U.S. Global Change Research Program

23 November 2018

To: Dr. Robin Bell (Chair) and the
NASEM Committee to Review the Fourth National Climate Assessment

From: Dr. David Reidmiller (Director, National Climate Assessment)
and the NCA4 Writing Team

We want to thank the special committee convened by the National Academies of Sciences, Engineering, and Medicine (NASEM) for its thorough review of the Third Order Draft of Volume II of the Fourth National Climate Assessment (NCA4): *Impacts, Risks, and Adaptation in the United States*. We value the consensus study report generated by the convened disciplinary experts – under tight deadlines while juggling many other professional commitments, as all are recognized leaders in the many relevant disciplines that comprise the contents of this expansive report. We appreciate both the statements the committee made about the report overall and the detailed analyses of where we could further clarify and/or improve the statements made in the Report Findings, Overview, and in the various chapters. The NCA4 writing team took the comments very seriously and extensively revised the assessment prior to submitting a Fourth Order Draft for final agency review and clearance by the Subcommittee on Global Change Research.

The Chapter Leads prepared short responses describing how they and their respective author teams dealt with the narrative comments from the NASEM review panel. In addition, NCA4 Vol. II author teams responded to the line-by-line comments provided as Appendix A of the NASEM report; those responses are available for viewing online here.

Finally, please note the full report underwent several additional rounds of review after these responses were generated and, therefore, edits may have been made (including to chapter titles) that are not part of the attributed set of comments included on the following pages.

Report Findings

- The Report Findings have been reordered to better reflect emphasis on topics in the underlying report.
- References to impacts in all ten regions and more specific examples of response actions have been added to findings where possible.
- Additional topic linkages to energy, wildfire, biodiversity and ecosystem services, forestry, and U.S. international interests have been added where appropriate.
- Previous input from the Tribes and Indigenous Peoples chapter authors indicated that broadening the Indigenous Peoples Report Finding to include vulnerable populations as recommended by the Committee would not be appropriate. Instead, we have expanded discussion of differences in population vulnerability within and across regions in the Communities and Health Report Findings using key messages from Chapter 24: Northwest as a model.
- Greater specificity about economic impacts that are well quantified in the literature has been added to the Economy finding (infrastructure, property, human health, and labor productivity).
- The Interconnected Impacts finding has been substantially rewritten to better highlight that understanding the interconnected nature of impacts is necessary to understand and manage the full scope of climate-related risk, and additional examples of interconnected impacts have been added to other report findings where relevant.
- Characterization of advances in adaptation and mitigation actions since NCA3 has been added to the Actions to Reduce Risks finding, which also now has a better balance between mitigation and adaptation.
- Report Findings have been reviewed to ensure that the updated chapters support the text and that the relative emphasis on topics is appropriate.

Chapter 1: Overview

- The balance of Chapter 1 has shifted significantly towards a greater focus on climate-related impacts, risks, and adaptation as discussed in the regional and national topic chapters.
    - Climate science content has been reduced substantially and has been shifted to a U.S. focus. In particular, Section 1.3 (Climate Change in the United States: Current and Future Risks) is completely new and is structured around three sections that synthesize the Report Findings: Infrastructure & Economy, Natural Environment & Ecosystem Services, and Human Health & Well-Being. Greater regional content (and examples) have been added to these sections as well as select "impacts" and accompanying "response action" figures from the underlying chapters.
- References to case studies in the underlying chapters have been added.
- A unifying graphic representing a key climate impact and response action from each region has been created (Figure 1.1).
- Text has been revised to better emphasize the interconnections among regions, sectors, and biophysical and social components of ecosystems and associated risks, including through far more references to underlying chapters.
- In addition, a new box on Interconnected Impacts across systems and sectors has been added based on the Committee's recommendation that the content from Chapter 17 be given greater visibility.

- A new box (1.2: Evaluating Risks to Inform Decisions) has been added, pulling some material from the old "Why is Risk Framing a Useful Tool for Decision-Makers", but taking care to define "risk" clearly up-front, while also acknowledging that risk-framing is relevant to both adaptation and mitigation. The revamped Box 1.1 (Confidence and Uncertainty in Climate Science), when read alongside the new Box 1.2, now helps the reader draw a greater distinction between "uncertainty" and "risk" throughout the report. The idea of adaptive risk management is now addressed in the Adaptation component of Section 1.4 with Figure 1.20 adding a graphical element to reinforce the concept.
- The "What's New in NCA4?" box has been renamed to "What's Happened since the Last NCA?" and significantly expanded to serve as more of an addendum to the Overview as opposed to a fully-integrated box. It highlights the following developments since the publication of NCA3 in 2014: (1) key scientific advances (drawn from the Executive Summary of NCA4 Vol. I); (2) extreme events (drawn from NOAA's Billion Dollar Disasters that serve as proxies for the types of impacts and risks we can expect in a warmer world); and (3) new sustained assessment tools and elements of NCA4 Vol. II that can inform climate risk management decisions.
- Content on physical climate science has been substantially reduced and simplified. The Indicators graphic (now Figure 1.2) has been redesigned substantially for greater readability and accessibility to the intended audience and the focus has been shifted to U.S. indicators of change rather than global indicators.
- In an effort to increase focus on impacts content in the Overview, (former) Figure 1.2: Global Surface Temperature Attribution has been moved to Chapter 2. Figure 1.3: Global Temperature Projections has been replaced with U.S. surface temperature projection maps for RCPs 4.5 and 8.5 at midcentury. Figure 1.4: Global Sea Level Rise Projections has been replaced with a map of U.S. sea level rise projections for the RCP 4.5 and 8.5 scenarios. A graphic covering progress in adaptation responses has been added along with accompanying text on the growth of adaptation activity since NCA3.
- A number of graphics in the Overview have been revised in light of the Committee's comments, including:
    - Figure 1.1: the Indicators figure has been redesigned substantially for greater readability and accessibility to the intended audience. The focus has been shifted to U.S. (not global) indicators. The inconsistency in time periods shown is a reflection of the available data and has been adjusted where possible. Colors have been standardized and the caption has been edited to explain what the arrows represent.
    - Figure 1.2: in an effort to increase focus on impacts content in the Overview, this figure has been moved to Chapter 2 (it is now Fig. 2.1) and is referenced in a shorter, more accessible Overview section on attribution.
    - Figure 1.3: redesigned to show only RCPs 4.5 and 8.5. The legend has been expanded to include text on relative emissions levels. The date typo has been corrected.
    - Figure 1.4: replaced with a projected sea level rise map of the U.S. for two different sea level rise scenarios as described here: https://scenarios.globalchange.gov/sea-level-rise
    - Figure 1.5: the authors of Chapter 29 (where this figure originates from) have made edits to this figure that are reflected in the updated Overview chapter. Specifically, these edits include a new map that is accompanied by a bar chart plotting the number of policies and measures by state, separated by sector.

Chapter 2: Our Changing Climate

- Revisions have been made to Key Message (KM) 6 and its associated text. We have: (1) removed the wording related to the geographical distribution of the projected shift from rain to snow; (2) briefly expanded on the multiple human and natural factors that affect flood and drought, while noting that the scope of this chapter is limited to physical changes in climate, and other subsequent chapters address issues such as land use cover and change and infrastructure; and (3) refer the reader to the Climate Science Special Report (CSSR) (also referred to as NCA4 Vol. I) for additional context regarding historical and paleoclimate context for droughts and floods.
- Figure 2.2, "1986-2005" has been corrected to "1986-2015" in both the figure caption and the text.
- KM 1 text already lists the activities that contribute to changes at the global to national scale, and mention of other factors, such as biophysical changes and additional detail on land cover and land use change, is beyond the scope of this chapter. A reference to Land Use/Land Cover (Chapter 5) was added.
- We added more explanation of the mechanisms or reasons for the observed and/or projected changes, specifically highlighting: (a) the Clausius-Clapyeron relationship, (b) the relationship between warming and tropical cyclone intensity, and (c) the long-term response of temperature and sea level to warming. (The Committee also mentioned the response of the biosphere, but this is beyond the scope of this chapter).
- Our Changing Climate (Chapter 2) is intended to summarize the highlights of the CSSR (NCA4 Vol. I) report, which contains chapters on precipitation and extreme storms. Hence, a full treatment of these topics is beyond the scope of this chapter. However, we have added a short paragraph to the beginning of the chapter highlighting the strong connections between the contents of this science summary chapter and the much more extensive CSSR document. In addition, brief (1-2) sentence explanations have been added to Chapter 2 to expand on these three key topics.
- The topics of long-term response of temperature and sea level to warming are well covered in various chapters in the CSSR. Mention of these topics has been expanded slightly in the text and in Box 2.1.
- Coverage of geographic distribution of projected large-scale changes in precipitation has been expanded, as has the discussion of uncertainty in such projections.
- Additional references have been added throughout.
- To clarify, this chapter includes an entire box on climate indicators, and a discussion associated with this point can be found in the CSSR, where various chapters highlight important observations.

Chapter 3: Water

- KM 1 was modified to improve the balance of the discussion of the effects of temperature and rainfall changes. Also, the Traceable Account (TA) for KM 1 now includes detailed statements concerning changes in temperature and precipitation based on KMs in the CSSR.
- Cross-references to several other chapters in the report were added, and text added to the Regional Rollup section explicitly linking to KMs in each of the Regional chapters.
- KM 3 has been extensively revised and now clearly presents several specific examples of adaptation responses in the water sector, primarily at the municipal scale.

Chapter 4: Energy Supply, Delivery, and Demand

- Edits have been made to address how the energy system is changing and how these changes, including the expanding role of natural gas and renewables such as wind and solar, may be impacted by climate change.
- To clarify, this chapter emphasizes the greater role and contribution of public–private partnerships in addressing energy system vulnerabilities and enhanced development and deployment of resilience solutions.
- Edits emphasizing the interdependencies between the energy sector and other sectors, with additional text, case studies, and cross-referencing to other NCA4 chapters have been made.
- Additional clarifying figures have been added.
- Text and new citations were added to KM 3 to address the important role of uncertainty in energy infrastructure investment planning and integration of economic assessment.

Chapter 5: Land Cover and Land Use Change

- KM 1 and KM 2 have been modified to better articulate the effect of land cover and land use change on climate.
- Major figure modifications have been made, additional citations included, and cross-references to other chapters in the report added.
- A paragraph discussing regional-scale empirical projections was removed, and a statement about the potential positive benefits to some land cover and land use change sectors resulting from climate change (e.g., increased growing seasons) was added.

Chapter 6: Forests

- Additional text regarding specific ecosystem services was added to better describe the value of forest ecosystems for a variety of purposes.
- Additional examples of climate change effects and management responses for specific forest ecosystems were added to provide a clearer picture of regional variation.
- Biogeographic variability in climate change effects in general was further emphasized. Additional text regarding wildfire and fuels management and forest carbon dynamics was added to improve clarity.
- Cross-references to other chapters in the report were added.

Chapter 7: Ecosystems, Ecosystem Services, and Biodiversity

- This chapter has been significantly restructured. The focus is now centered around multiple scales of climate impacts: species and populations, ecosystems, and ecosystem services.
- In our adaptation KM, we have added examples of specific federal and non-federal adaptation activities. We did not have room for a new table, but some of the citations in the section link to federal management plans that readers can peruse. We added references to more specific decision support tools like scenario planning and structured decision making. To address climate resilience, we have linked the term “resilience” to the USGCRP glossary, as well as to the adaptation chapter where this term is discussed. We have added a sentence about how ecosystems can be managed to enhance carbon sequestration, and we link to other chapters where mitigation is discussed in more detail. Carbon storage is also called out in KM three as an important ecosystem service that is at risk from climate change.
- Where appropriate, the synergistic effects of non-climate stressors are discussed. These references occur in the state of sector, an entire paragraph in KM 1, and in KM 4. We have

added references to the impacts of temperature, drought, and carbon dioxide enrichment on ecosystems in the "primary productivity" section in the state of the sector. Cross-references to other chapters have been added. Because of space limitations we have not addressed equity issues.
- Additional graphics and cross-chapter references have been added
- The regional roll-up section has been refined to acknowledges that there are regional variation in impacts, and additional case studies have been added to the map that links to regional chapters in order to increase cohesiveness across the report
- The TA for KM 4 was edited to more closely align with the discussion in the KM.

Chapter 8: Coastal Effects
- Several of the Committee's comments on this chapter focused on Figure 8.2, which has been built out into an interactive figure (online) with informational pop-up boxes.
- The adaptation examples were pulled from the regional chapters and are meant to be illustrative and not a comprehensive review of adaptation activities.
- In regards to the suggestion that social equity be included in the front section of NCA4 and interwoven throughout chapters as appropriate, a discussion on social equity and disproportionate impacts has been integrated throughout the restructured "impacts" section of Chapter 1(Overview) – particularly sub-sections on Natural Environment & Ecosystem Services; and Human Health and Well-Being – and throughout the underlying chapters, as appropriate.

Chapter 9: Oceans and Marine Resources
- The chapter emphasizes climate impacts on fisheries because it brings home, in an economically quantifiable way, what is at risk from climate change in the oceans. The trend in the literature toward defining "climate-ready" fisheries management is also discussed. This is one of the strongest examples of adaptation in our sector.
- Additional economic connections between humans and the oceans, including tourism, recreation, and aquaculture were added. The discussion of cultural connections, especially with respect to indigenous peoples has been expanded. A new figure (Figure 1) explicitly calls out these ecosystem services.
- The discussion of efforts to build resilience by limiting other stressors or through conservation measures like marine protected areas and fishery management has been expanded. The interaction between nutrient inputs from the land and warming, stratification, and deoxygenation is also discussed, the most important message being that what we are seeing in the literature is the limitation of these approaches.
- Additional citations have been included, as have more cross-references to other chapters in the report.

Chapter 10: Agriculture and Rural Communities
- All KMs were revised and the chapter restructured to improve flow and clarity. Redundant text has been deleted. Additions include a section on secondary effects of erosion, runoff, leaching, and flooding on water quality and a new section on Emerging Issues, and Research Gaps.
- Figure modifications have been made, additional citations included, and cross-references to other chapters in the report added.

- Advances made since NCA3, emerging issues, and research needs have been added.
- The TAs were revised, including adding information to the roll-up section to better describe how regional input was synthesized to develop the KMs.

Chapter 11: Built Environment, Urban Systems, and Cities

- Cross-references to other chapters in the report were added, and changes were made to selected graphics to improve clarity.
- The issue of building standards not addressing non-stationary hazards is now discussed in the supporting KM 2 text.
- Text has been added to KM 4 to address that risk methods are a critical component of urban adaptation.
- Text has been added regarding the corrosion and degradation of structures due to the effects of salinity, temperature and humidity.
- TA includes confidence levels, but not likelihood, because of the lack of data at the national scale about urban areas to support the latter, per the provided author guidance.
- Social and economic systems are an extremely important topic, but an in-depth discussion is outside the scope of this chapter. In this chapter, coverage of the causes and consequences of urban social vulnerability is strong, and text was added on how social vulnerability is or is not being addressed as part of urban adaptation.
- Our assessment did not uncover enough significant advancements in the science of urban heat islands since NCA3 to warrant an extensive discussion, but the topic is mentioned in multiple places in the chapter and additional references have been added.
- TA text on uncertainty was revised to explain that monitoring is part of being able to understand how well response efforts are working and where on the trajectory of climate change a city is headed in order to inform adaptive management.

Chapter 12: Transportation

- A reference discussing interdependencies/technologies (e.g., social, economic, multiple sectors, behavior, culture or aging infrastructure, population, & land use, IT, autonomous vehicles, alt. fuels) was added, but there is a significant lack of relevant literature. This is reflected in the discussion on confidence levels in the TAs.
- Regarding the theme of building standards and risk-based design, transportation is challenged to address the changing environmental/boundary conditions rather than the standards. We have, however, added relevant information to KM 2
- Figures have been modified to improve clarity, and an additional figure has been added.
- Our TAs for KM 1 and KM 2 have been rewritten. We addressed the literature gaps, as well as the reasons for the extensive use of the gray literature.

Chapter 13: Air Quality

- KM 1 and KM 2 have been revised to frame climate-related air quality concerns in the broader context of air quality and to focus more strongly on the adverse consequences for human health of worsened air quality.
- KM 4 has been revised to emphasize the immediate air quality co-benefits of greenhouse gas mitigation. We have also added a reference to the co-benefits review paper by Gao et al. (2018) in the body of the chapter.

- Additional references (e.g., Jhun et al. 2014; Kai et al 2018) have been added to support the text on temperature-ozone associations.
- The Major Uncertainties section of the TA for KM 1 has been revised to read "Model simulations of future air quality indicate that climate warming generally increases ground-level ozone across the United States, but results differ spatially and in the magnitude of the projected signal."

Chapter 14: Human Health

- KM 1 was split into two KMs: one on risk and the other on resilience.
- The TA has been revised to provide information on the direction and magnitude of mitigation and health co-benefits. Additional information on KM 3 related to the method and data was also added to the TA.
- We refer the Committee to the 2016 Climate and Health Assessment (health2016.globalchange.gov) as this report addresses a number of issues that were raised.
- KM 2 includes a discussion of health benefits and harms that can arise from other sectors.

Chapter 15: Tribal and Indigenous Communities

- Chapter was revised to highlight issues relevant specifically to Indigenous peoples and tribal entities, including the interacting effects of past and ongoing federal policies that limit the capacity of tribes to plan for and implement self-determined actions to adapt to climate change, build their economies, and promote community health. Additional specific examples, cross-references to other NCA4 chapters, and citations were added.
- KMs were revised to provide additional specificity and clarity. Language was also added to KM 3 to emphasize that there is a history of knowledge and capacity in confronting environmental changes that offers Indigenous communities strengths in adapting to climate change, but at the same time, these strengths are severely constrained by socio-political and economic factors.
- The authors edited the State of the Sector section and reorganized the text to better integrate Figure 15.1, which is meant to serve as a regional roll-up of adaptation activities. The authors cite between figures and added text to clarify the main messages of figures.
- Figure modifications have been made, additional citations included, and cross- references to other chapters in the report added.

Chapter 16: Climate Effects on U.S. International Interests

- The discussion regarding projected change in climate along the Mexican and Canadian borders has been expanded.
- Cross-references to other NCA4 chapters and the CSSR have been added
- KM 2 has been revised to provide additional clarity and context.
- A discussion of how opening the Arctic to more shipping will affect U.S. military interests has been added.
- Additional references have been added throughout the chapter to strengthen the traceability and transparency of the conclusions made.
- To clarify, the chapter has a discussion on migration (population displacement) and has addressed food security and water through the Egypt and Syria examples. No additional text was added.

Chapter 17: Sectoral Interdependencies, Multiple Stressors, and Complex Systems

- The overarching recommendation from the Committee's review was to include more references to social systems. We have incorporated a range of references to broader societal linkages, with a particular emphasis on cascading impacts to human health in KM 1 and KM 2. We have brought forward human health impacts in the Hurricane and Northeast Blackout boxes. We have included a new conceptual diagram that motivates the chapter and includes explicit reference to the social systems that mediate interactions among systems. Societal implications are mentioned in several lists of systemic concerns. We have included some estimates of economic damages from climate-related events in the chapter, for example, in the Northeast Blackout box. However, we note that economic costs are quite difficult to estimate and total costs may be quite different than the sum of costs considered one sector at a time. For this reason, we have not emphasized economic costs in the chapter.
- The box on international trade effects was deleted and the text woven into KM 1.
- All KMs were refined for clarity. In addition, cross-references to other chapters of the report and additional citations have been added.
- Shifts in the evidence base were made to reflect literature and examples from after NCA3 (2014). We also note that, while acknowledging and referring to the broader evidence base in complex systems science, the authors have emphasized the ways in which multi-sectoral interactions and multiple stressors manifest themselves in climate change impacts. This has meant that we have limited our discussion of more general issues such as agent-based models, studies of networks, and many historical studies of emergence that are not specifically focused on climate change impact assessment as initially called out in the terms of reference for the chapter.

Chapter 18: Northeast

- To improve clarity, all KMs have been revised.
- Figure 18.7 has been replaced. This new figure is a clearer representation of projected changes to the onset of frost-free days than the original figure.
- A discussion of urban heat islands was added under KM 3. Readers are also directed to Appendix 5 for a further description of the urban heat island effect.

Chapter 19: Southeast

- Adaptation options for identified risks have been added to the KMs, and wording clarified throughout.
- KM 1 and KM 4 have been clarified and restructured to better differentiate between rural and urban impacts and the reasons for them.
- Additional content and an additional reference were included on urban heat islands and the relation to climate change.
- Cross-references to multiple chapters within the report were added, where appropriate.
- Information related to port infrastructure in Charleston, Savannah, and Jacksonville, and its vulnerability to SLR was added.
- A discussion of the Southeast Florida Compact and its updated climate action plan was added.
- Additional information was included in the TA to support the assigned level of confidence and uncertainty.

Chapter 20: U.S. Caribbean

- Additional information was included on similarities and differences between Puerto Rico and the U.S. Virgin Islands. Throughout the chapter, we've also clarified whether Puerto Rico, the U.S. Virgin Islands, or the U.S. Caribbean is being referenced.
- All KMs have been reexamined for clarity and consistency, with minor revisions to many of them. We modified KM 6 by noting the value of building sustainable institutional adaptive capacity. Where possible, we have used examples of international adaptation and mitigation initiatives. The information has been elaborated upon somewhat to emphasize the challenges in sustaining the effort. However, to go beyond this would be overly prescriptive, a result the authors felt was beyond their remit.
- Figures and captions have been revised as suggested, and additional references added.
- In terms of literature cited, we have made an effort to be as inclusive as possible with studies relevant to the U.S. Virgin Islands. However, the body of literature focusing on Puerto Rico is greater – a fact that is reflected in the balance of the literature cited.
- In the Background section, text discussing the imbalance of information and data in Puerto Rico and the U.S. Virgin Islands was added, and text was added to KM 3 identifying key coastal infrastructure for the U.S. Virgin Islands.
- Likelihood and confidence statements were added to the TAs along with supporting documentation.
- Language was added throughout the chapter to highlight distinct hazards and vulnerability characteristics for U.S. Caribbean, and commonalities with other small islands as presented in Chapter 27 (Hawai'i and U.S.-Affiliated Pacific Islands), particularly on messaging related to marine resources (impacts on coral reefs).
- In regards to Committee's suggestion related to the discussion of emissions scenarios, we resolved this based on revisions to figures (and caption) where only climate model projections using Representative Concentration Pathways (RCPs) are used. This has also been discussed in the evidence-based and uncertainties discussion in KM 1. The text referencing Figure 20.6 (streamflow projections), which does use the older Special Report on Emissions Scenarios (SRES), also explains their use.

Chapter 21: Midwest

- Information regarding the Great Lakes was added to KM 3 and KM 5.
- To clarify, KM 1includes a paragraph that discusses major categories of adaptation, including the use of irrigation (particularly in the northern portion of the Midwest).
- To clarify, KM 3 refers explicitly to the climate change/land use interaction, with supporting text discussing restoration of wetlands, prairie lands, and floodplains.
- Vapor pressure deficits are discussed in KM 2 and the corresponding figure because our forestry experts consider it a key factor which is often overlooked.
- To clarify, the text specifies that current understanding of historical drought patterns is that human activities have not played a major role, and that there is considerable uncertainty concerning future drought frequency.
- Regarding the issue of irrigation, we added some text on irrigation as an adaptive strategy. We looked at U.S. Department of Agriculture (USDA) data and the amount of irrigation in the Midwest is modest and relatively stable over time. For the Midwest, irrigation is limited by surface- and ground-water availability, soil type, crop type, commodity prices, etc., making it difficult to estimate future use due to climate change. After much discussion with

the agricultural and social science experts in our group, we concluded that significant climate-related land abandonment is not likely in the Midwest.
- Regarding TAs for the health section, references have been added to support each assertion in the KM including air quality impacts, impacts associated with high temperatures and heavy rains, risks associated with higher pollen counts, projected costs and potential adaptation options.

Chapter 22: Northern Great Plains
- We have revised KM 1 to avoid any ambiguity that this sensitivity is not just hydrological, but that water is fundamental to the key climate-related issues (agriculture, recreation / tourism, energy production, and indigenous issues) across the region.
- To incorporate better linking and cross-referencing with Chapter 10 (Agriculture & Rural Communities), we met with the authors of that chapter and agreed there are complementarities between the two chapters. Both chapters have increased linkages and cross-references as a result of this additional constructive exchange of information.
- We now provide a more comprehensive description of the region and its climate impacts. This includes a regional map that aims to: (1) illustrate the spatial variability across the region, (2) highlight variation in climate change impacts, and (3) highlight adaptation actions that have been undertaken in the region.
- Uneven representation of variability – in terms of climate, climate change, and impacts – across the region was also highlighted as a gap in the chapter. Some comments were general (lack of clarity about within region definitions or about regional differentiation of impacts) and some were very specific (e.g., missing info on dryland ag in Montana). We attempted to address these concerns by clarifying and simplifying the text.
- The Committee noted that the author team does not contain a representative from each state in the region, which could undermine report impact/credibility. In our chapter's TAs, we explained that we attempted to engage co-authors from every state (but were unsuccessful). We also explained that we did actively engage stakeholders throughout the region and that we believe we have a very strong author team that is engaged throughout the region.
- We now cite the two substantive climate assessments published for the region (Montana and Nebraska) and include a link to state climate assessments conducted within the region.
- We now explicitly identify national monuments and national parks in the discussion of ecosystems and recreation.
- We have chosen to include a brief mention of biofuels within the text as suggested since the area devoted to biofuel feedstock crops in the region is considerable. However, this is not the most important source of energy or the most vulnerable to climate change, and we believe that the level of importance does not justify inclusion in the KM text.

Chapter 23: Southern Great Plains
- All KMs were revised to improve how they characterize climate-related risk. Correspondingly, the TAs were rewritten.
- Both the projections section and background section were augmented with additional graphics to provide a visual presentation of the importance of climate change in the Southern Great Plains.
- Authors are aware of the "Texas-centric" nature of our chapter. The State of Texas comprises over 80% of our region's population and 65% of the land area. It also has a coastline

susceptible to weather hazards and ecosystem changes not shared by Oklahoma and Kansas. We took great care to try and augment the content from both Oklahoma and Kansas. We prioritized issues that all three states shared, especially as it pertained to the 2010-2015 drought. We searched diligently for case studies that would bring to light the issue of climate change in Kansas and Oklahoma. Water resources are certainly featured, as well as the important tribal and indigenous people issues found primarily in Oklahoma and Kansas, but not in Texas.

Chapter 24: Northwest

- The Summary Overview was revised to better frame the overall chapter, state what is new in NCA4, and highlight the wealth of case studies and adaptation efforts that are ongoing in the Northwest across multiple sectors.
- KM 1 and KM 2 were revised to better support the associated narrative and to be more consistent with KM 3 through KM 5.
- To point out potential effects of management and variability in adaptive capacity, the chapter has been revised to include several boxes that highlight potential management and adaptation strategies and their results.
- Additional "success" stories using ecosystems as part of the solution were added.
- References to literature discussing co-benefits of both terrestrial and coastal habitat restoration for mitigation and resilience were added.
- Text was revised to highlight the climate variability associated with the Northwest's proximity to the Pacific Ocean, and cross references to other chapters added.

Chapter 25: Southwest

- KM 1 was revised to include content on flooding. Supporting text was added to clarify the articulation of changes to snowpack and hydrology in the region. A discussion of water supply augmentation by desalination was also included.
- Text was added to KM 2 to elaborate on seasonal variability and associated humidity changes. Supporting references were added.
- KM 3 was modified to include references to the extensive work done by California state agencies and communities to reduce vulnerabilities, restore coastal habitat, and improve preparedness for the projected impacts of sea level rise, storm surge, and complex compound impacts. The text on ocean acidification and its implications for ecosystems was expanded.
- KM 4 text was modified to more specifically reflect the intent of including 'livelihoods', and references were added to the TA to provide supporting evidence.
- In regards to the suggestion to elaborate on the effects of coastal cloud cover on California coastal solar power in KM 5, the TA was edited to reflect the uncertainty in the reliability of solar generation along the California coast.
- In KM 6, we removed reference to rural livelihood, as it was not supported. Text was added to the document to reflect the broad impacts of food reduction.
- Additional references were added to KM 7.
- Additional text was added regarding urban climate issues (in the public health KM text), and an online supplement is being considered to provide a sample of climate action plans and assessments in the Southwest region was added.

Chapter 26: Alaska

- Terms unique to the Alaska chapter have been defined within the chapter as suggested.
- There were a number of comments about the use of the Mann et al 2012 publication, and the fact that forests are becoming shrublands. For clarification, the relevant text has been revised.
- The narrative in the Adaptation section thus was updated to provide examples of the types of activities being conducted in Alaska, which currently include climate change action plans and vulnerability assessments, hazard mitigation planning, and relocation of communities.
- Figures have been revised to provide additional clarity.

Chapter 27: Hawai'i & U.S.-Affiliated Pacific Islands

- With respect to comments on the statistical and dynamical projections used in the chapter and KM 1, these differences are largely addressed in the associated TA. As the Pacific Islands do not have the same breadth of downscaled projections available as the continental U.S., our region is currently limited to two products: one dynamical and one statistical. Many in the regional climate community believe it is best to present the few available projections and interpret the differences among them as indicative of the inherent uncertainty in downscaling. The supporting text for KM 4 has been modified as suggested to more explicitly link an increase in temperature to impacts on coral reefs.
- Box 27.1 is meant to provide readers with an overview of the importance of ENSO to the region, as the impacts are often only summarized for the continental U.S. at the national level. The focus of this box is the regional impacts of seasonal swings of ENSO on precipitation, sea level, and cyclones. For a more technical overview of climate variability, we have an inserted a parenthetical comment directing readers to Chapter 5 of the CSSR.
- Figures 27.7 and Figure 27.9 have been revised to provide additional clarity.
- The TA for KM 3 has been revised to include confidence language and relevant references, and the TA for KM 1 has been revised to clarify that the confidence is based on the best available data.

Chapter 28: Near-Term Adaptation Needs and Increased Resiliency

- KMs have been refined for clarity.
- As suggested, the word "forests" was deleted where appropriate.

Chapter 29: Reducing Risks Through Emissions Mitigation

- To greater emphasize that a "large number of mitigation responses have been undertaken beyond the federal government—by individuals, local and state governments, large corporations, and many other institutions", more detail was added to Section 29.3.2. Also, a new "mitigation" KM was added.
- KM 3 (originally KM 2) and Section 29.4 were revised to emphasize the importance of distinguishing between the timing of how both mitigation and adaptation actions affect risk.
- To better frame the chapter in a risk management and communication framework, the title was changed to 'Reducing Risks Through Emissions Mitigation". The text was also modified to improve the connections between the analyses summarized in the chapter and a risk management framework.
- Additional citations and cross-references to other chapters of the report were added.

Appendix 5: Frequently Asked Questions

- The majority of the Committee's suggestions were incorporated into the revised FAQs.
- The NCA4 Federal Steering Committee was involved in the selection of the FAQs for NCA4, which resulted in a mix of climate science and impacts and adaptation questions. This mix stemmed from the Steering Committee's decision to carry-over the vast majority of the FAQs contained in NCA3 (https://nca2014.globalchange.gov/report/appendices/faqs). In addition, there was a call to the NCA4 authors and Federal Steering Committee for FAQs they would felt should be included.