactions as constraints and enablers.	We added a reference to Pacific Islanders in paragraph 2, and in other places "racialized minorities" can encompass this and other unnamed groups. In paragraph 3, we have noted that decarbonization can reduce air pollution, but there is not sufficient space or scope in this chapter to delve deeply into pollution exposure.
Whitney	Berry	Whole Chapter	18. Complex Systems	1	72	1	73	1	Under Key Topic 2, should include toxics/toxin exposure from point sources (e.g., facilities) and non-point sources (e.g., leaching from plastics packaging) as a point of discussion in compounding impacts	Environmental racism, with its implications for the distribution of toxins within the environment (air, water, soils), is relevant to the scope of this section. However, we choose to focus our examples more squarely on ones that have an obvious climate angle given the scope of the chapter.
Whitney	Berry	Whole Chapter	18. Complex Systems	1	72	1	73	1	Under Key Topic 3, in terms of accessibility, important to address langauge justice and the need for examinging how we communicate the message and who is the messenger	Communicating appropriately to different audiences is critical for knowledge accessibility (especially understanding language justice implications and focus on the messenger as a key actor). This has been added in the sentences describing boundary agents as key mediators and communicators of knowledge.
Whitney	Berry	Whole Chapter	18. Complex Systems	1	72	1	73	1	Under Key Topic 3, also important to address the impact of information/mesaging on indivuals - from action to apathy (exploring climate change and menthal health)	Messaging is also an important aspect of actionability of knowledge, we have added this in the sentences describing boundary agents as key mediators and messengers of knowledge.
Whitney	Berry	Whole Chapter	18. Complex Systems	1	71	1	71	1	Under Key Topic 1, bullet about potential case study: As complex adaptive systems, fisheries faced many challenges and impacts resulting from the COVID-19 pandemic, many of which are likely to have corollaries with intensifying climate change. For example, there were unanticipated impacts to the system through altered fisher behavior as a result of the pandemic, with the behavior dependent upon sector (e.g., increases in recreational fishing as a safe outdoor pastime but decreases in commercial fishing, where supply chain disruptions were limiting demand). At the same time, data collection was hampered, limiting full knowledge of impacts of these shifts in fishing practices on fish stocks. There were also interesting adaptations to emerge from the pandemic, like the emergence of alternative seafood networks that brought seafood to consumers through local and direct sales networks (e.g. see Stoll et al. 2021 Front. Sustain. Food Syst. https://doi.org/10.3389/fsufs.2021.614368).	We have decided to focus this box on the example of data centers, as a timely and innovative entry point to enduring themes of energy, water, and land interactions. Fisheries are considered as a crucial sector and example and many other chapters, including the regional chapters.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Susan	Fancy	Whole Chapter	19. Economics						It would be great to blend the broader social and environmental context for climate change in this chapter if possible. I imagine this chapter as planned would focus on the economics of various adaptation and mitigation options. Would it be possible to also consider the broader context in which we are operating? According to BP's latest summary on fossil reserves, we have around 50 years of oil and natural gas, more for coal. But we will run out. Our entire economy is based on fossil fuels. And, the IMF released a working paper last fall estimating that fossil fuel subsidies, direct and indirect via impacts are well over $5T in an approx $85T global economy. Suggestions: 1) Is there a truly green penalty for the various options that will be discussed in this paper if we remove fossil fuel subsidies (I realize this is a wildly unpopular idea that powerful forces will resist)? 2) Knowing that eventually fossil fuels need to go away completely, how do CO2 mitigation options and preparing for a non-fossil based economy need to synergize? Carbon capture and utilization, and using plants (water, land) to make humanity's huge appetite for carbon-based goods are a part of the solution (as is plastics recycling as a source of carbon). I think we need to start shifting the conversation towards managing climate change within the context of transitioning our entire economy off fossil sources. On the timescales of capital planning cycles which are 20-100 years, the time to get a new economy on paper is right now.	Thank you for this thoughtful comment. However, the mandate of the chapter is to report on the economic consequences of climate change, rather than causes. Thus, we will not be able to incorporate these topics into our chapter. But it is worth noting that these topics may be addressed in the Chapter 32 on Mitigation.
Gina	Karp	Whole Chapter	19. Economics						The outline of the chapter looks very interesting. I had a few comments: -Under Key Topic 1: It notes impact to the economy e.g. crops ‚Äì would this include crop insurance? I really like seeing the implications for inequality because there is already research showing that the LMI areas are most at risk. -Under Key Topic 2: If regulators/lenders highlight ‚Äúhigh‚Äù risk areas will there be loan availability in those areas? I think some refer this to Blue-lining or underwaterwriting. Would unintended consequences be discussed or possible impacts to loan availability? Would nonbank sector then become more prominent in these areas? -Also, I read that when major public firms sell fossil fuel assets to decarbonize small operators are buying them and thus who is financing them? -I was wondering also about disclosure from a consumer perspective e.g. will the market be more transparent so that consumers/home buyers are more aware of risks? Under Key Topic 3: -What would this mean for migration ‚Äì will people buy homes and live where there are more economic opportunities? Will this further the divide between areas/income gap?	Thank you for these comments. The chapter will address topics related to crop insurance, inequality, lender risk, disclosure to home buyers and migration. We will not be addressing issues associated with decarbonization as that is beyond the mandate of this chapter (see Chapter 32 on Mitigation).
Bill	Mayben	Whole Chapter	19. Economics						Dear Coordinating authors; 1. First, we must keep in mind that we are in an exponential phenomena, and as such, time is not our friend. It is commonly understood that our present expenditures toward mitigation are the cheapest cost for the greatest effects; and that over time, mitigation will become more and more expensive, until we are left with expensive and urgent adaptation measures. 2. My view is that we are dealing with cultural change. Thwarting the most disastrous effects of climate change depends on broad citizen involvement. There is a strong public relations aspect to this. The shift to sustainable practices will progressively be led by economics, or thwarted by economics. 3. Because government participation is based, ultimately, on a viable economy; we have the responsibility to encourage R&D into economically viable, sustainable and resilient methodologies, systems and products to replace; starting with the key disruptions to our climate. This needs to be addressed sector by sector. 4. It may well be that the general underlying expectation is that adaptation to climate change involves loss. It involves change and endurance. What we lose is not sustainable, and will be taken from us at some point, a point in which our choices will be fewer and more costly. So attempts to delay loss, in sure it. Successful transition to a sustainable and resilient economy is dependent on economic viability during the pivot. 5. One potential example of this change, would be supplanting polluting suburban transportation in a number of single family vehicles, to the use of Neighborhood Electric Vehicles. The consumer saves acquisition and operation costs; we encourage public transportation regionally, and we save the air. There are industry shifts in the background; which are necessary; but driven by consumer preferences. We create an industry. 6. Another example would involve the use of residential and commercial heat exchange systems, using the ambient temperature of the earth to modulate heating and cooling. We eliminate the use of natural gas, lower the costs, lower atmospheric effects/generation effects of air conditioning, for instance; and create a sustainable industry	Thank you for this comment. However, the mandate of the chapter is to report on the economic consequences of climate change, rather than causes. Thus, we will not be able to incorporate these topics into our chapter. But it is worth noting that these topics may be addressed in the Chapter 32 on Mitigation.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
David	Rodziewicz	Whole Chapter	19. Economics						Generally, the economics chapter covers a number of timely climate economics topics that run the range of community level, regional, and national impacts. The one topic that seems absent in this chapter (and also in the Energy chapter) is the economic impacts of energy transitions. The economic implications for energy transitions (i.e., shifts in the way we produce and consume energy) toward lower carbon sources is instrumental to climate risk change mitigation. Thus, the economic implications of energy transitions is an important topic to cover in NCA5. Economic implications of Energy Transitions: -Local, Regional, National, and International Implications (What are the economic implications at different scales?) -Impacts to components of the energy sector (e.g. coal, oil/gas, renewables) -Implications for carbon intensive industries (e.g. utilities, Manufacturing Ag) -Costs and Benefits of Energy Transitions -Equity issues with the energy transition (e.g. higher potential energy cost of low-income households) -Energy Transitions and potential spillovers (e.g. Mining/Critical Materials, Changes in Geo-political landscape, lending practices/capital flows). As I go through the list of the economic implications of energy transitions, it seems like this topic touches on a number of chapters in the NCA5. Although this topic best resides in the economics chapter, there is probably some cross-disciplinary work that could be had here. Best of Luck with the Chapter. David Rodziewicz, Federal Reserve Bank of Kansas City	Thank you for this thoughtful comment. However, the mandate of the chapter is to report on the economic consequences of climate change. Thus, we will not be able to incorporate discussions of transition risks into our chapter. But it is worth noting that these topics may be addressed in the Chapter 32 on Mitigation or Chapter 5 on Energy.
Serena	Popatia	Whole Chapter	19. Economics						I think that the overall chapter properly addresses how climate change impacts the economics of a country. It speaks to how the economics of a country has been affected in the past due to climate change and what measurements will be taken in the future to see how climate change affects the economy of a country in the future.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful.
Joseph	Zajac	Whole Chapter	19. Economics						state the margin of error for all data previous used in models and model errors	We will discuss limits to the predictability of models and present uncertainty in several estimates.
Joseph	Zajac	Whole Chapter	19. Economics						lack of qualified and successful business people as authors	The author team was selected based on their scientific expertise on the economic consequences of climate change.
Juanita	Constible	Whole Page	19. Economics			74			Key Topic 1: The economic impacts of climate change also include health-related financial burdens from deaths, illnesses, and injuries stemming from climate sensitive exposures. Although these impacts are poorly tracked at this time, there is sufficient evidence in the peer-reviewed literature to point to in this chapter on this pressing topic. This chapter should robustly engage with the literature on health-related economic valuation of climate impacts, including the direct costs of medical care in emergency rooms and hospitals and other costs and impacts stemming from deaths, prescription medications, and ongoing healthcare needs after climate-sensitive events. The chapter should also engage with the respective payers of these health-related costs, including healthcare insurers (public and private), employers, families, and individuals.	Thank you for this thoughtful comment. The chapter will address the economic impacts of climate change as represented by health impacts, both in terms of their impact on wellbeing and the pecuniary costs assocated with care, including impacts on health insurance systems.
Juanita	Constible	Whole Page	19. Economics			75			Key Topic 3: In referring to health and well-being, the chapter should also engage with health-related financial burdens from deaths, illnesses, and injuries stemming from climate-sensitive exposures. Although these impacts are poorly tracked at this time, there is sufficient evidence in the peer-reviewed literature to point to in this chapter on this pressing topic. This section should robustly engage with the literature on health-related economic valuation of climate impacts, including the direct costs of medical care in emergency rooms and hospitals and other costs and impacts stemming from deaths, prescription medications, and ongoing healthcare needs after climate-sensitive events. The section should also engage with the respective payers of these health-related costs, including healthcare insurers (public and private), employers, families, and individuals.	Thank you for this thoughtful comment. The chapter will address the economic impacts of climate change as represented by health impacts, both in terms of their impact on wellbeing and the pecuniary costs assocated with care, including impacts on health insurance systems.
Juanita	Constible	Whole Page	19. Economics			75			Key Topic 3: In addition to describing adaptation costs, this section should also describe the benefits and cost savings linked to climate change adaptation, including savings derived from reduced health problems achieved as a result of adaptation actions including early warning systems, infrastructure resilience, landcover modification, etc.	The chaper does address some adaptation costs and benefits, including those that impact health. However, due to space constraints, we are unable to explicitly discuss each of these topics.
Juanita	Constible	Whole Page	19. Economics			75			Key Topic 2, 7th bullet on Insurance markets: Should discuss whether climate-health impacts are affecting insurance premium setting among at-risk groups of insured people or locations.	This topic will be addressed in the chapter.
Juanita	Constible	Whole Page	19. Economics			75			Key Topic 3, first and second bullets on Households and Businesses list Adaptation costs: These sections should speak to how the absence of well-developed adaptation scenarios describing comparable levels of adaptation in different locations and settings hampers our abaility to compare adaptation costs, once estimated, or to estimate the Return On Investment of funding adaptation, compared to the costs in terms of health and otehrwise, that adaptation can help avoid.	The chapter will discuss what is understood about adaptation and the ability of societies to adapt to warming. We will also discuss the costs and benfits, and the idea that some costs may prevent adoption of certain adaptation technologies that may be effective.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Emily	Wasley	Whole Chapter	19. Economics						I am hoping this chapter will include research and evidence to answer the following important questions decision-makers have as they become increasingly required to disclose their climate-related financial risks and opportunities in alignment with the Task Force on Climate-related Financial Disclosures (TCFD) or in response to Executive Order on Climate-Related Financial Risk: ‚Äć How does the research community define adaptation finance and/or the economics of adaptation? ‚Äć What variables are generally included in this definition? ‚Äć How does the research community calculate the cost of adaptation in the U.S.? ‚Äć What has adaptation cost the U.S. historically (and what is the timeframe to estimate historic costs)? ‚Äć What are some cost estimates or projections the research community has on financing or investments needed for the U.S.? ‚Äć Does the research community estimate costs in aggregate or are they able to break it down by U.S. region, sector, scales (e.g., local to national), and impact (e.g., sea level rise, extreme temperatures, storms)? ‚Äć What economic or financial instruments are currently available to estimate the cost of adaptation for the U.S. or at other scales, sectors, or impact? ‚Äć What level or amount of investment in national and global efforts are needed to reduce greenhouse gas emissions that can have a significant influence on future adaptation needs and costs?	The chapter will address how costs are broken down by region and sector, and also how they are aggregated. The chapter is also able to discuss the economics of adaptation, although we will not be able to take on all of these topics due to space constraints. Some of these questions may be addressed in Chapter 31 (Adaptation) or Chapter 32 (Mitigation).
Mark	Chopping	Whole Page	19. Economics			75			At "‚Äć International trade and supply chains" Please include here some discussion of the export of woody biomass from U.S. plantations for combustion in foreign (British and European) thermal electricity generation plants, where the CO2 is not captured. When the climate costs of trans-Atlantic shipping are included, this trade is hardly benign and certainly not climate-neutral.	Thank you for this comment. However, the mandate of the chapter is to report on the economic consequences of climate change, rather than causes. Thus, we will not be able to incorporate these topics into our chapter. But it is worth noting that these topics may be addressed in the Chapter 32 on Mitigation.
Michael	Wright	Whole Chapter	19. Economics						General Comments IIIII The 21st century American economy remain highly dependent on fossil fuels, with few incentives for renewable energy, energy conservation, sustainble transportation, and low carbon products and food.	Thank you for this comment. However, the mandate of the chapter is to report on the economic consequences of climate change, rather than causes. Thus, we will not be able to incorporate these topics into our chapter. But it is worth noting that these topics may be addressed in the Chapter 32 on Mitigation.
Michael	Wright	Whole Chapter	19. Economics						General Comments IIIII Reducing emissions still relies primarily on market based strategies, which remains mostly unregulated and insufficient to meet carbon reduction goals to avert the worst impacts of climate change.	Thank you for this comment. However, the mandate of the chapter is to report on the economic consequences of climate change, rather than causes. Thus, we will not be able to incorporate these topics into our chapter. But it is worth noting that these topics may be addressed in the Chapter 32 on Mitigation.
Michael	Wright	Whole Chapter	19. Economics						General Comments IIIII Many Americans, primarily conservatives. oppose funding climate action while dismissing the costs of climate change impacts. These impacts include A. disaster relief and recovery, B. disease and death, C. international competition in renewable energy and green technology, D. power utility costs, E. availability of food and other goods, E. property and health insurance rates, F. economic inflation, G. infrastructure, e.g., capacity of drain and sewage.	This chapter will address each of these topics, except F (inflation) due to a lack of findings on this topic, to date.
Michael	Wright	Whole Chapter	19. Economics						General Comments IIIII Jobs will be at risk as well, with market based loss of fossil fuel jobs and competition for renewable energy jobs. Low income workers, many of whom hold multiple jobs just to feed their families, are not concerned about climate change or reducing emissions, much less in the market for solar panels, electric vehicles, or even LED lighting.	This chapter will address some consequences of climate change related to labor, earnings and employment.
Michael	Wright	Whole Chapter	19. Economics						Key Topic 1 IIIII Identify likely economic consequences by mid century, if no significant emissions reductions are effected by 2030.	This chapter will report several consequences of climate change that may emerge by mid-century in the absence of effective mitigation policies.
Michael	Wright	Whole Chapter	19. Economics						Key Topic 2 IIIII Address fossil fuel divestment, including A. There has been fossil fuel divestment by some high profile organizations, but this has served as a relatively insufficient protest against the fossil fuel industry. For example, the Federal Employee Retirement System Thrift Savings Plan market investments remain unchanged since inception in mid 80's. B. The definition of socially responsible investments remains relatively subjective, with no formal criteria established by federal regulators, e.g., SEC. Further, many funds do not disclose this to potential investors. C. For example, PA's 529 plans are through Vanguard, whose portfolio includes investments in the fossil fuel industry. Only prospective investors who look closely at Vanguard's holdings, which are simply based on the FTSE index, will find that Vanguard's actual investments are not socially responsible. This points to a violation of SEC Rule 270.35d 1, which prohibits investment fund names that are inconsistent with their actual holdings. D. There is thus a need for restrictions on what investment plans, mutual funds, or any other investment program can claim with regard to their socially responsible investment portfolio. E. There is also a need for objective criteria for SRI's, so that socially responsible investors can rest assured that their investments are not going to support companies whose policies and actions exacerbate climate change, such as those whose revenue does not depend on fossil fuels.	Thank you for this comment. However, the mandate of the chapter is to report on the economic consequences of climate change, rather than causes. Thus, we will not be able to incorporate these topics into our chapter. But it is worth noting that these topics may be addressed in the Chapter 32 on Mitigation.
Michael	Wright	Whole Chapter	19. Economics						Key Topic 2 IIIII Address funding to address climate change, including A. More national and state budgets will be spent to both respond to climate induced disasters, and also to address climate change driven social needs such as food and water insecurity, energy supply, infrastructure repair, housing and insurance, health and disease. B. Consequently, less funding will be available to implement adaptation measures and emissions reductions measures, such as renewable energy development, energy conservation programs, and sustainable transportation. C. Billions in federal infrastructure funding is being used to plug approx. 2 million abandoned oil and gas wells leaking methane and contaminating water, per Ref.6. Also noted under Energy, Northeast.	Thank you for this thoughtful comment. The chapter will address the fiscal risks posed by climate change, whereby climate change simultaneously impacts government revenues and the demands on government services and programs. However, the mandate of the chapter is to report on the economic consequences of climate change, rather than causes. Thus, we will not be addressing the issues of renewable energyin our chapter. But it is worth noting that those topics may be addressed in the Chapter 32 on Mitigation.
Michael	Wright	Whole Chapter	19. Economics						Key Topic 2 IIIII Address financial incentives for climate change mitigation, including A. There is no financial incentive for the fossil fuel industry to plug abandoned wells; although they are required to plug, penalties are insufficient compared to the cost of plugging, per Ref.6. Also noted under Energy, Northeast. B. There are few market based incentive to conserve forested or other natural land cover that sequesters carbon, compared to profits gleaned through development, or in some cases agriculture. Also noted under Land Cover, Forests, Agriculture.	Thank you for this comment. However, the mandate of the chapter is to report on the economic consequences of climate change, rather than causes. Thus, we will not be able to incorporate these topics into our chapter. But it is worth noting that these topics may be addressed in the Chapter 32 on Mitigation.
Michael	Wright	Whole Chapter	19. Economics						Key Topic 2 IIIII With regard to insurance markets, mention climate induced damage to housing, vehicles, and land results in increases to insurance rates.	Thank you for this comment, these topics will be addressed in the chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	Wright	Whole Chapter	19. Economics						Key Topic 2 IIIII With regard to international trade, there is a need to establish international policies regarding climate change and emissions, i.e., to respond to nations that fail to meet emission reduction or forest conservation goals. For example, to discourage both illegal and legal destruction of rainforests for agriculture and timber, the U.S. should prohibit importing rainforest sourced products, e.g., palm oil, tropical fruit, beef, lumber from nations that do not adequately protect rainforests. Also noted under International Interests.	Thank you for this comment. However, the mandate of the chapter is to report on the economic consequences of climate change, rather than causes. Thus, we will not be able to incorporate these topics into our chapter. But it is worth noting that these topics may be addressed in the Chapter 32 on Mitigation.
Michael	Wright	Whole Chapter	19. Economics						Key Topic 2 IIIII Note that for decades, the economy has been prioritized over the environment, with protection of the latter usually implemented reactively rather than proactively. Often, the case for economic development is couched as a need for flexibility and ''balance'' between the economy and the environment, without acknowledgement that balance has already been lost to the former. As a result, the acceptable baseline continues to shift toward more development. Thus, the environment must now be prioritized, with recognition that the economy and indeed the future of humanity depends on protecting what's left of healthy ecosystems. Also noted under Land Cover.	Thank you for this comment. However, the mandate of the chapter is to report on the economic consequences of climate change, rather than causes. However, we will provide some background on the Social Cost of Carbon, which is a concept regarding the pricing of carbon emissions based on the resulting impacts it has via climate change. Use of the Social Cost of Carbon to price carbon is widely understood to be an approach that would allow market mechanisms to balance some of the tradoffs described in the comment. Some of these topics may be further addressed in the Chapter 32 on Mitigation.
Michael	Wright	Whole Chapter	19. Economics						Key Topic 3 IIIII Address the misconception, primarily on the part of conservative policymakers, that taking climate action will somehow harm the economy. Rather, not taking proactive, ambitious action on climate will hurt the economy.	The focus of this chapter is to report on what is understood about the economic consequences of climate change.
Michael	Wright	Whole Chapter	19. Economics						Key Topic 3 IIIII Address the need for greater awareness, on part of public, policymakers, and stakeholders, that addressing climate change is actually necessary to ensure a strong economy. This is due to A. impacts to infrastructure, B. technological and market competitiveness, C. constraints on fossil fuel energy, D. disaster response and recovery, E. property values, F. inflation, G. health care.	We will discuss how awareness about the impact of climate change may affect how risks posed by climate change are managed by individuals, businesses, institutions, and governments.
Michael	Wright	Whole Chapter	19. Economics						Other Comments IIIII Mention increased demand due to: increased use of personal electronics, more parasitic and standby loads in homes and businesses, and increased shipping of goods ordered online and returned, with concomitant use of resources for packaging and transportation. Also noted under Energy, Land Cover, Transportation.	Thank you for this comment. However, the mandate of the chapter is to report on the economic consequences of climate change, rather than causes. Thus, we will not be able to incorporate these topics into our chapter. But it is worth noting that these topics may be addressed in the Chapter 32 on Mitigation.
Michael	Wright	Whole Chapter	19. Economics						Other Comments IIIII Mention the increased availability and consumption of ethanol blended gasoline produces high upstream emissions and induces greater fuel consumption due to its lower energy content compared to pure gasoline, requiring more fuel to travel the same distance. Also noted under Energy, Land Cover, Agriculture, Transportation.	Thank you for this comment. However, the mandate of the chapter is to report on the economic consequences of climate change, rather than causes. Thus, we will not be able to incorporate these topics into our chapter. But it is worth noting that these topics may be addressed in the Chapter 32 on Mitigation or Chapter 5 on Energy.
Jhoset	Burgos	Whole Chapter	19. Economics						Comment: Economic considerations should also include the current, projected, and potential impacts of multimeter sea level rise plus short-term flooding events and coastal erosion. It is important to recognize our inability to precisely predict long-term sea level rise.	Thank you for this comment, we will work to address these topics and discuss the limits of prediction.
Jhoset	Burgos	Whole Page	19. Economics			74			Under: Key Topic 1: What are the direct impacts of climate change on components of the economy (e.g., crops, labor, infrastructure)? Which of these impacts are being observed today? What are the projected effects on the economy? Under: Projected impacts: Across sectors and regions, what are the market and nonmarket damages and adaptation costs of future climate conditions? Add as a subsection a specific question about sea level rise. Suggested Language: What are the expected near term (30 years) and long term (100 years) impacts of projected and potential multimeter sea level rise plus short-term flooding events and coastal erosion?	We aim to address all of these points in the chapter to the extent that they have been analyzed in the literature, subject to word limits for the chapter.
Jhoset	Burgos	Whole Page	19. Economics			75			Under: Key Topic 2: How are existing economic systems (e.g., markets, regulators) responding to climate change and managing climate-related risks? Will they dampen and/or magnify the influence of climate change? How will these responses affect the distribution of impacts across society? Where do spillover effects occur across markets? Comment: Comment: This section should expressively evaluate projected and potential multimeter sea level rise plus short-term flooding events and coastal erosion. It is important to recognize our inability to precisely predict long-term sea level rise.	We aim to address all of these points in the chapter to the extent that they have been analyzed in the literature, subject to word limits for the chapter.
Jhoset	Burgos	Whole Page	19. Economics			75			Under: Key Topic 3: What are implications for the economic opportunities of Americans? Comment: While we will lose valuable assets to sea level rise we will have to accommodate those communities and economic functionality elsewhere. Add as a subsection the economic opportunities of rebuilding or relocating vulnerable coastal structure, due to sea level rise, to higher ground. In addition, consider economic opportunities to innovate coastal infrastructure.	We will discuss some of the issues related to adaptation via population migration or relocation, althought the word limits and scope of the chapter prevent us from doing a deep dive into these topics. However, they may be more thoroughly address in Chapter 9 on Coastal Effects or Chapter 31 on Adaptation.
Whitney	Berry	Whole Chapter	19. Economics	1	75	1	76	1	Under Key Topic 2, aggregate market responses, worth exploring the changing focus of some fossil fuel/petrochemical industries in response to increased climate policies (e.g., an increased focus on production of single use plastics in response to a projected decrease in demand for other petrochemicals based on the transition to EVs)	Thank you for this comment. However, the mandate of the chapter is to report on the economic consequences of climate change, rather than causes. Thus, we will not be able to incorporate these topics into our chapter. But it is worth noting that these topics may be addressed in the Chapter 32 on Mitigation or Chapter 5 on Energy.
Clare	Cannon	Whole Chapter	20. Human Social Systems						The chapter describes recognition, procedural, and distribute forms of environmental justice but does not include capabilities. The inclusion of capability justice may assist in furthering reflect understanding of the intersections of climate change, human social systems, and justice. Another avenue of current research applies intersectionality theory to better understand the relationship across diverse human social systems of difference and informs how social systems respond to and experience climate change.	Thank you for your comment. The author team examined several models of environmental justice (EJ) and made the determination that the three forms used in the chapter afford the broadest overarching categorization.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Robert	Brulle	Whole Chapter	20. Human Social Systems						This chapter's discussion of the social science around climate change fails to engage at all with the extensive literature on the role of power, ideology, propaganda, and organized efforts to oppose climate action. Here is a partial list of some of the relevant peer reviewed research on this topic. Ard, K., Garcia, N. and Kelly, P. (2017). Another avenue of action: An examination of climate change countermovement industries,Âô use of PAC donations and their relationship to Congressional voting over time. Environmental Politics, 26, 1107-1131. Allgaier, J. (2019). Science and environmental communication on YouTube: Strategically distorted communications in online videos on climate change and engineering. Frontiers in Communication, 4, Article 36. doi.org/10.3389/fcomm.2019.00036 Barley, S. (2010). Building an institutional field to corral a government: A case to set an agenda for organization studies. Organization Studies, 3, 777-805. Beder, S. (1998). Public relations,Âô role in manufacturing artificial grass roots coalitions. Public Relations Quarterly, 43, 20-23. Beder, S. (1999). Corporate hijacking of the greenhouse debate. The Ecologist, 29 (March/April), 119-122. Benestad, R. E., Nuccitelli, D., Lewandowsky, S., Hayhoe, K., Hygen, H. O., van Dorland, R. & Cook, J. (2016). Learning from mistakes in climate research. Theoretical and Applied Climatology, 126, 699-703. Bloomfield, E. F. & Tillery, D. (2019). The circulation of climate change denial online: Rhetorical and networking strategies on Facebook. Environmental Communication, 13, 23-34. Bohr, J. (2016) The ‚Äúclimatism‚Äù cartel: Why climate change deniers oppose market-based mitigation policy. Environmental Politics, 25, 812-830. Bohr, J. (2020). Reporting on climate change: A computational analysis of US newspapers and soures of bias, 1997-2017. Global Environmental Change, 61, 102038 doi.org/10.1016/j.gloenvcha.2020.102038 Bolin, J. L. & Hamilton, L. C. (2018). The news you choose: News media preferences amplify views on climate change. Environmental Politics, 27, 455-476. Boussalis, C. & Coan, T. G. (2016). Text-mining the signals of climate change doubt. Global	Thank you for the extensive reference list. The issue of organized efforts to oppose climate action is an important one. We have added some of the suggested references, but space limitations preclude adding them all.
Kai	Olson-Sawyer	Whole Chapter	20. Human Social Systems						Comments for U.S. National Climate Assessment 5 1/11/2022 Kai Olson-Sawyer, Sr. Research and Policy Analyst, GRACE Communications Foundation kbynos@gmail.com Please accept my written comments, which were also presented to Dr. Jacobs and Mr. Scheetz at the virtual meeting earlier today. (NOTE: These identical comments were shared with the Whole Draft report authors, as Mr. Scheetz asked that I share them with the overall group.) First, I would like to recommend for inclusion to the chapter the work of Dr. Elinor Ostrom, the first woman to receive the Nobel Prize for Economics in 2009. Her work was interdisciplinary and pushed more broadly into the social sciences. She was particularly ground-breaking in terms of explaining the modalities various social groups used to address the problems of common pool resources. Moreover, she turned that lens to analyze self-organized governance that happens at multiple levels; from global to local. The framework that she and her husband, Vincent Ostrom, developed, is the polycentric governance. This describes complex governance in which leaders and residents produce different structures and levels of governance that allow for distributed, somewhat autonomous decision making in these structures. The Paris Agreement, with its openness to climate action at the national government level, but also at the sub-national level (e.g., US states, business, municipalities, NGOs, etc.) could be viewed as one example of polycentric governance. RESOURCES Polycentric governance (overview): https://ostromworkshop.indiana.edu/library/teaching-resources/polycentricity.html ‚ÄúA Polycentric Approach for Coping with Climate Change,‚Äù: https://openknowledge.worldbank.org/bitstream/handle/10986/4287/WPS5095.pdf ‚ÄúBeyond Markets and states: Polycentric Governance of Complex Economic Systems,‚Äù ***** Secondly, I'd like to propose the addition of a new format and structure to NCA5 in light of the	Thank you for this comment. The idea of first-person testimonials is an intriguing one, and would likely be better suited for regional chapters.
Joyce	Coffee	Whole Chapter	20. Human Social Systems						Hello, You may find it interesting to review: TAKING STOCK AND STAYING IN THE VANGUARD: CLOSING THE RESILIENCE GAP THROUGH TRANSFORMATIVE ACTION https://kresge.org/library/closing-resilience-gap-through-transformative-action With support from the Kresge Foundation, we held the core workshop at the National Adaptation Forum, to ascertain the current state of the field, profile examples of transformative action, identify examples of transformational adaptation with social equity at the center and engender commitments for resilience field leaders to enact critical actions.	Thank you for the reference suggestion. We believe it is better suited to the adaptation chapter.
Sara	Delaney	Whole Page	20. Human Social Systems			79			Key Topic 4: This topic will address climate change communication, interpretation, and meaning. Individuals and institutions interact with knowledge and meaning to communicate and make decisions about climate change under conditions of uncertainty It may be interesting in this section to include a discussion of communication to farmers on climate change and climate risk, since agriculture is important both in terms of GHG emissions, as well as the future of our food supply in a changing climate. So the interpretation by farmers of risks, benefits and options becomes very important.	Thenk you for this suggestion. We are coordinating with the agriculture chapter to figure out how best to address this topic.
Joseph	Zajac	Whole Chapter	20. Human Social Systems						use of politically correct terminology has no place in this report - social justice, Environmental Justice, for examples	These terms are appropriate and commonplace in the social scientific literature being assessed.
Joseph	Zajac	Whole Chapter	20. Human Social Systems						this entire chapter needs to be deleted	This suggestion is not actionable by the chapter team.
Joseph	Zajac	Whole Page	20. Human Social Systems			80			Bogus premise: Key Topic 5: Climate change impacts are expected to significantly alter the geographic distribution of human population - in the US, politics, job opportunities, and tax polices are the key drivers to people moving within the border. tens of thousands of people a year are moving to Florida. tens of thousands of people are moving out of NY and CA.	We have revised the key message and expanded the explanatory text in the key message and traceable account sections to clarify that we are not asserting that climate change is a principal driver of intra-USA migration.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Cara	Adams	Whole Page	20. Human Social Systems		78				As a Political Science and Sociology double major I've been introduced to the relationship that human social systems have with climate change. While marginalized communities are addressed, it's important to specify that human social systems in relation to climate change is rooted in environmental racism. The actions of individuals who are major players in anthropogenic industrialization perpetuate environmental racism because the plight of minority communities are largely ignored. The participation dimension of the environmental framework does address the need for marginalized communities to be included in decision making processes; however, another dimension of the environmental framework could be education. Most often than not, people in marginalized communities aren't even aware of how their health is at risk. Overall, if an entire marginalized communities were well aware of the presence and effects of environmental racism then there would be more pressure to devise new solutions that would help those people, and also help the environment.	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.
Juanita	Constible	Whole Chapter	20. Human Social Systems						This chapter represents a hugely ambitious, but much needed addition to the NCA. The proposed Key Topics have the potential to help readers better understand the root causes of inequitable exposures to climate hazards and similarly inequitable outcomes. Given the crucal importance of this chapter and the relative unfamiliarity of most decisionmakers with social science and EJ concepts such as reimagining the distribution of power, it will be important to ensure the key messages for the chapter are relatively jargon free. Also, the more guidance in this chapter on how to translate theory into practice the better, particularly when it comes to adaptation.	Thank you for the comment. We are working diligently to reduce the amount of technical jargon in the chapter, and to be sure we are explaining foundational concepts. We are coordinating with the adaptation chapter and with regional chapters discussing implementation of adaptation on how to translate theory to practice. You may also find relevant text in the section on communications and on just transitions.
Juanita	Constible	Whole Page	20. Human Social Systems		77				Insert the section on What's New for this chapter, for consistency with other chapters. Because this is a new chapter for NCAs, this could be a brief discussion as to why the issues in this chapter are important to discuss (and perhaps why they have not been considered in depth in the past).	After consideration, the author team determined that the narrative flows best as written; the chapter has not been restructured in the proposed way.
Juanita	Constible	Whole Chapter	20. Human Social Systems						Chapter should include discussion of best practices to establish a sustained engagement process that is two-way and inclusive of affected communities, especially those most vulnerable to climate impacts	We are not entirely certain if this comment is about sustained engagement in producing and disseminating NCA5, or sustained engagement in terms of adaptation, mitigation, and resilience policies and programs. We do address elements of engagement in the key messages on communication, governance, and just transition, but are not using the terminology of best practices as that depends on the specific context.
Emily	Wasley	Whole Chapter	20. Human Social Systems						When discussing "social systems," it would be helpful to cite research related to the complexity of human behavior and how dependent we truly are on human behavior to change in order to significantly reduce our GHG emissions AND adapt in a transformative manner. The unknowns or uncertainties and knowns around historic and future behavior of how humans will take action on climate change v. how dependent we need to be on technology and the built systems would be important to include in this chapter.	We are coordinating with the adaptation and mitigation chapters to ensure that there is adequate coverage of literature on human behavior and individual/ collective climate action.
Michael	Wright	Whole Chapter	20. Human Social Systems						State of the Sector IIIII Change title to ''What's New,'' to be consistent with other chapters.	After consideration, the author team determined that the narrative flows best as written; the chapter has not been restructured in the proposed way.
Michael	Wright	Whole Chapter	20. Human Social Systems						State of the Sector IIIII Under ''Environmental Justice,'' address intergenerational justice. i.e, future generations will have to cope with and adapt to climate change, with presumably fewer financial and natural resources.	Thank you for your comment. The author team examined several models of environmental justice (EJ) and made the determination that the three forms used in the chapter afford the broadest overarching categorization. We are developing a figure on the elements of EJ and will make sure to address integenerational justice in the figure and/ or text.
Michael	Wright	Whole Chapter	20. Human Social Systems						State of the Sector IIIII Add that, religious leaders, particular those of the Roman Catholic and Eastern Orthodox churches, have advocated for climate action and care for creation. Despite this, the U.S. Catholic Church has been slow and virtually silent when it comes to climate change, per Ref.14. This has implications for not only the churches' response to the climate crisis, even as a pro life issue, but for conservative voters' choices that utlimately impact climate policy.	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.
Michael	Wright	Whole Chapter	20. Human Social Systems						State of the Sector IIIII Address the recent proliferation of climate disinformation and relatively vocal conservative opinions that generate a lack of understanding and concern regarding climate change, its causes and impacts. These opinions, in turn, move conservative voters to elect policymakers who generally oppose climate action and perpetuate disinformation, thus creating a vicious cycle of climate inaction and opposition. Also noted under Agriculture, Sector Interactions.	We do address practices for climate communication in the communications key message. We do not have space for an extensive analysis of the literature on mis- and dis-information.
Michael	Wright	Whole Chapter	20. Human Social Systems						Key Topic 3 IIIII Note the recent history of actions on the part of conservative officials in government, including A. the Supreme Court's rulings, including allowing more ''dark money'' in government and diluting the Voting Rights Act, B. disinformation campaigns and GOP legislators fueling of doubt over election security, C. recent state laws that effect voter suppression and election certification, D. partisan redistricting. Assuming these actions will enable more wins for conservatives at all levels of government. the resulting conservative imbalance will consequently affect climate policy by limiting or even prohibiting action necessary to meet emission reduction goals.	Detailed coverage of these topics is beyond the scope of this report.
Michael	Wright	Whole Chapter	20. Human Social Systems						Key Topic 3 IIIII Note that government policies have been inadequate to deal with climate change with regards to emissions reductions, impact mitigation, and adaptation strategies. The four years under the Trump Admin saw a loosening of emissions regulations, support for the fossil fuel industry that included opening up federal land for extraction, and both dismissal and opposition to climate action. Thus, precious time that the nation could have used to make progress in combatting climate change was spent on retreating from it.	Detailed coverage of these topics is beyond the scope of this report.
Michael	Wright	Whole Chapter	20. Human Social Systems						Key Topic 3 IIIII Note that without robust government policies to address climate change, as is the situation to date, all the data and impact assessments will be insufficient, particularly in this age of ubiquitous disinformation and politicization of science.	Detailed coverage of these topics is beyond the scope of this report.
Michael	Wright	Whole Chapter	20. Human Social Systems						Key Topic 4 IIIII Analysis of pubic opinion about climate change and concomitant behaviour, e.g., reduction in emissions and deforestation, increase in renewables and conservation following highly publicized scientific appeals, e.g., IPCC WG1, COP26, versus opinion and efforts prior to and in the weeks following.	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.
Michael	Wright	Whole Chapter	20. Human Social Systems						Key Topic 5 IIIII Migration induced by sea level rise will result in more development on inland forests, grasslands, and farmland. This significant increase in development on land with natural cover decreases carbon sequestration capacity, while also increasing risk of climate change impacts in these areas. Also noted under Land Cover, Forests, Coastal Effects, Built Environment.	This suggestion is outside the scope of this chapter and is more relevant for the other chapters listed here.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Michael	Wright	Whole Chapter	20. Human Social Systems						Key Topic 5 IIIII Include estimates of offsetting impacts of reduced carbon emissions associated with decreased human population, i.e., reduced socioeconomic development as a consequence of climate change.	Key message 2 discusses human factors as related to carbon emissions. We do not have space to include an exhaustive analysis of the suggested topic.
Michael	Wright	Whole Chapter	20. Human Social Systems						Key Topic 5 IIIII Identify likely social consequences by mid century, if no significant emissions reductions are effected by 2030. This includes recreation, migration, and other social stressors such as food and resource scarcity that may also increase incidents of violence.	We are confining our analysis to existing literature and data, and do not have space to get into this broader literature on possible future societal scenarios.
Michael	Wright	Whole Chapter	20. Human Social Systems						General Comments IIIII This chapter is overly laudatory with regards to the actions taken in the northeast, particularly in Pennsylvania, or PA. Therefore, in addition to citing progress in addressing climate change, also include the lack of progress, which is significant considering the emission reduction targets needed to avoid the worst impacts of climate change.	This chapter does not have the space to include specific examples of progress or lack thereof, which is better suited to regional chapters.
Jhoset	Burgos	Whole Page	20. Human Social Systems		79				Under: Key Topic 3: Governance structures, laws, regulations, and policies can reallocate risk and adaptation through different regions and populations; as well as across temporal and geographic scales. Under: Disaster policies, land management policies, and mitigation policies; whether policy, regulation and law can adapt rapidly as necessitated by climate change; property rights as structuring of risk creation and disaster mitigation; social movements; institutions; development agendas; policy pathways, including the role of discretion; international/global governance and its intersection with local action. Add: zoning and sea level rise Suggested Language: Disaster policies, land management policies, zoning, and mitigation policies; whether policy, regulation and law can adapt rapidly as necessitated by climate change and sea level rise; property rights as structuring of risk creation and disaster mitigation; social movements; institutions; development agendas; policy pathways, including the role of discretion; international/global governance and its intersection with local action	Thank-you for this suggestion, we are taking your suggested language into consideration during the rewriting period.
Jhoset	Burgos	Whole Page	20. Human Social Systems		80				Under: Key Topic 5: Climate change impacts are expected to significantly alter the geographic distribution of human population through migration and non-migration. Empirical examples of individual and collective migration in relation to environmental hazards in the US show how population distribution is affected by social inequalities in representation and participation in knowledge systems, governance, and risk communication and decisionmaking. Under: Human settlement patterns in relation to environmental amenities (coasts, mountains, mild weather) and disamenities (natural and anthropogenic hazards); migration trends (urbanization, aging and life course residential mobility dynamics; residential segregation) and migration drivers (economic change, housing markets) and their intersection with climate change and hazards; voluntary and involuntary mobility and immobility; manifestations of climate-related migration in disaster-related evacuations, resettlement, managed retreat, gentrification, land grabs, home buyouts and local zoning laws; (potential for) climate-change related immigration; hazard mitigation and moral hazards; examples of these types of migration and non-migration from past disaster events to illustrate policy processes and their intervention in the environment,Äìmigration relationship. Add: sea level rise planned and unplanned relocation Suggested Language: Human settlement patterns in relation to environmental amenities (coasts, mountains, mild weather) and disamenities (natural and anthropogenic hazards); migration trends (urbanization, aging and life course residential mobility dynamics; residential segregation) and migration drivers (economic change, housing markets) and their intersection with climate change and hazards; voluntary and involuntary mobility and immobility; manifestations of climate-related migration in disaster-related evacuations, resettlement, managed retreat, gentrification, land grabs, home buyouts and local zoning laws; (potential for) climate-change related immigration; sea level rise driven planned and unplanned relocation of coastal communities; hazard mitigation and moral hazards; examples of these types of migration and non-migration from past disaster events to illustrate policy processes and their intervention in the environment,Äìmigration relationship.	Thank-you for this suggestion. We have significantly rewritten this key message, taking some of these comments into consideration.
Joseph	Zajac	Whole Chapter	21. Northeast						use of politically correct terminology has no place in this report: Key Topic 3: The disproportionate impact on historically marginalized and low- and moderate-income communities has driven new advocacy and policy work to advance equity and environmental justice across the region.	This comment is inconsistent with the author team's thorough assessment of the science.
Daniel	Brown	Whole Chapter	21. Northeast						Please consider collaboration with Midwest Chapter authors to develop materials that span the Great Lakes region. The geographic structure of the NCA artificially segments this culturally and economically coherent region. Materials that describe the region holistically or summarize materials from the Midwest and Northeast chapters will be welcome and useful. The Great Lakes Integrated Sciences and Assessments Center previously provided similar materials for the Third NCA. Example available at: https://glisa.umich.edu/media/files/Great_Lakes_NCA_Synthesis.pdf	Thank you for calling attention to the Great Lakes as a unique region that requires collaboration across chapters. The chapter author teams have held regular meetings with the Midwest and other chapters to ensure coverage of areas with cross-chapter dependencies.
Juanita	Constible	Whole Page	21. Northeast		81				The chapter section that parallels the fourth bullet here should include discussion of rural community climate response needs in the Northeast, a region often seen as strictly urban. The Northeast includes many rural areas; the chapter should discuss regional coordination of response and adaptation to equitable protect both urban and rural communities.	Rural communities are very important. The Northeast chapter authors placed emphasis on the value and importance of the rural portions of the region in NCA4 (https://nca2018.globalchange.gov/chapter/18#key-message-1). For NCA5 the regional chapter is focusing on emergent issues, and significant changes in the region since NCA4.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
DAnn	Williams	Whole Chapter	21. Northeast						From: D,ÃôAnn Williams, Johns Hopkins School of Public Health, Center for a Livable Future To: USGCRP ,Äì NCA5 Chapter Authors Re: USGCRP NCA5 Chapter Outline Comment Disclaimer: The opinions expressed herein are our own and do not necessarily reflect the views of The Johns Hopkins University. February 19, 2022 Dear Chapter Authors, Thank you for the opportunity to comment on the United States Global Change Research Program Strategic Plan (2022-2031) Prospectus and Chapter Outlines. We are researchers at the Johns Hopkins Center for a Livable Future (CLF), an interdisciplinary research center based at the Johns Hopkins Bloomberg School of Public Health. CLF applies science and systems thinking to help build healthy, just, equitable, resilient, and sustainable food systems. We have reviewed the USGCRP strategic plan prospectus (SPP), reviewed the chapter outlines and have attended many of the NCA5 Public Engagement Workshops held by USGCRP and chapter authors. These virtual sessions have been informative, as well as interactive and inclusive. We strongly support the vison and mission of this multi-agency cooperative program to fully ,Áúunderstand the forces shaping the global environment, both human and natural and their impacts on society.,Áù There are four pillars for this work as stated in the USGCRP SPP: 1. advancing science, 2. informing decisions, 3. engaging the nation and 4. collaborating internationally. Under these four pillars are cross-cutting themes, diversity and inclusion, risk-based approaches, enhanced social science integration, communication, and workforce development. To adequately advance science and inform the development and implementation of climate change solutions, we urge you to stress the importance of developing multi-agency research and programs that improve our understanding of the public health implications of climate change and pathways to address agriculture and food systems contribution to climate change while protecting public health and environmental justice. Currently there are numerous gaps in our knowledge around current policies and practices and climate change and even fewer	Thank you for the emphasis on agriculture, food systems, and concerns with animal feed operations. This focus might be best placed in the context of food security, as it is not a topic unique to the Northeast as a region.
Michael	Wright	Whole Chapter	21. Northeast						What's New IIIII Mention that while many states have joined the Regional Greenhouse Gas Initiative, or RGGI, PA's conservative legislature is challenging participation. PA continues to subsidize fossil fuel extraction and distribution, while disincentivizing renewables like solar. In fact, there has been no significant renewable energy incentives in PA since the Sunshine grant program over a decade ago. Further, PA is the only major oiland gas producing state without a severance tax, and its percentage of utility demand from solar of 0.5% is one of the lowest in the nation.	The unique position of Pennsylvania relative to other states in the Northeast region is addressed in KM4 in the chapter.
Michael	Wright	Whole Chapter	21. Northeast						What's New IIIII Significant fugitive emissions of methane have recently been detected from thousands of ophaned coal mines and gas wells in the northeast, per Ref.4.	Thank you for your comment. Methane emissions are important, but addressing the specifics of this issue explicitly is outside of the scope of our chapter due to space constraints. Methane emissions records might be a better fit for the Energy or mitigation chapters.
Michael	Wright	Whole Chapter	21. Northeast						Key Topic 1 IIIII Under ''Northeast's responses,'' include that significant action and responses have not be undertaken by most jurisdictions in the northeast. For example, in the 14 years since PA enacting their Climate Change Act, there has been no comprehensive and independent data on methane that shows emissions have actually decreased, e.g., upstream, fugitive, yet extraction from fracking and construction of new pipelines, such as the Mariner 2, have continued unabated.	Thank you for your comment. We looked more closely at the compilation of regional responses to extreme events to consider how we can include “no action” . Response can include adaptation as well as reduction in GHG emissions or other mitigation efforts. Lack of these actions, especially as planned, is significant and should be part of the story.
Michael	Wright	Whole Chapter	21. Northeast						Key Topic 1 IIIII Under ''Transition from coal,'' clarify references to WV and PA, whose economies and policies are still wedded to coal. In the case of PA, there has been a greater emphasis on natural gas, including lax industry regulations have contributed to even more GHG emissions. This is particularly due to high upstream emissions from hydraulic fracturing, and fugitive emissions from wells and extraction, drilling, and distribution infrastructure.	Thank you for your comment. We looked more closely at the compilation of regional responses to extreme events to consider how we can include both reduction and increases in GHG emissions. Response can include adaptation as well as reduction in GHG emissions or other mitigation efforts. Lack of these actions or the opposite of these actions is significant and should be part of the story.
Michael	Wright	Whole Chapter	21. Northeast						Key Topic 4 IIIII Note that not all northeast states offer tax or other incentives for renewable energy, particularly residential systems. For example, PA offers no state tax credits and deductions, grants, or low interest loans for homeowners who install solar power systems.	Duly noted; the authors thank the commenter for raising this issue. While explicit mention of this fact is beyond the scope of KM4, the relative level of climate action in PA vs states in the region is made clear.
Michael	Wright	Whole Chapter	21. Northeast						Key Topic 4 IIIII Note that not all northeast states impose severance taxes on fossil fuel extraction, PA being the prime example.	Duly noted; the authors thank the commenter for raising this issue. While explicit mention of this fact is beyond the scope of KM4, the relative level of climate action in PA vs states in the region is made clear.
Michael	Wright	Whole Chapter	21. Northeast						Key Topic 4 IIIII Note that there is no financial incentive for the fossil fuel industry to plug abandoned wells; although they are required to plug, penalties are insufficient compared to the cost of plugging. Thus, billions in federal infrastructure funding is being allocated to plug approx. 2 million abandoned oil and gas wells leaking methane and contaminating water, per Ref.6. Also noted under Energy, Economics.	The authors appreciate the commenter for raising this point, but addressing this issue explicitly is outside the scope of Key Topic 4 given space constraints.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Sarah	Reiter	Whole Chapter	21. Northeast						Dear Lead Author Whitehead, On behalf of the New England Aquarium (NEAq), I am writing to provide comment on the Annotated Outlines of the Fifth National Climate Assessment, in particular, Chapter 21: Northeast Region. This Chapter is directly relevant to NEAq,Äôs mission to protect the blue planet by holding the growing blue economy accountable for ocean protection and sustainable practices. We are deeply concerned about the climate crisis. As an ocean conservation organization, waterfront steward, and scientific research institute, we respectfully request the authors consider NEAq,Äôs science-based input. Chapter 21: Northeast Region: NEAq supports a focus on ocean acidification, climate-ready fisheries, and marine protected areas. ‚Äâ¢Key Topic 2: Understanding of current and future impacts to oceans, coastal habitats, and living marine resources have advanced and are driving climate adaptation. We encourage the authors to prioritize reference to region-specific scientific information regarding ocean acidification, climate-ready fisheries, and marine protected areas within this key topic. New England, in particular, has 16 overfished stocks (more than twice that of any other region in the country), and the Gulf of Maine has warmed faster than 99% of the world,Äôs oceans. Meanwhile, our waters are becoming more acidic. Ocean acidification threatens the vital role of the ocean in our communities, economies, and well-being. NEAq served on the Massachusetts Ocean Acidification (OA) Commission from 2020-2021, resulting in report findings that OA poses a serious threat to the state economy and a potentially existential threat to the coastal economies that rely on shellfishing (https://www.mass.gov/files/documents/2021/12/15/massachusetts-ocean-acidification-report-feb-2021.pdf). The dire outlook for fisheries in New England calls for protecting marine environments from human activities to enhance resilience. Though most of the existing highly or fully protected areas are in the Central and Western Pacific, NEAq scientists were instrumental in providing scientific evidence that helped designate the Northeast Canyons and Seamounts Marine National Monument (Monument) in 2016, and later, restore the Monument,Äôs protection from harmful human activities in 2021 (https://doi.org/10.3389/fmars.2020.00566). A nearly 5,000 square mile underwater sanctuary that lies	The authors thank the commenter for highlighting issues of equity, environmental justice, and access in the region. Our drafts incorporate new information about assessments of climate injustice dynamics, including the associations between green resilient infrastructure, gentrification, and minority populations (e.g., Shokry et al., 2020, Urban Climate, 31, 100539)
Whitney	Berry	Whole Chapter	21. Northeast	1	82	1	83	1	Key Topic 2: Perhaps include a section on advances in data collection, management, and sharing technology which led to the progress in understanding climate impacts. There could also be a section on data challenges which are leading to slowed progress.	The authors appreciate the commenter for raising this point, but addressing this issue explicitly is outside the scope of Key Topic 3 given space constraints.
Whitney	Berry	Whole Chapter	21. Northeast	1	82	1	83	1	Key Topic 2: I am not seeing anything on the impacts to small island communities as climate advances. What happens to those island communities who have always depended on fishing if species are not there anymore. How are we building the need for new job training into need for communities to adapt over time? \nHow do we build impacts to communities into mgmt decisions?	The authors appreciate the commenter for raising this point. We plan to incorporate information about how fishing communities with less social resources may be more vulnerable to cliamte-related changes in fishing patterns than others (NOAA 2022). Additionally, eastern coastal Tribal Nations propose on example of an adaptation framework that incorporates community impacts into management decisions (Leonard, 2021, WAMPUM Adaptation framework: eastern coastal Tribal Nations and sea level rise impacts on water security, Climate and Development, 13:9, 842-851, DOI: 10.1080/17565529.2020.1862739).
Whitney	Berry	Whole Chapter	21. Northeast	1	82	1	83	1	Key Topic 3: There should be a bullet on steps being taken to mitigate and better understand inequities in these communities like targeted stakeholder engagement	The authors thank the commenter for highlighting the importance of methods like targeted stakeholder engagement to address climate inequities. We plan to incorporate new research about challenges and opportunities of community-scientist collaborations (e.g., Cordner A, Poudrier G, DiValli J, Brown P. Combining Social Science and Environmental Health Research for Community Engagement. International Journal of Environmental Research and Public Health. 2019; 16(18):3483. https://doi.org/10.3390/ijerph16183483)
Whitney	Berry	Whole Chapter	21. Northeast	1	83	1	83	1	Key Topic 4; Bullet 2: nclude Regional Ocean Partnerships as an avenue for diverse stakeholders, Tribes, and agencies to collaborate on climate issues.\n\nAlso include changes to the National Ocean Policy since NCA5	Thank you for your comment. This is beyond the scope of this particular KM. However, the comment was relayed to the Oceans chapter for their consideration
Whitney	Berry	Whole Chapter	21. Northeast	1	83	1	83	1	Key Topic 4; Bullet 4: Turning to Regional Ocean Partnerships can be framed as a solution here.	Thank you for your comment. This is beyond the scope of this particular KM. However, the comment was relayed to the Oceans chapter for their consideration
Whitney	Berry	Whole Chapter	21. Northeast	1	83	1	83	1	Key Topic 5: There should be a bullet on challenges accessing allocated funds from Congress through yearly appropriations and legislation	Thank you for your comment. The NCA is a scientific assessment and does not report on policy considerations in federal funding, or on appropriations.
Joseph	Zajac	Whole Chapter	22. Southeast						use of politically correct terminology has no place in this report: Cross-cutting themes for the Southeast chapter Does the history of the Southeast manifest in the present as disproportional climate impacts on limited resource communities? (racist!)	This comment does not substantively relate to the scientific content of our chapter.
Joseph	Zajac	Whole Chapter	22. Southeast						further proof that climate change is not a top priority. The Southeast region is home to 10 of the 15 fastest-growing large cities in the country.	Our chapter centers human/climate interactions in the Southeast, including how urban land use can exacerbate climate stressors.
Joseph	Zajac	Whole Chapter	22. Southeast						why does government continue to allow flood insurance for homes built in flood zones? Don't build anything in flood zones.	What governments choose to do is beyond the scope of our chapter; however ,we do talk substantively about flood-prone area topics relevant to hazard mitigation strategies such as buyouts and managed retreat.
Joseph	Zajac	Whole Page	22. Southeast		87				stupid comment. - How do flooding events that disrupt transportation corridors shut off access to critical community resources like schooling and community centers? FLOODING EVENT says it all.	Flooding events can happen along waterways when they exceed the capacity of the banks, but floods can also happen in low-lying areas in communities due to an intense precipitation event that the ground simply cannot absorb adequately. Transportation infrastructure is vast and drainage systems associated with roads, highways, rail and other transportation pathways is not necessarily designed to handle short-duration, intense precipitation events that we are seeing today or understand may worsen into the future. When roadways become flooded either from out-of-bank flooding or localized accumulation of rainwater due to a storm event, roadways that have as much as 2 inches of standing water are unsafe to cross and therefore, areas of the community may become cut off. Transportation pinchpoints in the Southeast such as ports, locks & dams, and major highways where cascading, multistate impacts can occur with unplanned disruptions in service are therefore important to explore.
Joseph	Zajac	Whole Page	22. Southeast		88				racist comment. - How are Black farmers---who are located predominantly in the Southeast and are less likely to have the resources to mitigate and adapt to the impacts of climate change---addressing climate resilience?	This comment does not substantively relate to the scientific content of our chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Richard	McNider	Whole Chapter	22. Southeast						22. Southeast You would be well served by reading this excellent summary for Alabama. https://www.nsstc.uah.edu/aosc/	We thank the reader for the comment and suggested resource. Upon review of the recent literature for the Southeast Chapter, we weighed the conclusions presented in this comment's resource and they stand in direct opposition to the vast majority of the literature on the Southeast and the general findings of the IPCC.
Chris	Manganiello	Whole Chapter	22. Southeast						Hello. I provided these comments during one of the live workshops. Page 85. ‚ÁúDoes the history of the Southeast‚Ä¶Ä¶ and ‚ÁúHow do Southern Identities and‚Ä¶Ä¶ Please be mindful that climate and nature do not determine history. Human decisions, actions or inactions are what make history. Climate and nature certainly influence human decisions and behavior, but it‚Äôs important to beware of making climate deterministic or to causal. There is a long and dangerous history of climate determinism in southern history. Page 88. ‚ÁúHow has climate change and other changes‚Ä¶Ä¶ Harmful algal blooms are an emerging concern in our region. Chattahoochee Riverkeeper, the National Park Service, the University of Georgia and the Auburn University are monitoring HABs in the Chattahoochee River and its reservoirs. You can find more information here https://chattahoochee.org/our-work/habs/ Thank you.	Thank you for your comment. The question on the influence of southern history and identity on climate vulnerability was meant to indicate exactly your point, that human and policy decisions made thorughout history have impacts on climate vulnerability today. Thank you for your comment; we will clarify this topic area. We will explore your suggested resource on harmful algal blooms.
Elizabeth	Rowe	Whole Chapter	22. Southeast						February 20, 2022 Re: Comments on Zero Order Draft, Chapter 22: Southeast Dear Jeremy Hoffman ‚Äì On behalf of the Joint Implementation Task Force of the Climate Resilience Plan for Agnes Scott College and the City of Decatur, we are pleased to submit the following comments focused on the Zero Order Draft for Chapter 22: Southeast. In February 2021 Agnes Scott College and the City of Decatur, Georgia completed a joint Climate Resilience Plan (CRP). The purpose of the CRP was to identify together the most pressing impacts of climate change anticipated in this region and outline the strategies for addressing these impacts, both in terms of preparation and response. The CRP is meant to give the college and the city the ability to work together, move beyond limited funding and incentives for climate response in Georgia, create new solutions, and jointly find funding support when needed. The implementation of the CRP is managed by a Joint Implementation Task Force from Agnes Scott College and the City of Decatur fire and emergency services, public works, city planning, and residents serving on the city‚Äôs Environmental Sustainability Board. Below is a link to the CRP which outlines specific strategies for energy, water, and public safety, while also addressing concerns about communications, equity, and community involvement. As stated in the Southeast outline, communities across the Southeast are planning for 20th century climate-related risks. The primary goal of our joint CRP is to build community partnership to ensure coordinated response to future climate scenarios. Within our first year of implementation, we have facilitated a joint meeting with every emergency management official for the City of Decatur, Agnes Scott College, City Schools of Decatur, and Dekalb County Emergency Management, to begin to coordinate our response to the most pressing climate scenarios for this region. Through this partnership, our community of staff, students, and residents who will be impacted by climate change locally in the months and years to come are now more organized to face these challenges. We believe our joint CRP provides a pertinent case study on the power of partnership in addressing the	Thank you for your comment and sharing the climate action planning that is happening in your community. We will explore this further and consider including in future drafts.
Juanita	Constible	Whole Chapter	22. Southeast						The ambitious proposal for this chapter represents a significant advance from NCA4. Particularly notable elements including weaving equity and southern culture and history throughout, as well as the specific discussions about horizontal-vertical integration, the role of work in climate exposures and vulnerabilities, the costs and ROI of adaptation, and compound events such as hurricanes plus heat waves.	Thank you for your thoughtful comment and your acknowledgement of the efforts that the team is making to consider exposures and vulnerabilities, culture and history, and compound events.
Juanita	Constible	Whole Page	22. Southeast		87				Key Topic 3: Consider referring in this section to this January 2022 GAO report: School Districts in Socially Vulnerable Communities Faced Heightened Challenges after Recent Natural Disasters	Thank you for sharing this resource. We will consider the findings of the report and how best to incorporate them into our considerations of the impacts of climate change. This is absolutely in line with the topic about livelihoods because education is a key contributing factor in livelihoods and local economies. This report shows that many of the schools impacted recently by significant natural diasters are in the Southeast. The report also highlights that disasters (such as those that we anticipate with future climate change) not only the impacts school infrastructure but also emotional trauma such as food insecurity, parental job insecurity, lost connections with communities, and others.
Juanita	Constible	Whole Page	22. Southeast		88				Key Topic 5, 3rd bullet: The reference to genetically modified organisms seems oddly specific. Will it be embedded in a broader discussion of other adaptation solutions?	Thank you for your comment. The mention of genetically modified organisms is seen as one mechanism that may help adapt in agricultural systems to the impacts of climate change. We will consider how best to address this in the future iterations of the topic.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
DAnn	Williams	Whole Chapter	22. Southeast						From: D,ÃõAnn Williams, Johns Hopkins School of Public Health, Center for a Livable Future To: USGCRP ,Äì NCA5 Chapter Authors Re: USGCRP NCA5 Chapter Outline Comment Disclaimer: The opinions expressed herein are our own and do not necessarily reflect the views of The Johns Hopkins University. February 19, 2022 Dear Chapter Authors, Thank you for the opportunity to comment on the United States Global Change Research Program Strategic Plan (2022-2031) Prospectus and Chapter Outlines. We are researchers at the Johns Hopkins Center for a Livable Future (CLF), an interdisciplinary research center based at the Johns Hopkins Bloomberg School of Public Health. CLF applies science and systems thinking to help build healthy, just, equitable, resilient, and sustainable food systems. We have reviewed the USGCRP strategic plan prospectus (SPP), reviewed the chapter outlines and have attended many of the NCA5 Public Engagement Workshops held by USGCRP and chapter authors. These virtual sessions have been informative, as well as interactive and inclusive. We strongly support the vison and mission of this multi-agency cooperative program to fully ,Äúunderstand the forces shaping the global environment, both human and natural and their impacts on society.,Äù There are four pillars for this work as stated in the USGCRP SPP: 1. advancing science, 2. informing decisions, 3. engaging the nation and 4. collaborating internationally. Under these four pillars are cross-cutting themes, diversity and inclusion, risk-based approaches, enhanced social science integration, communication, and workforce development. To adequately advance science and inform the development and implementation of climate change solutions, we urge you to stress the importance of developing multi-agency research and programs that improve our understanding of the public health implications of climate change and pathways to address agriculture and food systems contribution to climate change while protecting public health and environmental justice. Currently there are numerous gaps in our knowledge around current policies and practices and climate change and even fewer	Thank you for presenting these substantitive points. We will consider adding these suggestions to the adaptation section of Key Message 22.4 on agriculture in the next draft of the chapter.
Whitney	Berry	Whole Chapter	22. Southeast	1	86	1	89	1	In Key Topic 2 there should be consideration of the impacts of more hot days on agricultural workers/laborers/fruit pickers who are often migrant laborers or who are from marginalized communities. This comment actually applies to all of the Key Topics - somewhere in here there should be specific mention of hot day impacts on migrant laborers and itinerant farmworkers especially from marginalized communities.	Thank you, this is an excellent point. We now include labor-related disproportionate exposures to heat and its impact on health and the regional economies of the Southeast.
Joseph	Zajac	Whole Chapter	23. U.S. Caribbean						the residents of the Caribbean look to be helpless and incompetent.	As residents of the Caribbean, the authors would like to point out that this comment is inappropriate, biased and discriminating, reflecting a lack of engagement of the reviewer with the ZOD. The chapter will provide a sense of agency, as has been shown by the communities.
Joseph	Zajac	Whole Chapter	23. U.S. Caribbean						where do you cover the political, social, and economic incompetence of the Caribbean governments such as Haiti?	We thank the reviewer for this comment. There is significant political, social and economic diversity in the Caribbean, and many of the governments of the Archipelago face multiple hardships due to complicated political, social and economic challenges stemming from inherited colonial processes that have strangled sovereign development, Haiti being one of these. Even though these situations are important to understand the risks, hazards and vulnerabilities of the Caribbean in general, we remind the reviewer that this Chapter 23 of the NCA5 is constrained to consider the conditions of the colonial territories of the US in the Caribbean: Puerto Rico and the USVI. We will therefore not have the space nor do we have the assignment to consider the political, social and economic histories and realities of our sister islands.
Melissa	Muroff	Whole Page	23. U.S. Caribbean			93			The USVI League of Women Voters (USVI LWV) requests that this Assessment (a) consider a review of the historic drivers for, and the long term risks associated with, the disparate adoption of distributed renewable energy among vulnerable communities and (b) characterize trends and opportunities for implementing widespread, equitable distribution of renewable energy access among all populations in the USVI and Puerto Rico. The USVI LWV also requests that the Assessment address obstacles to community solar initiatives. In particular, the League requests that the Assessment consider the availability of information and education on the logistics, availability and cost of residential, small-scale and community solar installations in the USVI and Puerto Rico. Further, the League suggests an analysis of the impact and influence of regulatory and market trends (including carbon pricing trends) on the development of community solar projects and other collective solar projects other than utility scale projects.	We will discuss how the governance of the energy sector and its dependence on fossil fuel can affect climate trajectories. We will also address in the discussion on adaptation pathways for decarbonization, and in the process also address equity issues related to the decarbonization strategies. We will not address in depth the policy or economic impact of a carbon based economy. Some of the information the commenter requested is outside the scope of the assignment to authors.
Melissa	Muroff	Whole Page	23. U.S. Caribbean			93			The USVI League of Women Voters (USVI LWV) requests that this Assessment consider the status and completeness of data on the environmental, social and health impacts on vulnerable communities (especially fenceline communities) caused by pollution and climate change. In our experience, baseline health impact and pollution (typically, air pollution) data associated with these communities are severely deficient. Such an analysis could address the short and long term risks to fenceline communities of cascading impacts of climate change on industrial petrochemical plants clusters, e.g., Limetree Bay refinery in St. Croix, USVI.	We thank the USVI LWV for this comment. We are taking this suggestion into account as we had already plannned to tackle these subjects moving forward.
Melissa	Muroff	Whole Page	23. U.S. Caribbean			91			The USVI League of Women Voters (USVI LWV) requests that this Assessment characterize how the short and long term climate change trends might disparately impact drinking water quality in communities sourcing drinking water primarily from rooftop rainwater collection. Please identify the unique adaptation needs, if any, for these communities.	We thank the USVI LWV for this comment. We agree that there is traditional knowledge and future hazards regarding rainwater harvesting from rooftops. We appreciate the reviewers sharing their personal experience in this topic and will consider this recomendation moving forward. We recognize the importance of cisterns as a critical source of water for USVI residents. We have adapted the text to acknowledge the challenges that these communities could face given predicted decreases in precipitation. Due to the breath of the topic and the page limit for the chapter, we focused on broad explanations rather than specific examples. We also included new references that addresses current challenges of the use of water from cisterns by USVI residents and vulnerabilities to climate extremes.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Melissa	Muroff	Whole Page	23. U.S. Caribbean		93				The USVI waste management policy currently is not informed by zero waste principles, including waste reduction, reuse and repair, composting, recycling, or product packaging restrictions. Littering is pervasive. In the context of planning and adaptation, the USVI League of Women Voters (USVI LWV) requests that this Assessment characterize the short and long term implications of current and anticipated waste management practices in the Caribbean both on climate adaptation efforts and on local habitats and existing resources. How might the confluence on climate adaptation pressures and current waste management practices influence the ecological balance and human health, well-being, and quality of life? Also in the context of planning an adaptation, the USVI LWV requests that this Assessment explore trends and opportunities for coalitions of Caribbean nations and territories to share resources and collaboratively develop climate change adaptation strategies. Perhaps case studies of successful collaborations could be profiled.	We thank the USVI LWV for this comment. We agree that there are pervasive challenges regarding waste management under changing climate paramenters and with variable adaptation or mitigation strategies. We are already tackling this topic and will keep this comment in mind moving forward. We are treating solid waste as a critical infrastructure system that can be impacted by climate change. We will address the fact that there will be an increase in discarded material if climate hazards intensify. We will address the need for more sustainable management of materials (including green debris) to offset impact of increase of waste on landfills. We will also discuss the fact that landfills have an environmental impacts: PR has methane capture on 2/27 landfills, USVI 0/2.
Jhoset	Burgos	Whole Chapter	23. U.S. Caribbean						Comment: The chapter is missing economic considerations of climate change and projected and potential multimeter sea level rise plus short-term flooding events and coastal erosion. We suggest adding an additional Key Topic for livelihoods and economy. Suggested Language: Livelihoods and economy ‚Äc Direct and indirect climate and sea level rise impacts on economic systems and livelihood, including prevalent economic activities, (e.g., tourism, fisheries, agriculture, insurance, banking, industry, etc.) ‚Äc Impacts on communities, sense of place, labor inputs/outputs, migration, remittances, etc. ‚Äc Policies to promote economic resilience, environmental justice, regenerative economies ‚Äc Economy-wide and sectoral decarbonization and carbon sequestration ‚Äc Economic opportunities to face climate and sea level rise adaptation (e.g. relocation of coastal infrastructure, developing innovative solutions, reinvention of property markets and concepts)	These are important and interesting suggestions. Most of these issues are cross-cutting and are integrated in various key messages to a certain degree. Instead of adding a new key message, our team is discussing most of these issues in 5 key messages. Our team will continue working to improve the Chapter considering comments and suggestions.
Jhoset	Burgos	Whole Page	23. U.S. Caribbean		91				Under: Key Topic 1: Human health, quality of life, and well-being; Under: Social determinants of health (livelihood security: economic stability, healthcare access and quality, cultural continuity and traditions, education access and quality, access to culturally relevant, nutritious foods [food insecurity] and physical activity opportunities, mental health and habitat security, neighborhoods and the built environment) Add: utility services Suggested Language: Social determinants of health (livelihood security: economic stability, healthcare access and quality, cultural continuity and traditions, education access and quality, utility services, access to culturally relevant, nutritious foods [food insecurity] and physical activity opportunities, mental health and habitat security, neighborhoods and the built environment)	We thank the reviewer for this comment. We will consider this suggestion moving forward.
Jhoset	Burgos	Whole Page	23. U.S. Caribbean		91				Under: Key Topic 1: Human health, quality of life, and well-being; Under: Water is essential for life. Climate change scenarios are stimulating the growing concern for water scarcity and water insecurity; Add: sea level rise Suggested Language: Water is essential for life. Climate change and sea level rise scenarios are stimulating the growing concern for water scarcity and water insecurity.	We thank the reviewer for this comment. We will consider this suggestion moving forward.
Jhoset	Burgos	Whole Page	23. U.S. Caribbean		91				Under: Key Topic 2: Water and food insecurity; Under: Food and water nexus: discuss how food systems and water resource availability affect each other, including the roles of aged infrastructure, leaking water distribution, decreased reservoir capacity, aquifers, ponds, intermittent power; Comment: Please consider the effects of sea level rise on the food and water nexus.	We address this comment within the text. Additionally, two figures highlight the effects of sea-level rise on the water and food nexus.
Jhoset	Burgos	Whole Page	23. U.S. Caribbean		92				Under: Key Topic 2: Water and food insecurity; Under: Description of potential figures Adds a figure. Suggested Figure description: Location of coastal aquifers and water infrastructure in Puerto Rico and the USVI.	The author team discussed this suggestion and had to make hard decisions based on limited space. We included the most relevant illustrations in our figures but we have not revised the figure to show all coastal aquifers and water infrastructure. However, we include a "ridge to reef" illustration that portrays aquifers as part of the water-food system nexus and depicts the connection between aquifer recharge, groundwater pumping and sea-level rise under different climate extreme scenarios. In the text, we also provide additional information on specific aquifers in peril and describe water infrastructure (irrigation, groundwater pumping, reservoir systems and distribution) challenges to sustain current and projected threats.
Jhoset	Burgos	Whole Page	23. U.S. Caribbean		92				Under: Key Topic 3: Ecology and biodiversity; Under: Climate change,Äiinduced impacts on terrestrial, coastal, and marine ecosystem function and health (diseases, pests, native and invasive species demographics and distribution); Add: Sea Level Rise Suggested Language: Climate change as well as projected and potential multimeter sea level rise plus short-term flooding events and coastal erosion ‚Äì induced impacts on terrestrial, coastal, and marine ecosystem function and health (	The observed and projected climate-related trends, including sea level rise, will be included and will be based on the findings of the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (Fox-Kemper et al., 2021), Fourth National Climate Assessment (Gould et al., 2018), NOAA 2021 report, and Puerto Rico's State of the Climate (Puerto Rico Climate Change Council, In Press) report, among other sources.
Jhoset	Burgos	Whole Page	23. U.S. Caribbean		92				Under: Key Topic 3: Ecology and biodiversity; Under: Cascading effects across ecosystems and compounded impacts from multiple events.; Comment: cascading effect should take into consideration projected and potential multimeter sea level rise plus short-term flooding events and coastal erosion.	The authors will review and synthesize existing literature on the status and trends of the coastal and terrestrial ecosystems and biodiversity considering the effects of climate change indicators such as the sea-level rise and short-term effects such as storm surges, flooding, and coastal erosion. The assessment will consider the observed ecosystem- and biodiversity-level changes in response to climate change due to direct impacts from climate stressors and the lack of effective planning and adaptation strategies, policies, and/or measures.
Jhoset	Burgos	Whole Page	23. U.S. Caribbean		92				Under: Key Topic 3: Ecology and biodiversity; Under: Description of potential figures Under: 3) Graphic that shows the cascading effects and compounded impacts from multiple events; Comment: Figure three should include sea level rise as part of the cascading effects and compounded impacts.	Sea level rise will be one of the global pressures that will be considered to highlight the potential effects, impacts, and consequences of climate change on Puerto Rico and US Virgin Islands ecosystems and biodiversity.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Jhoset	Burgos	Whole Page	23. U.S. Caribbean		93				Under: Key Topic 4: Infrastructure and energy; Comment: The infrastructure section should expand from the energy sector. Coastal infrastructure and communities in PR and the USVI are threatened by climate changed and projected and potential multimeter sea level rise plus short-term flooding events and coastal erosion Considerations of the built environment must be added to this section. Suggested Additional Language: Built Environment ‚Äc Impacts of climate and sea level rise stressors on built infrastructure: private (e.g., homes and businesses) and public sector (e.g., energy, water, communication, transportation, defense, healthcare, etc.). ‚Äc Impacts can be physical or otherwise (e.g., effects on emergency management resources, regulatory burdens, insurance/reinsurance, property value, bond ratings, etc.) ‚Äc Managed retreat, climate readiness, and related policy mechanisms (e.g., coastal setbacks) ‚Äc Building codes and similar mechanisms designed for climate and sea level rise mitigation and adaptation. ‚Äc Urban ecology, innovation, zoning, and nature-based solutions to protect infrastructure.	The preliminary assessment established and confirmed the observed ecosystem- and biodiversity-level changes in response to climate change due to direct impacts from climate stressors and the lack of effective planning and adaptation strategies, policies, and/or measures.
Jhoset	Burgos	Whole Page	23. U.S. Caribbean		93				Under: Key Topic 4: Infrastructure and energy Under: How systems, as currently operated, can fail because of impacts of climate change and reinforce inequities; or impact of failure of infrastructure systems, as operated now, caused by climate change,Äiinduced hazards, on vulnerable communities. Add: Sea Level Rise Suggested Language: How systems, as currently operated, can fail because of impacts of climate change, sea level rise, and reinforce inequities; or impact of failure of infrastructure systems, as operated now, caused by climate change,Äiinduced hazards, on vulnerable communities.	We can make the change
Jhoset	Burgos	Whole Page	23. U.S. Caribbean		93				Under: Key Topic 4: Infrastructure and energy Under: Description of potential figures; Under: 4) Amount of infrastructure at risk of sea level rise or other flooding; Comment: When developing the figure, short term (30 year), mid term (50 years), and long term (100) projected and potential of sea level rise should be included.	We can accommodate this ask.
Jhoset	Burgos	Whole Page	23. U.S. Caribbean		93				Under: Key Topic 5: Planning and adaptation; Under: Status/progress of development and implementation of climate adaptation policies and plans in the region (since the Fourth National Climate Assessment); governance of adaptation: the role of governance arrangements and decision-making processes in the public sector in adaptation planning and risk reduction. Add: sea level rise Suggested language: Status/progress of development and implementation of climate and sea level rise adaptation policies and plans in the region (since the Fourth National Climate Assessment); governance of adaptation: the role of governance arrangements and decision-making processes in the public sector in adaptation planning and risk reduction	Sea level rise is addressed in the First Order Draft. The text includes data on housing units impacted in Puerto Rico, but there is no known source for similar data for the U.S. Virgin Islands. The writing team will verify whether the NOAA 2021 report on sea level rise for Puerto Rico includes data or projections for the U.S. Virgin Islands. The team will also check if the projections used by CariCOOS to produce the storm surge maps for the U.S. Virgin Islands include data for sea level rise.
Jhoset	Burgos	Whole Page	23. U.S. Caribbean		93				Under: Key Topic 5: Planning and adaptation; Under: The possibility of climate-induced out-migration and in-migration and the implications for adaptation planning; Comment: This should also consider the in-migration of PR diaspora from sea level rise vulnerable locations (e.g. special vulnerabilities on certain parts of Florida).	The issue of in/out migration is included in the First Order Draft. However, the implications of the specific source of in-migration mentioned in the comment cannot be addressed in this report, particularly if it has to be differentiated from other sources and causative factors.
Jhoset	Burgos	Whole Page	23. U.S. Caribbean		93				Under: Key Topic 5: Planning and adaptation; Under: Existing and emerging opportunities in planning and adaptation; development planning, public policy development including financial risk management, sectoral and integrated approaches (e.g., ICZM, IWRM) land management, ecosystem-based solutions, and social norms: as determinants (or drivers) of environmental, social, and economic sustainability; Add: Zoning Suggested Language: Existing and emerging opportunities in planning and adaptation; development planning, public policy development including financial risk management, sectoral and integrated approaches (e.g., ICZM, IWRM) land management and zoning, ecosystem-based solutions, and social norms: as determinants (or drivers) of environmental, social, and economic sustainability	The authors agree that zoning is an important component of planning and adaptation programs. The relevance of zoning will be captured in statements on sustainable land management practices. If such statements in the First Order Draft are deemed to be insufficient, additional text will be added.
Jhoset	Burgos	Whole Page	23. U.S. Caribbean		93				Under: Key Topic 5: Planning and adaptation; Under: Existing policies and laws that support immediate climate change adaptation programming; Comment: As a subsection this should include the need for immediate changes in zoning and building codes to reduce/avoid/mitigate the effects of climate change and sea level rise on infrastructure and communities.	The comment is relevant, but prescriptive. The issue will be included in the text on sustainable land management.
Jhoset	Burgos	Whole Page	23. U.S. Caribbean		94				Under: Key Topic 5: Planning and adaptation; Under: Training, education (and embedding) in practice a new cadre of professionals focused on network building, climate risk analysis, and resilience in island environments; Comment: We suggest including as a subsection recent/new initiative for planning and adaptation including the University of Puerto Rico Resiliency Law Center and the Caribbean Center for Rising Seas under the Puerto Rico Science, Technology & Research Trust.	The suggested information can be included in the introductory text for the chapter on what is new since NCA4.
Whitney	Berry	Whole Chapter	23. U.S. Caribbean	1	92	1	94	1	in the Description of Potential Figures under Key Topic 3 there is mention of Mangrove, Riparian, and Aquifer assets - should mention coral assets too and coral should be specifically identified as a major asset for Puerto Rico and USVI.	The authors acknowledge the value of coral reefs. They serve as the islands' first line of defense against storms and waves. The chapter will communicate why coral reefs, as well as other coastal and terrestrial ecosystems, are valuable for risk reduction and why are in need of protection and management.
Joseph	Zajac	Whole Page	24. Midwest		96				what is this garbage? Key Topic 3: Health and community well-being	This comment does not appear to raise a question or suggest a revision. Health and community well-being are directly tied to climate change as evident in our chapter and NCA.
Joseph	Zajac	Whole Page	24. Midwest		96				are you going to discuss the stress created by the news media and meteorologists?	Thank you for your comment, but we will not address your concern. It is not relevant to the discussion of climate change in our chapter.
Joseph	Zajac	Whole Page	24. Midwest		97				FALSE premise- Increased climate-related deaths, climate related deaths are DOWN per capita.	Thank you for the comment. Please refer to references in the Health section of the chapter that provide evidence of a rise in climate-related deaths.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						Page 95 to 98 1. Perhaps a discussion of climate migration. May the midwest, especially upper midwest be a receiver of climate migrants? Implications to housing, prices, community cohesion, etc.; there are internal regional differences depending on what is meant by midwest. Upper midwest is different from lower midwest 2. Water pollution is - algal blooms - are caused by other forms of pollution and exacerbated by a warming climate and precipitation bursts 3. Upper midwest has forests!	Thank you for your comments. 1) We discuss climate migration as it relates to managed retreat. This report assesses existing and available information sources. Overall, there is not sufficient research at this time to address climate induced migration into the Midwest Region and we draw the commenter's attention to the Traceable Accounts in our Chapter. 2) The algal bloom topic has been given extensive consideration in our Chapter under KM 24.5 Water. 3) Forests in the Midwest were thoroughly addressed in previous assessments (NCA4). Though we do not cover forests as extensively in this assessment, they are addressed in our KM 24.2 Natural Resources.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						Green Bay ice fishing could be an interesting inclusion here. Ice rescues from drifting ice might be something that could show a signal, such as timing and numbers through time? Trends of larger ice on and earlier ice off.	Thank you for the topic. We address nature-based recreation, including fishing and ice safety. We address changes in ice cover for the Great Lakes as well.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						The northern Wisconsin shift from walleye lakes to largemouth bass lakes has been an ongoing topic of research. It is also relevant culturally to the historical fishers of the region, from indigenous spearfishing to modern sportfishing. https://labs.waterdata.usgs.gov/visualizations/climate-change-walleye-bass/index.html	Thank you for the comment. Because changes in fish communities were addressed in depth in NCA4, we will summarize new understanding and focus on tribal engagement and adaptation in fish management.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						Timing of spawning could be changed. Reports of later than usual lake whitefish spawning in Lake Michigan from commercial fishers who typically have large catches in the last week of October, before the seaon closes in November. Above average water temperatures in 2021 = no fish showing up at typical time. Could should the harvest numbers from WI compared to past, although this is only a single year (but also indicator of temperature and spawning timing in an important species).	Thank you for the question. We address changes in water temperature and oxygen condition and new studies on fish growth, survival, and abundance.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						call out the use of agricultural chemicals in this region and the potential for ecological and human health hazards	Thank you for your comment, but we will not address your concern. While it is important, it is not relevant to the discussion of climate change in our chapter.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						demonstrate greater responsibility for water efficiencies despite relative water wealth compared to other regions	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. Decisions on how to be more responsible being a water rich area of the United States falls to policy-makers.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						compile life cycle impacts of Great Lakes domestic shipping (i.e. not just the St. Lawrence)	We thank the review for the comment. We have included these impacts in the Great Lakes by address water quantity issues and well as a section of Port resilience. We refer the reader to additional citations for a more in-depth investigation.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						The Midwest Chapter, should contain a section devoted to the Mississippi River and impacts to the river	Thank you for your suggestion. The Midwest Chapter highlights the impacts to the Mississippi, Lower Missouri, and Ohio River as major thoroughfares of products and commodities.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						With respect to the Mississippi specifically - water-based transportation often receives high merits for low emissions for long-distance shipping of commodities, but we would benefit from lifecycle analysis of long-distance movements and discussion of market regionalization	We thank the reviewer for the comment, but the suggestion of a lifecycle analysis is outside the scope of this report. We will discuss and provide information on water quantity with respect to climate change so that other uses of this information downstream, including application to the discussion of market regionalization, may proceed. We do have a discussion of ports in the Midwest Chapters, highlighting their role as transportation and trade infrastructure.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						Adaptation section notes systemic barriers. Should call out the limitation of traditional BCA in accruing benefits to those with greater assets and the biases against measures that would provide ecological or social benefits due to their lack of monetization. Need to move to comprehensive benefits analysis (or other broader valuation lenses) to address inequities and underperforming federal investments. Currently, a lot of planning is underway that may still deliver biased outcomes.	We thank the reviewer for the comment. We have noted the economic cost of inaction and maladaptation where appropriate. For a more in-depth look at the systematic barriers and human interactions, we refer the reader to Chapter 18 in the NCA5: 18. Sector Interactions, Multiple Stressors, and Complex Systems.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						interaction of N laden groundwater with Miss River backwaters can spark HABs, nuisance algae, eutrophication. This can be a significant impact of climate change in agricultural regions.	Thank you for your comment. The chapter focuses on broad trends for the topic. We refer those interested in a deeper treatment of HABS to research provided in the citations. We focus on the overall impacts of water quantity and quality,
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						On the Mississippi, floodplain forest health is in decline, lack of recruitment, hydrologic shifts, greater frequency disturbance events will all further strain that system which is regional biodiversity stronghold for birds, insects, herps	Thank you for the comment. We already addressed flash droughts and wildfire in the Midwest, and address landscape adaptation, but have added a specific mention of floodplain forests.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						Could discuss intersection of climate and water quality, specifically as it relates to things like TMDL implementation. Do regulations and plans in place do enough to consider climate change impacts in the context of water quality?	Thank you for your comments. The Midwest Chapter discusses water quality in KM 24.5 for both the Mississippi River System and the Great Lakes. As for regulations, the National Climate Assessment is a scientific document that provides a basis for decision making, but does not prescribe policy. For us to question whether regulations "do enough" is outside the scope of our document.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						information on impact of climate change to ice cover on inland lakes and the Great Lakes. Risk of drownings increase (e.g. ice breakups on Green Bay in 2022 stranding fisherpeople on the ice and needing to be rescued). Loss of tourism and recreation dollars. Impact of low ice cover of Great Lakes fish populations. Damage to coastlines during winter storms because there is no protective ice barrier (e.g. January 2020 storms in SE Wisconsin).	We thank the reviewer for the comment. We discuss the impacts on recreation and tourism as well as the overall potential changes in ice for the Great Lakes.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						WICCI Assessment report has been released, and while specific to Wisconsin, there is a lot of information that is broadly applicable throughout the Midwest. I recommend the authors read the report and see if there are appropriate highlights that could/should be incorporated here.	We thank the commenter for this suggestion and have added the suggested citation to the chapter.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						Recent papers on transition of inland lakes from walleye lakes to bass-dominated lakes could be included. That was not included in NCA4.	We thank the reviewer for the comment. We have included new research in this area into this chapter under our Natural Resources Key Message.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						Report could highlight adaptation resources developed by NIACS that are available for ecosystems in the midwest, including the Great Lakes coastal adaptation menu, forest adaptation menu, Tribal Adaptation menu, non-forested wetland menu, etc.	We thank the commenter for this suggestion and have added the suggested citation to the chapter.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						Increased risk of climate change in cities that have combined sewer overflows would be something to mention. Recent news articles on this issue in midwest cities like Chicago.	We thank you for the comment. We plan to discuss in broad terms how changes in water quantity can have impacts in above and below ground water supplies. We will discuss the overall need for infrastructure upgrades to include climate considerations of the Midwest including rapid transitions between wet and dry, and overall increases in intense rainfall.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						HABs on Lake Superior would be good to mention as we believe them to be directly related to climate change, and Lake Superior is typically thought of as a 'pristine' ecosystem. Bob Sterner, Kait Reinl, Brenda LaFrancois, Gina LaLiberte all good resources. Also information in the WICCI Great Lakes working group report.	We thank the review for the comment. We have included this topic in our Key Message Water.
Wisconsin Initiative on Climate Change Impacts	WDNR UW Madison	Whole Chapter	24. Midwest						Should discuss the issue of armoring and grey infrastructure in trying to prevent negative impacts of high Great Lakes water levels. This can have negative impacts to fish, wildlife, habitat, sediment transport, etc. on the Great Lakes. But armoring is done to protect homes and critical infrastructure. We need more green and natural solutions to build resiliency in the system as a whole rather than solely focusing on protection of infrastructure. Highlighting this tension and balance would be useful.	We thank the reviewer for the comment. We do not directly address the issue of armoring and grey infrastructure in our Chapter due to space limitation. However, we address many issues concerning infrasture upgrades outside of tradional grey infrastructure. We also address green and natural solutions in our Natural Resources and Built Environment key messages.
Daniel	Brown	Whole Chapter	24. Midwest						Please consider collaboration with Northeast Chapter authors to develop materials that span the Great Lakes region. The geographic structure of the NCA artificially segments this culturally and economically coherent region. Materials that describe the region holistically or summarize materials from the Midwest and Northeast chapters will be welcome and useful. The Great Lakes Integrated Sciences and Assessments Center previously provided similar materials for the Third NCA." Example available at: https://glisa.umich.edu/media/files/Great_Lakes_NCA_Synthesis.pdf	We thank the reviewer for the comment. We have engaged with the Northeast Chapter to discuss our collective treatment of the Great Lakes, but will be taking the lead on both the Great Lakes and The Mississippi River system as a while.
Daniel	Brown	Whole Chapter	24. Midwest						Re: The need for extensive evaluation of the vulnerability of dams to climate change As the probability of damaging storms continues to increase, many communities struggle to accurately assess the future vulnerability of dams and other in-stream infrastructure. The catastrophic failure of the Edenville and Sanford Dams in Michigan in 2020 highlight the need to consider precipitation projections in future dam maintenance, repair, construction and removal decisions. During the summer of 2021, the Huron River watershed in southeast Michigan experienced 3 storms that fit the criteria of a 50-year storm as described by NOAA Atlas 14. The flood that broke the Edenville and Sanford dams near Midland, Michigan, was characterized as a 500-year year flood event. In 1986, the same area experienced a 100-year flood. Three such storms of similar magnitude have hit the area of Michigan in the past 34-years. These types of events and precipitation patterns have reinvigorated discussion of dam safety and dam removal in the Midwest. Of note: the following study should be reviewed by authors as they consider future precipitation recurrence intervals, flood risk, and vulnerable infrastructure. Kirchmeier-Young, M. C. and Zhang, X.: Human influence has intensified extreme precipitation in North America, P. Natl. Acad. Sci. USA, 117, 13308,Äì13313, 2020.	We thank the review for the comment. We agree that dams are an important topic in this Chapter and have included it our Key Message 24.4 Built Infrastructure. We thank the reviewer for the Tech contribution as well.
Whitney	Berry	Whole Chapter	24. Midwest	1	95	1	96	1	Glad equity considerations are worded in a section: " How does it impact people/natural systems?" and also What can we do or what will happen in the absences of adaptative action/mitigation?	We thank the reviewer for the comment. Although we have removed these questions as subtitles per se, these questions helped guide our initial chapter development to ensure we are framing the Chapter in a risk-based framework.
Joseph	Zajac	Whole Page	25. Northern Great Plains		102				what the heck does this have to do with climate change? - Indigenous peoples' adaptation actions- ... and storytelling to limit loss of culture and language and maintain identity. Have people not learned how to write anything down? Make a video or a tape recording?	This comment is inconsistent with the author team's thorough assessment of the science.
Joseph	Zajac	Whole Chapter	25. Northern Great Plains						weak and irrelevant material	This comment is inconsistent with the author team's thorough assessment of the science.
Joseph	Zajac	Whole Chapter	26. Southern Great Plains						what is the optimum number of species for balance biodiversity?	Thank you for your comment. There is no magic number for how many species lead to a balanced ecosystem. For an ecosystem to be resilient to disturbances (e.g., weather hazard, climate change), studies show that the higher biodiversity, the better. However, different climate regimes support different levels of biodiversity naturally.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Joseph	Zajac	Whole Page	26. Southern Great Plains		104				what does this have to do with climate change? - Effect of ¬icompassion fatigue" among faith-based, nonprofit, and private organizations	Thank you for your comment. Climate extremes, like drought, floods, hurricanes, etc., typically require the services of the listed organizations. With increases in the intensity and/or number of these events associated with a changing climate, these organizations are experiencing fatigue that has been labeled "compassion fatigue" (similar to that experienced by health care workers during COVID). We will bring it into future drafts only if we find studies that document it. The list of topics in the zero-order draft are meant for discussion and may not be ultimately in the final draft.
Joseph	Zajac	Whole Page	26. Southern Great Plains		105				use of politically correct terminology has no place in this report: Key Topic 4: How we share: justice and equity	Thank you for your comment. We intend the chapter to be readable and will define terminology if we determine, with the help of our editing team, that our wording is not commonly understood. In this case, we intend to discuss the differences in how climate hazards currently impact and are projected to impact different populations.
Joseph	Zajac	Whole Chapter	26. Southern Great Plains						weak material	Thank you for your comment. The material in the zero-order draft is only the list of topics. Statements, sources, and citations appear in future drafts.
Catherine	Buchanan	Whole Chapter	26. Southern Great Plains						Under Justice and Equity: When discussing agriculture, the different types of agriculture need to be separated into their appropriate categories for everyone to be properly and adequately described. The different categories include: factory farms, public land livestock grazing, small family ranches, small organic family farms, Big Ag plantations such as Con Agra and ADM, the farms that produce tons of food to export out of the country, the massive vineyards, and etc. If there is no process that appropriately categorizes the various types of agriculture in recognizing their compounding negative effect on the water resources, there will never be an equitable sharing of the diminishing water supply. Without an equitable plan to preserve the small farms in this country, there will always be injustice.	Thank you for your comment. The material in the zero-order draft is only the list of topics. Details will appear in the future drafts. Also, the SGP chapter is waiting to see what details the Agriculture, Food Systems, and Rural Communities (Ag/FS/RC) chapter is covering to know better how to discuss the details in our region. We intend to distinguish differences among agriculture components and to link to both the Water Resources and Ag/FS/RC chapters in our discussion.
Kavita	Heyn	Whole Chapter	27. Northwest						I would like to suggest for section on Key Topic 4: Built Infrastructure highlights examples of how public infrastructure agencies in the region (for example water utilities) are already implementing strategies to adapt their infrastructure to more extreme events. For example, the Portland Water Bureau has developed a set of extreme heat strategies to reduce risk of failure for drinking water pump stations during extreme heat waves, and these strategies have helped identify and resolve potential failures during heat waves in 2020 and 2021: (see https://www.wucaonline.org/assets/pdf/heat-impact-case-study-portland.pdf) Also, Seattle Public Utilities redesigned a sewage and stormwater tunnel to accommodate and anticipate heavier future rainfall from climate change: (see https://www.wucaonline.org/assets/pdf/engineering-case-study-seattle.pdf). These are infrastructure strategies that can help mitigate to and adapt to extreme events in the region.	Thank you for these comments - we have included a paragraph that discusses new tools and strategies adapted by public agencies to increase water system resiliency in the Built Infrastructure KM.
Joseph	Zajac	Whole Chapter	27. Northwest						use of politically correct terminology has no place in this report: Understanding of the inequitable distribution of climate impacts and community-led responses to address these inequities	This comment is inconsistent with the current state of the science on this topic. Authors have assessed the current research landscape and recognize that climate change impacts are not distributed equally across communities or geographies.
Joseph	Zajac	Whole Chapter	27. Northwest						another chapter whose goal is to create victims because of climate change	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac	Whole Page	27. Northwest		109				Claim - Disruption of transportation routes, which in turn reduces access to other services. Please discuss how local governments failed to do contingency planning such as redirecting traffic.	Thank you for this comment - while we do not explicitly call out how local governments fail to do contingency planning, the Built Infrastructure KM discusses how some transportation infrastructure are aging - which affects how climate change can amplify existing transportation failures, especially for high criticality routes.
Joseph	Zajac	Whole Chapter	27. Northwest						add in the negative impact of water consumption by illegal marijuana farms	We thank the reviewer for this comment. While authors have associated how irrigation can exacerbate water supply, there is insufficient evidence on how marijuana farms affect regional water supply and associated climate change impacts to this water supply.
Juanita	Constible	Whole Page	27. Northwest		108				1st two sub-bullets at the top: This is generally a strong list of vulnerable popoulations. However, please consider including indoor workers as well. E.g., During the 2021 heat dome, OSHA received many complaints from food service workers about dangerously hot indoor conditions.	We thank the reviewer for this comment. Our chapter has used a similar framing focusing on three general frontline communities and are no longer listing all types of vulnerable populations. However, there is a sentence that describes occupational exposure to extreme heat - which inclues food service workers.
Juanita	Constible	Whole Page	27. Northwest		108				Bullet about climate action centering equity: Please consider including a discussion about the widening of the wealth gap that can arise from inequitable distribution of post-disaster aid.	Thank you for this comment. While authors did not focus specifically on post-disaster aid, we have added in a discussion on how socioeconomic disparities can arise from inequitable adaptation policies.
Juanita	Constible	Whole Page	27. Northwest		108				Bullet about cross-cutting adaptation: It's not clear from the description whether this will be a discussion about the need for cross-cutting adaptation, examples of cross-cutting adaptation, or both. (Both would be most useful.)	We thank the reviewer for this comment - we have revised this chapter to eliminate this discussion and have embedded cross-cutting adaptation within the key message narrative text to make sure these examples and case studies are sector-relevant.
Juanita	Constible	Whole Page	27. Northwest		108				The mental health impacts of reduced recreational and exercise opportunities don't get enough attention, so it's great to see that listed here as a potential topic.	We greatly appreciate the reviewer's comment.
Juanita	Constible	Whole Page	27. Northwest		109				It's not clear what the environmental health disparities map will entail, and how it will be different from the overlap figure proposed in the last bullet of Key Topic 1. If it is an acutal map, will it cover the entire Northwest region? Or zero in on a couple of communities with multiple disparities?	Thank you for this comment. The authors have taken out this figure since there is not robust data or resources to consistently map environmental health disparities across the Northwest region. However, we have included a sentence to existing state-level resources.
Juanita	Constible	Whole Page	27. Northwest		109				Key Topic 3: Please consider including a discussion about how climate-related health threats to workers could slow or otherwise impede a transition to the green economy without adequate protections. E.g., construction workers, solar installers, and utility workers are extremely vulnerable to heat and wildfire smoke, but occupational health and safety rules governing both are patchy in the Northwest.	We thank the reviewer for this comment. We have included a brief discussion that describes occupational exposure to extreme heat in relation to a low-carbon green economy.
Juanita	Constible	Whole Page	27. Northwest		109				Key Topic 4: Please include a discussion of extreme heat in this section, particularly with regards to transportation and energy infrastructure and how increases in demand for air conditioning has the potential to increase emissions and reduce reliability.	We thank the reviewer for this comment and have integrated this topic into our Built Infrastructure Key Message.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Juanita	Constible	Whole Page	27. Northwest		110				Key Topic 6: Please consider including heat in the discussion of impacts to outdoor activities. Also, when it comes to security for residents or homeowners, do coastal zones deserve a special call out in addition to the wildland urban interface? Some tribal communities have already had to move or consider moving due to sea level rise.	We thank the reviewer for this comment. We have included discussions of both WUI-related risks and coastal-related risks - including communtiy relocation and managed retreat examples.
Juanita	Constible	Whole Page	27. Northwest		108				Key Topic 2: Please consider adding information, where available, about potential economic costs of climate-related health harms.	We thank the reviewer for this comment and have integrated non-monetary economic impacts associated with climate-related health harms, when available.
Juanita	Constible	Whole Page	27. Northwest		109				Key Topic 5: Consider adding a discussion of nature-based adaptation solutions and their role in protecting ecosystems.	We thank the reviewer for this comment and have added a seection on nature-based adaptation solutions.
Whitney	Berry	Whole Chapter	27. Northwest	1	109	1	110	1	Under Key Topic 3, sub-bullet ?Tribal natural resource economics? focuses on commercial and subsistence economies, which are direct uses of natural resources by Tribes, but should also include ?tourism and recreational industries.? There are a few Washington coastal Tribes that are highly dependent on tourism (e.g., camping, motels, restaurants) and recreational activities (e.g., sportfishing, hunting, boat launching, guiding) for their local economy.	We thank the reviewer for this comment. We have included discussions of recreation-based industries and economies - including for tribal communities - whenever literature is available.
Whitney	Berry	Whole Chapter	27. Northwest	1	109	1	110	1	Under Key Topic 4, sub-bullet on ?Water infrastructure? focuses on stormwater and fresh water supply, but does not mention anything in the marine environment (e.g., jetties) that protect communities and marinas.	We thank the reviewer for this comment. Authors have included discussions of coastal adaptations in other sections and believe the water infrastructure should continue to focus on water supply and associated infrastructure systems that store and deliver water.
Whitney	Berry	Whole Document	27. Northwest	1	110	1	110	1	Under Key Topic 5, sub-bullet on ?Riverine and watershed impacts? focuses only on conditions that result in less water (e.g., less snowpack, drought), and should also include ?flooding and higher rainfall.? This bullet also mentions ?decline of some native or desirable non-native aquatic species,? but does not mention impacts associated with potential increases in aquatic invasive species.	We thank the reviewer for this comment. Authors have included discussions of precipitation driven impacts for riverine systems and also included discussion of some aquatic invasive species, such as the European Green Crab.
Whitney	Berry	Whole Document	27. Northwest	1	110	1	110	1	Under Key Topic 5, ?Coastal, nearshore, and marine impacts? sub-bullet: Unlike the previous sub-bullet that mentions impacts to habitat for coldwater fishes and declines in native or desirable non-native aquatic species, this sub-bullet does not mention fish at all. We also noted that ?salmon? is mentioned throughout the Northwest chapter and is used in multiple examples as it relates to Tribes and freshwater habitats, but it is conspicuously absent from the ?coastal, nearshore, and marine? section.	We thank the reviewer for this comment. There is a more robust discussion of salmon in marine systems now.
Joseph	Zajac	Whole Chapter	28. Southwest						Advances in understanding (fill in the blank) - list the flaws in the previous information that not so advanced	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. The Chapter includes a traceable accounts that lists the major uncertainties and research gaps. The Chapter also identifies areas where our scientific knowledge has not progressed significantly since the prior assessment.
Joseph	Zajac	Whole Page	28. Southwest		111				use of politically correct terminology has no place in this report: ... climate change equity and environmental justice for vulnerable, marginalized, and frontline communities, and Indigenous peoples across the Southwest	The points the commenter raises are inconsistent with the mandate for the report. The U.S. Congress established the U.S. Global Change Research Program (USGCRP) in the Global Change Research Act (GCRA) of 1990.One of the products mandated by the GCRA is a quadrennial assessment that USGCRP is to prepare and submit to the president and Congress. The NCA is directed by the GRCA to analyze the effects of global change on human social systems. The USGCRP guidance specifically instructs authors to identify ways in which certain systems or groups more vulnerable than others.
Joseph	Zajac	Whole Chapter	28. Southwest						add in the negative impact of water consumption by illegal marijuana farms	We thank the reviewer for the comment. This report assesses existing and available information sources. The author team has noted the lack of literature and evidence base to evaluate this comment. Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples.
Joseph	Zajac	Whole Chapter	28. Southwest						continued focus on the FALSE premise that wildfires are the result of climate change	We thank the reviewer for the comment. This comment is inconsistent with the current state of the science on this topic. This comment is inconsistent with the author team's thorough assessment of the literature. The current science, literature, and author assessment and consensus conclude that climate change is clearly linked to increases in wildfire activity.
Juanita	Constible	Whole Chapter	28. Southwest						Adaptation doesn't seem to get much of an emphasis in this chapter, despite the statement on p. 112 about it being a cross-cutting theme. It would be great to see more adaptation discussion and case studies (especially community-led adaptation) in each Key Topic, particularly given that California and Arizona have been leaders in this space.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. The author team has included specific examples of adaptation pathways and solutions in each Key Message area including specific examples from various states in the region, including California and Arizona, among others.
Juanita	Constible	Whole Page	28. Southwest		111				It's great to see the inclusion of effective governance in the What's New section.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful
Juanita	Constible	Whole Page	28. Southwest		112				Key Topic 2, bullet 7: Are there coastal-specific discussions to be had about fire risks that wouldn't be covered under Key Topic 5?	We thank the reviewer for the comment. The author team has incorporated this recommendation to improve coordination between sections.
Juanita	Constible	Whole Page	28. Southwest		112				Key Topic 2: Please consider adding a discussion about sea level and erosion-related loss of public beaches, and what that could mean for equitable access to outdoor recreation and coastal resources.	We thank the reviewer for the comment. Due to the breadth of the topic and the page limit for the chapter, we focused on broad trends rather than specific examples.
Juanita	Constible	Whole Page	28. Southwest		113				Key Topic 2: The proposed sea level rise figure could be really useful, particularly if it focuses on sectoral interdependencies and the potential for cascading failures, which are not top of mind for most people.	We thank the reviewer for the helpful suggestion, which has been incorporated into the figure.
Juanita	Constible	Whole Page	28. Southwest		113				Key Topic 4: Please include mental health as well, including the effects of extreme heat and wildfires. It would also be helpful to include what is known about the health costs of climate-related events.	We greatly appreciate the reviewer's comment. The text has been revised to incorporate this suggestion/information.
Juanita	Constible	Whole Page	28. Southwest		113				Key Topic 4, bullet 4: Please include indoor workers as well. For example, see recent media coverage in the LA Times about heat-related illnesses among warehouse workers in the Inland Empire.	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.
Juanita	Constible	Whole Page	28. Southwest		113				Key Topic 4, potential figures: Is the proposed multi-modal ensemble just going to show temperature changes, or societal impacts of those temperature changes? The latter would be more helpful, but admittedly more difficult. Also, it would be great to have some kind of illustration of health adaptation solutions.	We thank the reviewer for the helpful suggestion. The author team has deliberated and prioritized the information and illustrations to include. Based on these agreed priorities, the chapter has been revised to include heat impacts as well as community resilience.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Juanita	Constible	Whole Page	28. Southwest		114				Key Topic 5: It would be extremely useful to have a discussion or case studies of systemic approaches to wildfire adaptation. I.e., not just actions by individual homeowners to create defensible space.	We greatly appreciate the reviewer's comment. The text has been revised to incorporate this suggestion/information.
Whitney	Berry	Whole Chapter	28. Southwest	1	112	1	112	1	Under Key Topic 2: given limited space in the chapter, recommend that saltwater intrusion, which is not only drive by climate change, could be discussed under the section on sea level rise. This would give attention to more focal concerns.	We thank the reviewer for the comment. The author team has incorporated this recommendation to improve coordination between sections.
Whitney	Berry	Whole Chapter	28. Southwest	1	112	1	112	1	Under Key Topic 2, bullet on Wildife: It may be less necessary to discuss specific wildfire impacts in ?the coast? section since it is a key topic unto itself on page 114.	We thank the reviewer for the comment. The author team has incorporated this recommendation to improve coordination between sections.
Whitney	Berry	Whole Chapter	28. Southwest	1	112	1	112	1	Under Key Topic 2, bullet on Climate change impacts on aquaculture and coastal fisheries: It could be useful to discuss the case study of Pacific herring. In short, herring show pronounced, climate correlated variability in recruitment/abundance, which impacts the wider ecosystem of marine birds, fish, mammals and fishing communities given herring?s role as a forage fish. In revising herring management under the Marine Life Management Act, California managers worked with industry and conservation stakeholders to link herring harvest to the abundance of other forage species in the surrounding ecosystem. The resulting harvest control rule (HCR) takes advantage of the way different components species of the overall forage base (e.g., herring, anchovy, sardine) tend to rise and fall differently in response to sea temperature. When alternative forage species are abundant, the HCR allows heavier herring harvest. When alternative prey for dependent predators are reduced by environmental conditions, making herring a more crucial ecosystem health driver, the HCR constrains the proportion of the herring stock that may be harvested. https://wildlife.ca.gov/Fishing/Commercial/Herring/FMP	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 author team has included several key examples of climate change impacts on aquaculture and coastal fisheries.
Whitney	Berry	Whole Chapter	28. Southwest	1	112	1	112	1	Under Key Topic 2, bullet on Impacts to marine flora and fauna: A case study potentially useful here might briefly explore responses and dynamics in the decline of bull kelp along the northern California coast and bull and giant kelp along central California coast. In the aftermath of a pronounced marine heatwave, beginning about 2015, purple urchins began to increase in number and have had subsequent negative impacts on kelp forests via increased herbivory. There were calls from many groups, as well as active projects, to smash and otherwise locally eradicate this native marine herbivore with the goal of restoring and recovering declining kelp forests. Better stability and overall kelp forest health in southern California ? ironically perhaps, due to its overall higher sea temperature and greater anthropogenic impacts (such as pollution) ? might be explained by healthy populations of urchin predators, like California sheephead and spiny lobster (e.g., see https://www.news.ucsb.edu/2017/017617/size-matters). These predators, uncommon in northern California, need to grow to a certain size before they begin to include urchins in their diets. This suggests a possible benefit of marine protected areas established in 2014 that can foster larger predators. Another key dynamic ? the likely climate-driven disappearance of the urchin regulating role player in northern California, the sunflower sea star (Pycnopodia helianthoides), which appears to play a solitary urchin regulating role in the absence of sea otters. A hypothesis that fisheries measures and targeted area protections could be more efficient than individual urchin removals and local eradications in regulating desired ecosystem outcomes undergoes a haphazard test in California shallow reef ecosystems.	We greatly appreciate the reviewer's comment. The text has been revised to incorporate this suggestion/information. The author team has revised the chapter rand included discussion of climate impacts on marine heat waves and harmful algal blooms including the impact to California bull kelp.
Joseph	Zajac	Whole Chapter	29. Alaska						100 degrees Fahrenheit, June 27, 1915 at Fort Yukon, Alaska, not mentioned	We will keep this example in mind as we develop the chapter. With space limited, however, not all details of Alaska's meteorological history can be included.
Joseph	Zajac	Whole Chapter	29. Alaska						continued focus on the FALSE premise that wildfires are the result of climate change	This comment is inconsistent with the author team's thorough assessment of the science. Wildfires are not solely the result of climate change, but climate change alters the conditions that lead to wildfires.
Joseph	Zajac	Whole Page	29. Alaska		116				FALSE - Alaska Native hunters experiencing poor success...	The outline mentioned several topics in telegraphic style. The written text will include more details and nuance. We appreciate the adaptability of Alaska Native hunters to variable and changing conditions.
Joseph	Zajac	Whole Page	29. Alaska		116				NOT due to climate change - Gulf of Alaska cod, Bering Sea red king crab, Bering Sea opilio crab, Alaska crab population crash blamed on mysterious mortality event	This comment is inconsistent with the author team's thorough assessment of the science. A "mysterious mortality event" is simply a description of what happened, not an explanation. The role of climate change in setting the conditions for unexpected mortality will be examined in more detail in the full chapter.
Joseph	Zajac	Whole Chapter	29. Alaska						weak material	The full chapter will have considerably more content and detail than the outline.
Annie	Kelly	Whole Chapter	29. Alaska						Alaska is one of the places in the US that I have wanted to visit since forever. So, it is important to me to read and interact with the issues happening in that state. It is a state that clearly has had to face a lot of issues because of climate change. Key topic number one is about how the biophysical change is rapid in Alaska. Reading about this, I think that something that could help is trying to preserve and protect as much wildlife and nature as possible. These climate change issues can be very impactful and because of the beauty that Alaska holds within the state, it is important to educate people about the effects of climate change on the state. I think the chapter does a great job on addressing this issue, and stating the key points about it. They do a great job explaining the problems within the bullet points, and informing the readers about the current events and key topics.	Thank you, and we hope you have a good visit to Alaska when you are able to come here. We appreciate your interest in our chapter and your kind words about the intended content.
Joseph	Zajac	Whole Chapter	30. Hawai'i & USAPI						weak material	This comment does not appear to raise a question or suggest a revision. Substantial additions have been made since the zero order draft.
Melissa	Tier	Whole Page	31. Adaptation		123				Regarding the parameters for "transformational adaptation" (Key Topic 2): #2 "in-depth changes" as written might not sufficiently represent a more normative goal of climate adaptation. Could it be rephrased or a Point #3 added to acknowledge that transformative change would need to be toward something (e.g., social justice principles). This might also help integrate with the next bullet point on "limited progress on adaptation in vulnerable, frontline communities".	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Melissa	Tier	Whole Page	31. Adaptation		124				When discussing cooperation and co-production (Key Topic 3), might be good to indicate that "interaction and coordination" should be sustained. (Esp since the lack of this is a common criticism of co-production research.)	The text has been revised to clarify this point.
Melissa	Tier	Whole Page	31. Adaptation		124				Under "social science research to inform..." (Key Topic 3), it would be helpful to highlight some of the key social science areas that will be drawn on in this section.	The text has been revised to incorporate this suggestion.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Melissa	Tier	Whole Page	31. Adaptation		125				Under "system change can be facilitated through change in..." (Key Topic 4), maybe add institutional/community norms?	The text has been revised to address this suggestion.
Joyce	Coffee	Whole Chapter	31. Adaptation						Hello, you may find it useful to review this: FOCUSED ADAPTATION: A STRATEGIC APPROACH TO CLIMATE ADAPTATION IN CITIES C40 and McKinsey & Company research identified a set of high-impact actions to reduce risk-that are cost effective, and satisfy many stakeholders. https://www.c40knowledgehub.org/s/article/Focused-Adaptation-A-strategic-approach-to-climate-adaptation-in-cities?language=en_US Thank you.	We appreciate the suggestion and have reviewed the source of information. We will assess its relevance for future drafts.
Joseph	Zajac	Whole Chapter	31. Adaptation						weak material	This comment does not appear to raise a question or suggest a revision.
Joseph	Sollod	Whole Chapter	31. Adaptation						This chapter should discuss building codes, which are an important policy tool in climate adaptation. Building codes and standards provide a common language and requirements for the design, construction, and operation of buildings aimed at supporting the building industry construct safe, resilient, and sustainable structures. They have long served as the main tool of governments in setting agreed-upon norms. Building codes are a fundamental contributor to community resilience. A community cannot be resilient without resilient buildings and the codes that support their development. Resilience in the built environment starts with strong, regularly adopted, and properly administered building codes. To date, energy codes have primarily been focused on reducing energy costs, energy use, and greenhouse gas emissions. However, as climate adaptation becomes a priority, energy codes are also being recognized for their contributions to resilience. Climate change is expected to result in an increase in extreme temperature events. Through provisions for efficient building envelopes and heating, ventilation, air-conditioning and refrigeration equipment plus guidance on shading and reducing solar heat gain, energy codes can reduce the impacts of such extreme events. Additionally, during these extreme events, the energy grid may become strained. Reduced energy demand to obtain comfortable temperatures through increased building efficiency can also enhance resilience of the energy grid. In addition to energy efficiency, building codes address multiple other important climate factors including water use, materials and waste, indoor air quality including ventilation and filtration, and sustainable economic growth and job creation. They also help protect occupants from the devastating impacts of climate change. While the perils covered by building codes can vary, they generally address climate-based risks including flooding, tropical cyclone/hurricane, wildfire/bushfire, and extreme snow through the provision of either performance or prescriptive requirements for structural loads, material properties, enclosure characteristics, and other design requirements.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Because space is limited, a more in-depth treatment of building codes will be found in the Built Environment chapter.
Elizabeth	Rowe	Whole Chapter	31. Adaptation						February 20, 2022 Re: Comments on Zero Order Draft, Chapter 31: Adaptation Dear Emily Wasley ,Äì On behalf of the Joint Implementation Task Force of the Climate Resilience Plan for Agnes Scott College and the City of Decatur, we are pleased to submit the following comments focused on the Zero Order Draft for Chapter 31: Adaptation. In February 2021 Agnes Scott College and the City of Decatur, Georgia completed a joint Climate Resilience Plan (CRP). The purpose of the CRP was to identify together the most pressing impacts of climate change anticipated in this region and outline the strategies for addressing these impacts, both in terms of preparation and response. The CRP is meant to give the college and the city the ability to work together, move beyond limited funding and incentives for climate response in Georgia, create new solutions, and jointly find funding support when needed. The implementation of the CRP is managed by a Joint Implementation Task Force from Agnes Scott College and the City of Decatur fire and emergency services, public works, city planning, and residents serving on the city‚Äôs Environmental Sustainability Board. Below is a link to the CRP which outlines specific strategies for energy, water, and public safety, while also addressing concerns about communications, equity, and community involvement. As stated in the Adaptation outline, there is growing evidence of the importance of intentional partnerships and coordination across sectors for resilience implementation. The primary goal of our joint CRP is to build community partnership to ensure coordinated response to future climate scenarios. Within our first year of implementation, we have facilitated a joint meeting with every emergency management official for the City of Decatur, Agnes Scott College, City Schools of Decatur, and Dekalb County Emergency Management, to begin to coordinate our response to the most pressing climate scenarios for this region. Through this partnership, our community of staff, students, and residents who will be impacted by climate change locally in the months and years to come are now more organized to face these challenges	We thank the reviewer for the comment. This example is being considered for inclusion as a case study in a future draft.
Juanita	Constible	Whole Chapter	31. Adaptation						The emphasis on equity throughout this chapter outline is a welcome advancement from NCA4, which framed equity more as an optional attribute of adaptation than an essential one.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful.
Juanita	Constible	Whole Page	31. Adaptation		123				Key Topic 1, last bullet: Maladaptation tends to be a tricky concept for people outside the adaptation field, so the proposed figure could be very useful.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful.
Juanita	Constible	Whole Page	31. Adaptation		123				Key Topic 2, 3rd bullet: Please consider including a public health example.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion briefly. Because space is limited, a more in-depth treatment of human health and adaptation will be found in the Human Health chapter.
Juanita	Constible	Whole Page	31. Adaptation		123				Key Topic 2, last bullet on p. 123: This definition should explicitly recognize the role of transformative adaptation in addressing root causes and starting point vulnerability. E.g., Shi and Moser 2021, Transformative Climate Adaptation in the United States: Trends and Prospects, Science 372, no. 6549.	The text has been revised to incorporate this suggestion and reference.
Juanita	Constible	Whole Page	31. Adaptation		124				Key Topic 2, 2nd full bullet on p. 124: The discussion of adaptation indicators could be very valuable.	We appreciate the reviewer's comment about the report and hope that the content is useful.
Juanita	Constible	Whole Chapter	31. Adaptation						There are a few references to vulnerable communities LIKELY bearing a disproportionate burden of climate risk (e.g., on p. 124). The use of the word LIKELY seems unnecessarily cautious, given that vulnerable communities are already bearing a disproportionate burden of climate impacts.	The text has been revised to clarify this point.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Juanita	Constible	Whole Page	31. Adaptation		124				Key Topic 2, last bullet: The first proposed figure sounds useful, but the second one less so. It seems that a map like the one proposed in the second concept would take up a lot of space that would be better served with more detailed case studies.	We thank the reviewer for the helpful suggestion, which has been incorporated into the set of figures in the chapter.
Juanita	Constible	Whole Page	31. Adaptation		124				Key Topic 3, last bullet: The proposed adaptation financing gap graphic could be very useful.	We appreciate the reviewer's comment about the report and hope that the graphics are useful. The figures for this chapter are still under development, but we will take this comment into consideration as we finalize them. Data limitations may constrain our ability to produce this figure.
Juanita	Constible	Whole Page	31. Adaptation		125				Key Topic 4, last bullet: It is a great idea to illustrate incremental vs. transformative adaptation, as proposed.	We greatly appreciate the reviewer's comment about the report and hope that the content is useful.
Juanita	Constible	Whole Chapter	31. Adaptation						You might consider including a discussion or case study of how the COVID-19 pandemic has set back or complicated adaptation efforts, especially in cash-strapped localities.	While the comment highlights a good example, the authors feel the existing examples are appropriate and adequate. Impacts of the pandemic are treated in a cross-chapter box seen elsewhere in the assessment.
Juanita	Constible	Whole Page	31. Adaptation		122				What's New, 2nd bullet: Consider specifically pointing to the issue of local and community capacity. Researchers and practitioners are increasingly calling out the capacity gaps that make adaptation funding inaccessible to many communities and the need for increased investment in capacity building.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Juanita	Constible	Whole Page	31. Adaptation		123				Key Topic 1, 4th bullet: Very glad to see inclusion of malaptation in this discussion! Recommend pointing specifically to government decision-making frameworks and resources that are maladaptive because they are out of date or do not consider future conditions (e.g., precipitation frequency estimates used to plan development), either here or under Key Topic 4.	We greatly appreciate the reviewer's comment about the report. We have updated the chapter and hope the discussion of decision-making frameworks is useful.
Juanita	Constible	Whole Page	31. Adaptation		123				Key Topic 1, final bullet: It may be useful to consider the framwork described by Carrion et al., Heading Upstream: Strategies to Shift Environmental Justice Research From Disparities to Equity, AJPH 112(1), pp. 59-62. That discussion is not specifically about climate adaptation, but the concept of shifting from identifying disparities to advancing equity seems broadly applicable.	We appreciate the suggestion and have reviewed the source of information. However, the author team determined that the current references with their narrower focus on environmental justice in a climate change context are appropriate and adequate given the chapter's space limitations.
Juanita	Constible	Whole Page	31. Adaptation		123				Key Topic 1, final bullet: In addition to the illustration, a more detailed discussion of adaptation and mitigation tradeoffs (real or perceived), as well as synergies, might be useful. In the advocacy space, it's common to see adaptation and mitigation framed as at odds with each other, or oversimplified to the point where it seems like accomplishing one means we won't need to worry about the other. That framing can be a real barrier to advancing effective, holistic solutions.	We thank the reviewer for the comment. We added new text and citation support to incorporate the suggestion.
Juanita	Constible	Whole Page	31. Adaptation		123				Key Topic 2, 6th bullet: Re: the disaster risk reduction paradigm, it may be useful to consider the alternative disaster cycle described by Bosher et al., Stop Going Around in Circles: Towards a Reconceptualisation of Disaster Risk Management Phases, Disaster Prevention and Management 30(4/5), pp. 525-537.	We appreciate the suggestion and will assess the provided reference for inclusion in future drafts.
Juanita	Constible	Whole Page	31. Adaptation		124				Key Topic 3, 3rd bullet : It's great to see the point included about adaptation needs depending on emissions reductions. It might be useful to have a more detailed discussion of this, even if it's qualitative (e.g., describing or giving examples of the approximate scale and scope of adaptation needs under different emissions scenarios).	We thank the reviewer for the comment. This point is addressed within the chapter, and we will consider expanding on it further in subsequent drafts. The authors are also coordinating with the Mitigation chapter and will consider this point in our collaborations.
Richard	McNider	Whole Chapter	31. Adaptation						31 Adaptation Migration of Agriculture as an Adaptation Strategy It seems that planned geographical changes in agriculture may be a valid adaptation strategy under the NCA. While many have voiced concerns about vulnerabilities of agriculture to future climate change less has been discussed about geographical changes in U.S. agriculture in the last century that increased its vulnerability both to climate change and climate variability. In the 20th century a significant amount of the Nation‚Äôs food and fiber crop production systems shifted from the East to the arid West due to the establishment of irrigation infrastructure and improved transportation. Similarly, with transportation improvements, corn and grain production became concentrated in deep water holding soils in a small area of the upper Midwest that avoided drought losses occurring in the shallow poor water holding soils in much of the East. This migration of agriculture which largely occurred between1940 -1970 was as remarkable in terms of its swiftness as its magnitude. The shifts that occurred in the last century were largely unplanned driven by transportation improvements and the search for consistent water for optimal production. However, the immediate market economic efficiencies that drove the shift in agriculture in the last century did not fully account for the environmental externalities, the future competition for water supply or the adverse societal impacts of abandoned agricultural land. The U.S. went from a distributed agricultural system where significant corn was grown in almost every state to one in which nearly 90% of the corn production is now concentrated in the Upper Midwest. Corn production has significantly declined in the Southeast. A similar shift occurred with cotton, vegetables, and potatoes where irrigated production became concentrated in the river basins of the arid West. Western irrigated cotton rapidly reduced cotton production in the Southeast. Southern cotton farmers, whose output and quality were hurt by frequent drought losses, could not compete with irrigating cotton farmers in California, New Mexico and Texas even after the boll weevil was controlled. In 1939 Maine, New York and Pennsylvania led the nation in potato production. By 1950, Maine, New York and Pennsylvania lost their historical top rankings in potato production to Idaho and	Thank you for these detailed comments. Given the space constraints of the chapter, we are not able to address all of them as fully as they merit. However, we will consider adding in a brief mention of migration of agriculture as an adaptation strategy. We will share this comment with the Agriculture, Food Systems, and Rural Communities Chapter for their consideration.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Joseph	Robertson	Whole Page	31. Adaptation		123				Under Key Topic 1, responding to: - ‚ÄúVarious dimensions of justice, including recognitional, distributional, procedural, and restorative, are fundamental to understanding climate vulnerability and adaptive capacity.‚Äù - ‚ÄúDifferent forms of maladaptation exacerbate the risks of climate change, can perpetuate existing vulnerabilities and inequities, and create new risks and inequities.‚Äù It is worth noting that the 1992 UN Framework Convention on Climate Change is built around a mandate to ‚Äúprevent dangerous anthropogenic climate change,‚Äù which is meant to be refined this year to a clear, universal statement of principle. Together, this suggests adaptation measures should be judged against a Zero Preventable Harm standard. If we use the Zero Harm standard for Adaptation, we are then compelled to consider actions that reduce harm to vulnerable and marginal communities, and to ecosystems and biodiversity. There are cascading benefits to such an approach, in practical terms relevant to human experience, including total cost and availability of resources when emergencies arise. The Zero Harm standard also compels us to treat resilience as an operational baseline imperative, rather than a best-case future outcome. How we plan, organize, act, and measure impact, will be affected by the decision to treat resilience as universally required or as an elusive ideal. In examining the justice and equity dimensions of Adaptation and Resilience, is it possible to: Set an overall range for adaptation and resilience that spans from zero harm in the best case to a worst case of highest cost and most pervasive compounding disruptions; Provide detailed, evidence-based analysis of the cost, risk, impact, and compounding benefits of specific adaptation actions at specific timescales, across human health and wellbeing, fiscal and opportunity cost, stability of the built environment, food security, and the integrity of ecosystems and natural capital?	Thank you for these detailed comments. Given the space constraints of the chapter, we are not able to address all of them as fully as they merit. However, we have added a discussion on different forms of justice and maladaptation, and we have added a note about how different stakeholders have different opinions about the goals of adaptation. Key Message 1 has added information about the need for more evidence-based evaluations of adaptation to include multiple dimensions of well-being.
Evan	Mills	Whole Chapter	31. Adaptation						A cross-cutting theme that seems to be rarely explored in the literature, and particularly relevant to this document, is the impact of climate change on the public sector (local to national). A discussion could synthesize conduits of vulnerability, including the National Flood Insurance Program, the USDA‚Äôs crop insurance, public health expenditures, impacts to publicly owned utilities, impacts to publicly-owned property, costs of publicly-funded disaster response, costs of publicly-funded disaster preparedness and recovery, military infrastructure (as distinct from strategic) implications etc. While there are isolated references to some of these throughout the document (e.g., a reference to military in 26. Southern Great Plains chapter, but not elsewhere), an integrated discussion could be of value (identifying nodes of exposure, ballparking baseline costs, potential leadership by example through the relevant public programs and functions, etc.). This analysis could also shed light on the relative allocation of such costs between the public and private sectors, and, for example, how the public sector is assuming an ever-increasing burden as insurance companies withdraw from markets.	Thank you for these detailed comments. These are examples of the costs of climate impacts and the costs associated with adaptation, which will be some examples included in future drafts. However, given space constraints, we will not go in-depth into these examples, but many of these examples will be considered across other chapters.
Jhoset	Burgos	Whole Chapter	31. Adaptation						Comment: Overall, this section should consider adaptation and resilience to projected and potential multimeter sea level rise plus short-term flooding events and coastal erosion. It is important to recognize our inability to precisely predict long-term sea level rise. As such, adaptation should consider a margin of safety.	We thank the reviewer for the comment, and will consider our treatment of this topic in future drafts. A more thorough discussion of sea level rise can be found in other chapters.
Jhoset	Burgos	Whole Page	31. Adaptation		123				Under: Key Topic 1: Vulnerability, inequity, and barriers to adaptation; Under: Different people and places experience climate and climate change differently due to differential vulnerability and adaptive capacity. Low-income communities and those populations that are marginalized due to race, ethnicity, gender, religion, or other characteristics are likely to experience climate change impacts at a disproportionate rate, creating a greater need for adaptation. These differences also drive what adaptation options are available and/or preferred. Add: geographic location (e.g. islanders). Suggested Language: Different people and places experience climate and climate change differently due to differential vulnerability and adaptive capacity. Low-income communities and those populations that are marginalized due to race, ethnicity, gender, geographic location (e.g. islanders), religion, or other characteristics are likely to experience climate change impacts at a disproportionate rate, creating a greater need for adaptation. These differences also drive what adaptation options are available and/or preferred.	We thank the reviewer for the comment. The chapter text has been revised to incorporate a broad range of factors.
Jhoset	Burgos	Whole Page	31. Adaptation		124				Under: Key Topic 2: Current state of adaptation Under: There is limited progress on adaptation in vulnerable, frontline communities that are likely to bear a disproportionate burden of climate risk. Add: Sea Level Rise Suggested Language: There is limited progress on adaptation in vulnerable, frontline communities that are likely to bear a disproportionate burden of climate and sea level rise risk.	We thank the reviewer for the comment. There are numerous types of climate stressors, including sea level rise. Rather than explicitly name every stressor each time that we mention climate impacts, we instead have opted include a variety of case examples that reflect these different stressors. Multiple case studies thorughout the chapter touch on adaptation responses to sea level rise. The chapter text has been revised to incorporate the suggestion.
Jhoset	Burgos	Whole Page	31. Adaptation		124				Under: Key Topic 3: Adaptation governance; Under: The nation‚Äôs adaptation efforts will necessitate mobilizing hundreds of billions of dollars in substantial public and private capital, suggesting the need for new partnership arrangements and financial instruments. National and global efforts to reduce greenhouse gas emissions will have a significant influence on future adaptation needs and costs. Comment: Consider that even if greenhouse gas emissions are stabilized or reduce, some climate effects will persist for centuries. This is particularly true for sea level rise. Thus, adaptation to such effects, including sea level rise, requires planning for these imminent effect regardless of greenhouse gas emission reduction efforts.	We thank the reviewer for the comment. Our introduction now highlights the fact that many climate impacts are already happening (and will continue even if GHG emissions are reduced substantially.) We hope that the treatment of sea level rise in future drafts is considered useful.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Jhoset	Burgos	Whole Page	31. Adaptation		125				Under: Key Topic 4: System transitions and transformation; Under: Ensuring our societal systems are adaptive to climate change requires fundamental changes in how we do business across multiple systems and sectors (e.g., infrastructure, agriculture, public health, natural resources, and others); critical and valued systems differ in criteria and definition across stakeholders. Add: Sea Level Rise Suggested Language: Ensuring our societal systems are adaptive to climate change and sea level rise requires fundamental changes in how we do business across multiple systems and sectors (e.g., infrastructure, agriculture, public health, natural resources, and others); critical and valued systems differ in criteria and definition across stakeholders.	We thank the reviewer for the comment. There are numerous types of climate stressors, including sea level rise. Rather than explicitly naming every stressor each time that we mention climate impacts--or prioritizing some stressors, like SLR--we instead have opted include a variety of case examples that reflect these different stressors. Multiple case studies thorughout the chapter touch on adaptation responses to sea level rise. The chapter text has been revised to incorporate the suggestion.
Jhoset	Burgos	Whole Page	31. Adaptation		125				Under: Key Topic 4: System transitions and transformation; Under: System change can be facilitated through changes in laws, standards, and regulations that shape decision-making and behavior for effective adaptation. There is increasing awareness of how non-stationarity affects decision-making, but adaptive governance and robust decision-making under uncertainty are still growing areas of research and innovation. Flexible adaptation pathways provide a means of navigating uncertainty and complexity in adaptation decision-making and avoiding maladaptive pathways. Comment: Flexible adaptation should consider margins of safety to account for uncertainty in models and projections for of future effects of climate change and sea level rise.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Whitney	Berry	Whole Chapter	31. Adaptation	1	124	1	124	1	Key Topic 3: would be good to see more on the direct engagement of people and communities facing higher risks of negative climate impacts. There are mentions of "whole community" representation but only explicitly names government, nonprofit, and private sector actors. There is essential information about needs, priorities, existing approaches to adaptation and the context in which adaptation investments will be made that can be provided by the people and communities.	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion. Both the governance and differential impact KMs discuss impacts to frontline communities and the need to directly engage with them.
Whitney	Berry	Whole Chapter	31. Adaptation	1	124	1	124	1	Key Topic 3: Monitoring and evaluation is mentioned but the issue of adequate public accountability for adaptation decicions, finances, and implementation could be elevated	We thank the reviewer for the comment. We hope the treatment of this issue in the governance section is useful.
Whitney	Berry	Whole Chapter	31. Adaptation	1	123	1	124	1	Key Topic 2: it would be useful to include a coastal port as one of the case studies referenced in bullet 3.	We thank the reviewer for the comment. This example is being considered for inclusion as a case study in a future draft.
Whitney	Berry	Whole Chapter	31. Adaptation	1	122	1	125	1	What's New: An example is the US joining the Ocean Panel and committing to create a sustainable ocean plan for the US EEZ, along with 15 other countries	We thank the reviewer for the comment. Due to the breadth of the topic and the page limit for the chapter, we mostly focused on broad trends and this example was not included. We will share this comment with the Oceans and Marine Resources Chapter for their consideration.
Whitney	Berry	Whole Chapter	31. Adaptation	1	122	1	125	1	What's New: An example is a commitment by the White House Ocean Policy Committee (OPC) to develop ocean-climate action plan	We thank the reviewer for the comment. Due to the breadth of the topic and the page limit for the chapter, we mostly focused on broad trends and this example was not included. We will share this comment with the Oceans and Marine Resources Chapter for their consideration.
Whitney	Berry	Whole Chapter	31. Adaptation	1	123	1	125	1	Key Topic 1 Potenial Case Study: The Pointe au Chien Indian Tribe is an example of a frontline community dealing with climate change adaptation inequities: \n\nhttps://www.pactribe.com/about	We thank the reviewer for the comment. This example is being considered for inclusion as a case study in a future draft.
Whitney	Berry	Whole Chapter	31. Adaptation	1	123	1	125	1	Key Topic 2; bullet 5: Perhaps discuss the Ocean Panel's goal to implement transformations for a sustainable ocean economy. The US joined the panel during COP 26, thus committing to incorporating the Ocean Panel's transformations in a National Sustainable Ocean Plan by 2026.\n\nDocument here: https://oceanpanel.org/ocean-action/files/transformations-sustainable-ocean-economy-eng.pdf	We thank the reviewer for the comment. Due to the breadth of the topic and the page limit for the chapter, we mostly focused on broad trends and this example was not included. We will share this comment with the Oceans and Marine Resources Chapter for their consideration.
Whitney	Berry	Whole Chapter	31. Adaptation	1	123	1	125	1	Key Topic 2; bullet 5: Look to and build on recommendations from the US Comission and PEW Ocean Reports from way back, and the latest on need for comprehensive ocean management. It's the same recommendations. Let's not reinvent everything. We know what we need to do, we need action!	We thank the reviewer for the comment. Due to the breadth of the topic and the page limit for the chapter, we mostly focused on broad trends and this example was not included. We will share this comment with the Oceans and Marine Resources Chapter for their consideration.
Whitney	Berry	Whole Chapter	31. Adaptation	1	124	1	125	1	Key Topic 2; bullet 9: Vulnerable, frontline communities must be engaged during the indicator identification process to curb inequities	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Whitney	Berry	Whole Chapter	31. Adaptation	1	124	1	125	1	Key Topic 3; bullet 1: Note that Regional Ocean Partnerships (ROPS) is an effective avenue to facilitate coordination and collaboration amongst States, Tribes, Federal Agencies, and stakeholders	We thank the reviewer for the comment. This example is being considered for inclusion in a future draft. We will share this comment with the Oceans and Marine Resources Chapter for their consideration.
Whitney	Berry	Whole Chapter	31. Adaptation	1	125	1	125	1	Key Topic 5; bullet 2: This could be a good place for the Block Island Wind Farm case study: https://keeptheoceanworking.com/block-island-wind-farm/\n	We thank the reviewer for the comment. This example is being considered for inclusion as a case study in a future draft.
Paul	Grund	Whole Chapter	32. Mitigation						This chapter should include (but not be limited to) a section containing recommended regulations to reduce greenhouse gas emissions. These recommended regulations should be organized into subsections corresponding to the major categories of greenhouse gas sources. These categories should include (but not be limited to) transportation, power generation, residential and commercial construction. The transportation subsection should include recommended regulations to limit the use of gasoline vehicles, and recommended regulations to promote the use of zero emissions vehicles. The power generation subsection should include recommended regulations to limit the burning of fossil fuels in power generation and to promote the use of renewable and nuclear power sources. The construction subsection should include recommended regulations to limit the use of natural gas in new buildings, and recommended regulations to promote accommodations for electric vehicles in new buildings.	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.
David	Koweek	Whole Page	32. Mitigation		129				Under Key Topic 3, it may be worth including information about comparative analyses of various mitigation opportunities and their sensitivities. Too often the specific technologies are examined in silos without a systematic framework to understand the comparative strengths, weaknesses, readiness, needs, and barriers of the myriad options for reducing carbon emissions and for carbon removal.	We appreciate this suggestion, and the author team will consider it in our assessment of mitigation options.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Ben	Lilliston	Whole Page	32. Mitigation		129				Opportunities to reduce agriculture and land use emissions. The liquified manure systems of hog and dairy CAFOs has been identified by the EPA as a primary reason for rising agriculture methane emissions. There are currently no national-level regulations of methane for CAFOs. The EPA has the power under the Clean Air Act to regulate methane CAFOs, as it has in the oil, gas and waste sectors. A first step toward mitigating CAFO driven methane emissions is for the EPA to set new standards for methane emissions for the largest hog and dairy CAFOs. The other major source of agriculture-related GHGs is the use of synthetic fertilizers on crops. Multiple studies have shown how many farmers over-apply these fertilizers, resulting in runoff and ultimately more emissions. A regulatory or tax-based framework targeting the overuse of fertilizers could bring immediate climate benefits. In the case of both CAFO and fertilizer-based emissions, it is critical that regulatory approaches be coupled with an expansion of conservation programs that help farmers transition toward less emitting agricultural systems.	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.
Ben	Lilliston	Whole Page	32. Mitigation		130				The creation of biogas from methane digestors placed on large-scale CAFO manure lagoons has multiple risks associated with it. These digestors are enormously expensive, so only make financial sense for the largest operators. They are energy intensive, so work best in warmer climates. They are also being positioned to pipe manure-based methane into natural gas pipelines, to meet that industry‚Äôs ‚Äúrenewable‚Äù fuel requirements. Neighboring rural residents from North Carolina to California have spoken out against these digestors. The manure from these CAFOs remain after the methane has been captured, and that manure routinely pollutes the water and air in many rural communities, many of which are populated by people of color. The remaining manure waste may contain higher levels of ammonia, another toxic chemical. There are reports of frequent leaks from these digestors. Lastly, the economics are important. We are already seeing large-scale dairies with digestors receive considerable payments for their methane. The higher the payments, currently approaching the payments for milk itself, incentivize the dairy operation to get bigger and produce more manure. The result is not only more animal-based emissions, but also more manure and other pollution. This CAFO-digestor system also threatens to push smaller and mid-sized dairies who many be more pasture-based out of business. It is clear that carbon market approaches to reducing greenhouse gas emissions have performed poorly. From California to Europe, cap and trade systems have failed to reach GHG reduction targets. The prices for carbon credits are too low, there are too many credits on the market, there are too many loopholes for polluters, and there still are not effective strategies to address carbon leakage. We have enough data and experience with cap-and-trade systems to show they will not meet the urgency of the climate crisis. Climate based standards and regulations, coupled with deep investments in a low emitting, more resilient economy, have more proven benefits.	The text has been revised to incorporate this suggestion/information.
Joseph	Zajac	Whole Chapter	32. Mitigation						show the margin of error in the data and models	We thank the reviewer for the comment. The chapter text has been revised to incorporate the suggestion.
Joseph	Zajac	Whole Chapter	32. Mitigation						weak material	This comment does not appear to raise a question or suggest a revision.
Joseph	Zajac	Whole Chapter	32. Mitigation						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.	We appreciate this suggestion, and the text will quantify costs and trade-offs of mitigation as much as possible.
Roy	Clark	Whole Chapter	32. Mitigation						Comment on NCA5 Chapter 32: Mitigation Roy Clark PhD President Ventura Photonics Thousand Oaks CA 91360 The first step for Chapter 32 is the quantitative determination of the effects of the observed increases in the atmospheric concentration of so called ‚Äúgreenhouse gases,‚Äù particularly CO2 on the earth‚Äôs climate. This then provides the foundation for any actions that need to be taken. Over the past 200 years, the atmospheric concentration of CO2 has increased by approximately 130 parts per million (ppm), from 280 to 410 ppm. The concentration still increasing and is now approaching 420 ppm [Keeling, 20201]. This has produced a decrease near 2 W m-2 in the longwave IR (LWIR) flux emitted to space within the CO2 emission bands. There has also been a similar increase in the downward LWIR flux from the lower troposphere to the surface [Harde, 2017]. At present, the annual average increase in CO2 concentration is about 2.4 ppm. This produces an annual increase in the downward LWIR flux to the surface of approximately 0.034 W m-2. A quantitative thermal engineering analysis of the effects of these CO2 induced LWIR flux changes on temperatures in the troposphere, and on the land and ocean thermal reservoirs shows that there has been no measurable effect on the earth‚Äôs climate [Clark, 2013]. The results from climate models such as the CMIP5/6 ‚Äúensembles‚Äù are fraudulent and should not be used for climate assessment. The fundamental climate modeling error is the assumption of an equilibrium average climate that can be perturbed by CO2 [Knutti and Hegerl, 2008]. A ‚Äúdoubling‚Äù of the CO2 concentration from from 287 to 574 ppm at mid latitude produces a maximum increase in the tropospheric heating rate of 0.08 K per day at an altitude near 2 km. This is shown in Figure 3 [Iacono et al, 2008]. The heat that is released is coupled to the local air parcel and dissipated though a combination of broadband LWIR emission, mainly by the water bands, and changes	We appreciate the suggestions, but the author team determined that the suggested references are not particularly relevant to our chapter.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Joseph	Sollod	Whole Page	32. Mitigation		128				The built environment is central to both enhancing resilience and mitigating greenhouse gas (GHG) emissions. Buildings are our shelter against the storm, the homes of our governments and institutions, drivers of economies, and symbols of our ideals. At the same time, buildings are significant users of energy and materials ,Äì accounting for approximately 40% of global greenhouse gas emissions. Building energy codes are an important policy tool in climate mitigation. To date, energy codes have primarily been focused on reducing energy costs, energy use, and GHG emissions. However, as climate adaptation becomes a priority, energy codes are also being recognized for their contributions to resilience. Climate change is expected to result in an increase in extreme temperature events. Through provisions for efficient building envelopes and heating, ventilation, air-conditioning and refrigeration equipment plus guidance on shading and reducing solar heat gain, energy codes can reduce the impacts of such extreme events. Additionally, during these extreme events, the energy grid may become strained. Reduced energy demand to obtain comfortable temperatures through increased building efficiency can also enhance resilience of the energy grid. 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 CO2 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 2021 IECC also includes an appendix for achievement of zero energy buildings. DOE has also found that use of the 2021 IECC will save U.S. homeowners an average of $2,320 over the lifetime of a typical mortgage (30 years) and, if implemented nationally, would create over 22,000 jobs in the first year and 632,000 jobs cumulatively over 30 years. According to DOE, from 2010 to 2040, if consistently implemented and regularly updated, the model	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.
Joseph	Sollod	Whole Chapter	32. Mitigation						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. Building codes and standards provide a common language and requirements for the design, construction, and operation of buildings aimed at supporting the building industry construct safe, resilient, and sustainable structures. Building codes are a fundamental contributor to community resilience. A community cannot be resilient without resilient buildings and the codes that support their development. Resilience in the built environment starts with strong, regularly adopted, and properly administered building codes They also help protect occupants from the devastating impacts of climate change. While the perils covered by building codes can vary, they generally address climate-based risks including flooding, tropical cyclone/hurricane, wildfire/bushfire, and extreme snow through the provision of either performance or prescriptive requirements for structural loads, material properties, enclosure characteristics, and other design requirements. 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. The NIBS report also found that retrofitting structures to current codes,Äô flood mitigation requirements can provide $6 in mitigation benefits for every $1 invested and that retrofitting structures to the Code Council,Äôs International Wildland-Urban Interface Code (IWUIC) could provide $2 to as much as $8 in mitigation benefits for each $1 invested. The U.S. Federal Emergency Management Agency (FEMA) in its Building Codes Save: A Nationwide Study found that the International Residential Code (IRC) and International Building Code (IBC) provided more than $27 billion in cumulative mitigation benefits against flood, hurricane wind, and earthquake	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.
David	Solan	Whole Chapter	32. Mitigation						In The Zero Order Draft of the Fifth National Climate Assessment, Chapter 2, page 4, you stated: ,Ä¶ changes in climate drivers continue to considerably influence the Earth,Äôs energy balance. These climate drivers include greenhouse gases ,Ä¶ [C]limate change [is] influenced by the warming due to increases in greenhouse gases ,Ä¶ And in Id., Chapter 2, Page 6: ,Ä¶ allowable greenhouse gas emissions [are related to] a given maximum warming target And in Id., Chapter 3, Page 9: ,Ä¶ carbon dioxide [is a] greenhouse gas[] Similar allusions can be found repeated ,Ä¶ in that report and, virtually ad infinitum, in the media and in college classrooms all over the world today. They are the usual fare we are all being subjected to now, throughout our lives, on a day-to-day basis. The question is, is any of it true? Or is it all baseless, originating in the 1890s from Arrhenius's benighted hypothesis of carbon dioxide's infrared absorption properties in the atmosphere warming the entire Earth? The fact is that the vast majority of scientists rejected this ,Äúgreenhouse effect,Äù of Arrhenius because they found it to be a preposterous oversimplification of the cause of the temperature of the Earth ... in 1890 ... and for many years thereafter. But, around the 1990s and thereafter, they did start to come around and agree with it when it became very	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.

First Name	Last Name	Comment Type	Chapter	Figure/Table #	Start Page	End Page	Start Line	End Line	Comment	Response
Mark	Schonbeck	Whole Chapter	32. Mitigation						February 19, 2022 From:Mark Schonbeck, Research Associate, Organic Farming Research Foundation To:US Global Change Research Program / National Climate Assessment 5 Re:Additional comment and references on organic agriculture as a natural climate solution Dear Authors of NCA5 Chapter 32 Mitigation: Thank you for the opportunity to participate in the USGCRP public engagement workshop on climate mitigation, held on February 7, to outline the potential of organic farming to contribute to GHG mitigation in agriculture, and to hear the perspectives of authors of NCA5 Chapter 32 and other stakeholders at the workshop. I especially appreciated comments by Monte Frank and Yvonne Fish citing Indigenous Tribal perspectives on land stewardship and climate, Cissy Ma and Jason Hill highlighting the climate and health impacts of N fertilizer use, and several comments recommending perennial plantings including urban agriculture and green spaces as natural climate solutions. The contributions of Indigenous agricultural knowledge to soil and resource conservation are gaining recognition at last (Johnson et al., 2021), research has shown that synthetic fertilizers reduce soil carbon sequestration (Khan et al., 2007), and multiple studies have shown that diversified perennial plantings such as permaculture gardens in disused urban lots can remove several tons of atmospheric CO2 per acre annually (Feliciano et al., 2018) I have worked as a research associate with the Organic Farming Research Foundation (OFRF, https://ofrf.org) for the past seven years. During this time, OFRF has conducted in-depth review of organic agricultural research findings, published a series of science-based practical guidebooks on soil health and organic farming practices, and conducted surveys of organic farmers to assess their research and technical assistance needs. Meeting the challenges of the climate crisis facing US agriculture has emerged as a top priority for OFRF. We seek both to elevate the potential of the organic method to contribute to climate solutions in agriculture, and to better realize that potential through research-based best organic practices for soil health, carbon sequestration, nutrient cycling, and GHG mitigation, as well as improved production and	We appreciate the suggestion and have reviewed the source of information. However, the author team determined that the current references are appropriate and adequate given the chapter's space limitations.
DAnn	Williams	Whole Chapter	32. Mitigation						From: D‚ÄôAnn Williams, Johns Hopkins School of Public Health, Center for a Livable Future To: USGCRP ‚Äì NCA5 Chapter Authors Re: USGCRP NCA5 Chapter Outline Comment Disclaimer: The opinions expressed herein are our own and do not necessarily reflect the views of The Johns Hopkins University. February 19, 2022 Dear Chapter Authors, Thank you for the opportunity to comment on the United States Global Change Research Program Strategic Plan (2022-2031) Prospectus and Chapter Outlines. We are researchers at the Johns Hopkins Center for a Livable Future (CLF), an interdisciplinary research center based at the Johns Hopkins Bloomberg School of Public Health. CLF applies science and systems thinking to help build healthy, just, equitable, resilient, and sustainable food systems. We have reviewed the USGCRP strategic plan prospectus (SPP), reviewed the chapter outlines and have attended many of the NCA5 Public Engagement Workshops held by USGCRP and chapter authors. These virtual sessions have been informative, as well as interactive and inclusive. We strongly support the vison and mission of this multi-agency cooperative program to fully ‚Äúunderstand the forces shaping the global environment, both human and natural and their impacts on society.‚Äù There are four pillars for this work as stated in the USGCRP SPP: 1. advancing science, 2. informing decisions, 3. engaging the nation and 4. collaborating internationally. Under these four pillars are cross-cutting themes, diversity and inclusion, risk-based approaches, enhanced social science integration, communication, and workforce development. To adequately advance science and inform the development and implementation of climate change solutions, we urge you to stress the importance of developing multi-agency research and programs that improve our understanding of the public health implications of climate change and pathways to address agriculture and food systems contribution to climate change while protecting public health and environmental justice. Currently there are numerous gaps in our knowledge around current policies and practices and climate change and even fewer	We appreciate the suggestion and have reviewed the source of information. However, the author team determined that the current references are appropriate and adequate given the chapter's space limitations.
Joseph	Robertson	Whole Page	32. Mitigation		129				Under ‚ÄòOpportunities to reduce agricultural and land use emissions,‚Äô it may be worth considering cascade effects and intermediary business opportunities, which can accelerate the use of data to drive climate-smart agriculture and the financial system,‚Äôs ability to reward regenerative practices and land stewardship. For instance, revaluing agricultural land to account for soil carbon richness, soil moisture, and other signs of ecological resilience, can unlock credit, banking, and insurance opportunities for farmers, creating conditions commodities markets are more likely to respond to. Enhancing intermediary services available to farmers to leverage Earth systems data to better deploy nature-based climate solutions as core farming operations can attract new investment and accelerate mitigation timelines. Both policies and practices, if well designed, can lead to cascade effects that improve the overall speed at which natural systems can begin to contribute substantially to carbon drawdown objectives. Is it possible to include in the evaluation of soil carbon and land stewardship mitigation opportunities the variation in timelines that would come with these changes in policy, practice, and related finance-driven cascade effects?	We appreciate this suggestion, and the chapter text discusses the role of increased carbon storage in agricultural soils to contribute to climate mitigation, but space limitations preclude a broader discussion of this topic.
Evan	Mills	Whole Page	32. Mitigation		132				Re: Key Topic 3 Consider discussing the potential for large-scale heat pumps in industry, particularly with thermal storage. This technology is employed quite extensively at scale in other industrialized countries (and has been for decades), but is quite rare in the US and is rarely a component of local and national carbon mitigation programs and policies. Some discussion and baseline data can be found in: Alstone, P., E. Mills, J. Carma, and A. Cervantes. 2021. "Towards Low-Carbon Hot Water and Industrial Heat with Efficient and Flexible Heat Pumps." Humboldt State University, 113 pp. https://drive.google.com/file/d/1iqZ1ANdveB_bVdNxIHyKUs0pmDGkHkel/view?usp=sharing	We appreciate this suggestion, and the author team will consider it in our assessment of industry mitigation options.

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Mark	Chopping	Whole Page	32. Mitigation		128				At "Key Topic 1: Sources, trends, and goals of US greenhouse gas emissions" The entire discussion focuses on emissions, with much detail evidently expected; for example, the breakdown by sector. However, I believe we risk a naive analysis in examining emissions outside the context of the short- and long-term carbon cycles. An obsession with emissions - and only emissions and their sources - is understandable but seems to have occluded our view of the problem in its entirety. We focus with good reason on decarbonization but do not place sufficient emphasis on drawdown, which does not appear to be addressed in the subsection titled "Key Topic 2: Established mitigation opportunities", where it might be expected (though dietary shifts, avoided waste, and agricultural and land management practices that could reduce demand for inputs _are_ considered). Can the authors address this? By "drawdown", I mean leveraging managed and natural biospheric processes and some potential geologic processes (e.g., the use of ground basalt on agricultural fields), not "direct air capture", or conventional CCS, neither of which seem to be feasible at scale, and thus to have any meaningful contribution to make.	We appreciate this suggestion, and the author team will consider it in our assessment of mitigation options.
Mark	Chopping	Whole Page	32. Mitigation		129				At "The needed scale of carbon management and costs at large scale, including carbon capture and storage, carbon utilization, and carbon dioxide removal (and the related questions of residual fossil fuel use, and monitoring and accounting of carbon sinks)" I suggest highlighting the minimal potential of direct air capture (DAC) and CCS, in view of the scale of the problem - as implied in the statement. It is highly unlikely that any current or near-future technology will be able to remove carbon gases from the atmosphere on time scales that matter. In my view, recent, highly publicized "advances" in DAC and geological sequestration only serve to highlight the complete inadequacy of the purported solutions; and, furthermore, risk continued inaction on reducing fossil fuel use.	This comment is inconsistent with the report authors' thorough assessment of the science.
Mark	Chopping	Whole Page	32. Mitigation		130				Under "Key Topic 4: Critical factors that will influence or be influenced by mitigation" - there are some excellent observations and suggestions for examining many areas of vital importance, for example, consideration of a just transition to a decarbonized economy, potential difficulties with sourcing critical materials (e.g., lithium), and the enhancement of carbon sinks - but perhaps an assessment of "direct air capture" and CCS as misdirected could be included here? In other words, there is a need to avoid wasted time, public funding, and effort on activities that are at this point clearly and palpably less than helpful with respect to mitigation: we need direction on what _not_ to do, as well as on what we should be doing.	This comment is inconsistent with the report authors' thorough assessment of the science.
Megan	Susman	Whole Page	32. Mitigation		130				In Key Topic 4, I suggest including discussion of communities that are dependent on fossil fuel extraction or processing and how mitigation efforts (especially transitioning to clean energy) will affect them (opportunities for them as well as costs). The federal interagency working group on energy communities is a good source of information (you could contact Matt Dalbey at EPA dalbey.matthew@epa.gov).	The chapter text has been revised to incorporate this perspective.
Whitney	Berry	Whole Chapter	32. Mitigation	1	128	1	130	1	Key Topic 1: in bullet one, suggest adding a shipping measure to the list of sector indicators, i.e., CO2e emissions by ship's cargo carrying capacity (deadweight tonnes, or DWT) by nautical miles traveled/	We appreciate this suggestion, and the author team will consider it in our assessment of mitigation options.
Whitney	Berry	Whole Chapter	32. Mitigation	1	128	1	130	1	Key Topic 1: include the administration's commitment to zero-carbon shipping by 2050 and an illustrative pathway	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.
Whitney	Berry	Whole Chapter	32. Mitigation	1	129	1	130	1	Key Topic 3: Add "maritime shipping" to examples of difficult to electrify subsectors in subbullet one.	The text has been revised to incorporate this suggestion/information.
Whitney	Berry	Whole Chapter	32. Mitigation	1	128	1	130	1	Key Topic 1; potential figures: Maybe include a figure highlighting renewable energy potential similar to maps showing offshore wind energy potential	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.
Whitney	Berry	Whole Chapter	32. Mitigation	1	128	1	130	1	Key Topic 2; bullet 1: highlight also wave, wind, tidal and technologies that are advancing in those sectors to make technology less harmful to environment like birds, bats, marine mammals.	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.
Whitney	Berry	Whole Chapter	32. Mitigation	1	128	1	130	1	Key Topic 2; bullet 1; sub-bullet 1: Include advances in sustainable shipping technology like green hydrogen, green amonia, and other electrofuels	The text has been revised to incorporate this suggestion/information.
Whitney	Berry	Whole Chapter	32. Mitigation	1	129	1	130	1	Key Topic X: There should be an explicit "Key Topic" on established mitigation challenges to pair with the "opportunities" section. I realize there may be some overlap with the Key Topic 5	We appreciate this suggestion, but space is limited. As written, the text covers challenges alongside opportunities.
Whitney	Berry	Whole Chapter	32. Mitigation	1	130	1	130	1	Key Topic 4; bullet 1: Supply chain constraints, not having ships to build offshore wind, and siting and permitting regulations for offshore and onshore renewable energy projects are all factors that will influence or be influenced by mitigation	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.
Whitney	Berry	Whole Chapter	32. Mitigation	1	129	1	130	1	Key topic 4; bullet 1; sub-bullet 7: Include interactions with exisiting industries, for example, the conflict between commercial fishing groups and the offshroe wind industry	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.
Whitney	Berry	Whole Chapter	32. Mitigation	1	130	1	130	1	Key Topic 5; bullet 1: Details on individual offshore wind projects can be included here: https://www.northeastoceandata.org/offshore-wind-projects/	Details on individual offshore wind projects are beyond the scope of this report.