

Note: USGCRP requires comments to be uploaded to its portal, rather than submitted as a letter. Below are the sections where comments were requested by the USGCRP (presented verbatim as the portal states) in **bold**. Information *in italics* are the comments submitted on behalf of AMWA and the Water Utility Climate Alliance (WUCA).

General Comments

NCA5 will be GCRA compliant and will include a number of overarching themes and perspectives that respond to needs and gaps identified by NCA4. The following is a list of proposed themes for NCA5:

- **Identification of advancements or improvements, relative to NCA4, in scientific understanding of human-induced and natural processes of global change and the resulting implications for the United States.**
 - **Identification of vulnerable populations for climate-related risks and potential impacts, a theme highlighted in multiple previous assessments.**
 - **Characterization of scientific uncertainties associated with key findings.**
 - **Characterization of current and future risks associated with global change with quantifiable metrics, such as indicators, where possible, and with the needs of multiple audiences in mind.**
 - **Emphasis on 1) near-term trends and projections that can inform adaptation needs; 2) long-term projections that are more scenario dependent; and 3) in some cases, timeframes past 2100, to be consistent with the GCRA and to indicate anticipated legacy effects of the human influence on the climate and oceans.**
1. *The way that NCA3 and NCA4 were organized online made it accessible and useful to practitioners and to the public. For NCA5, USGCRP should definitely continue the practice of highlighting key messages for each section and quantifying the statements by including supporting evidence and confidence levels.*
 2. *AMWA and WUCA support the approach indicated in the FR notice that NCA5 will attempt to highlight advancements or improvements, since NCA4, in understanding of the science of human-induced climate change and the resulting implications for the United States.*
 3. *It is important for this information in NCA5 to be presented in ways that allow for decisionmakers to take action to be taken on the information. This will enable readers to quickly compare indicators that have changes and act accordingly. For example, if there is additional supporting evidence or evidence to the contrary to support a finding, or if confidence levels have changed since NCA4, this should be clearly be highlighted in the NCA5 report.*
 4. *It is good for the USGCRP to characterize uncertainty, as current and future risks and quantifiable risks and measures are other examples of good actionable information for decisionmakers. In addition, a discussion of near and long term trends – both observed and modeled with comparison/contrasts to the different models used past 2100 would be useful information to help decisionmakers – particularly those that plan for decades in the future such as water utilities – better understand the scientific basis for what is seen and may be expected in the future*

5. *The identified response to the needs and gaps identified from NCA4 are appropriate and will build well on the foundation of NCA4 and previous NCAs. Having a consistent treatment of different time frames of interest throughout the report is a sound approach. In addition, if there are any ongoing research projects at federal agencies to address any gaps identified in NCA4, it would be helpful to have these called out.*
6. *One of the key uncertainties that should be described in NCA5 is how changes in precipitation patterns will manifest themselves along certain time frames and scales on a subregional level. While trends can be identified on a regional level, describing future changes in timing and amounts of rainfall on a finer scale may be more difficult due to topographical or other features. On a regional or subregional level, quantifying what is known and unknown, and any improvements in our knowledge of precipitation changes, will be helpful for water resource managers.*

Part 1: Intro and context

This content will describe the following:

- **Context for NCA5 as noted above, including the NCA's relationship to complementary domestic and international assessment efforts.**
- **Advancements in science since NCA4, and discussion of the scientific confidence and uncertainty associated with these findings, as well as any new approaches or differences in scope relative to NCA4. This information will include any special assessments completed or in progress post-NCA4, in particular those under the auspices of USGCRP.**
- **Changing global and national conditions that influence 1) drivers of climate change, namely the activities that lead to emissions and atmospheric buildup of greenhouse gas concentrations; and 2) factors that affect resiliency and vulnerability, such as demographic and land-use changes, behavioral changes, advances in technology, and economic development.**
- **The geographic scope (see Part 4) and the temporal scope (i.e., historic to the next 25 to 100 years).**
- **Risks to interconnected natural, built, and social systems, which are increasingly vulnerable to cascading impacts of global change that are often difficult to predict. For example, extreme weather and climate-related impacts on one system can result in increased risks or failures in other critical systems, including water resources, food production and distribution, energy and transportation, and international trade.**
- **Terms and their definitions used to describe confidence and uncertainty levels associated with key statements and findings (and accompanying traceable accounts), which may be similar to those used in NCA4.**

1. *AMWA and WUCA support the outline for the introductory sections of NCA4. It is a sound approach to use the same lexicon for describing uncertainty as in the previous NCA as well as the Climate Change and Human Health assessment.*
2. *USGCRP should clearly describe any new approaches or differences in scope relative to NCA4 in its introduction and support framework.*
3. *AMWA and WUCA support the inclusion of the changing global and national condition that influence drivers – and factors that affect resilience and vulnerability. These are important changes for decisionmakers to understand.*

Part 2: Foundational physical and biological science

NCA5 will assess the state of scientific evidence regarding the physical and biological drivers of global change, with an emphasis on advances in knowledge since NCA4. This section will include the following:

- **Observations of changes in climate-related phenomena such as atmospheric composition, radiative forcing, temperature, precipitation, climate variability, large-scale climate modes (e.g., El Niño events), drought, floods and associated hydrologic events (e.g., streamflow, snowpack), sea-level rise and other physical ocean changes, biogeochemistry of land and marine systems, ocean acidification, extreme storms (e.g., hurricanes), atmospheric rivers, polar changes (including permafrost and land-ice dynamics), ice-sheet dynamics, and attribution of physical and biophysical processes to human activities. Where appropriate, descriptions of observed changes specific to the United States at national and subnational scales.**
 - **Future projections of changes in Earth system processes based on modeling results of the Coupled Model Intercomparison Project (CMIP). Treatment of future scenarios, and associated risks and impacts as described below, will emphasize the most recent literature (i.e., CMIP6), with CMIP5 and other future scenarios included as determined by the available literature.**
1. *It is important to continue to present the foundational science. In doing so, USGCRP can reference previous volumes available rather than reinvent the wheel by repeating information available in previous NCAs. However, USGCRP should bolster the foundational science by referencing observations and trends and information from new studies not previously mentioned in NCA documents.*

Part 3: Human health and welfare, societal and environmental vulnerabilities to a changing climate

The GCRA of 1990 requires that the NCA analyze “the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity.” NCA5 will provide national-level overviews of observed and potential effects and projected trends in these key areas of concern for people and the environment, with supporting regional information, as described under Part 4.

To better understand global change, non-climatic trends (e.g., population changes) will be briefly discussed in order to set a broader context within which the effects of climate change can be understood. Current and future risks, impacts, (including differential impacts), and benefits will be identified in each of these topic areas, using quantifiable metrics, such as indicators, where possible. The impact of extreme events in each area will be addressed where possible. In addition, potential adaptive measures to minimize risks will be described for each area, to the extent these are identified in the published literature.

In addition to coverage of these mandated topics, the following additional specific areas are proposed for inclusion in NCA5: land cover and land use change; forests; ecosystems and ecosystem services; coasts; oceans and marine resources; built environment; urban systems; air quality; effects on tribal and Indigenous communities; economics; and international effects, in particular those that may raise environmental, humanitarian, trade, or security issues for the United States.

AMWA and WUCA support the inclusion of the specific sections described to discuss climate change implications to human health and welfare. USGCRP should also consider a discussion of the cross-sector implications across the water-energy-land nexus. AMWA and WUCA also support the plan to continue to build on the sections that include a discussion of implications for urban systems and the built environment, as this would be a continuation of NCA4 discussions on urban systems and infrastructure vulnerability.

Part IV: Regional Analyses within the United States

This section will describe regional-level perspectives for each of the areas identified in Part 3, allowing for discussion of topics of interest to each region.

The proposed regional analyses for NCA5 will follow the model developed for NCA4, which included the following regions of the United States: Northeast, Southeast, U.S. Caribbean, Midwest, Northern Great Plains, Southern Great Plains, Northwest, Southwest, Alaska, and Hawai'i and U.S.-Affiliated Pacific Islands (see nca2018.globalchange.gov/chapter/front-matter-guide/#fig-1). Areas of focus will vary across regions based on the availability of research and the regional identification of needs.

As appropriate and where available, the perspectives described in Part 4 will also highlight state-level information, as well as urban and rural case studies to showcase climate trends, potential risks, and resiliency planning with local specificity.

- 1. AMWA and WUCA agree with the approach for Part 4, and support a subregional discussion for this section. The NCAs have traditionally discussed regional implications and trends, and this should definitely continue.*
- 2. One of the key uncertainties that should be described in NCA5 is how changes in precipitation patterns will manifest themselves along certain times and scales on a subregional level. While trends can be identified on a regional level, describing future changes in timing and amounts of rainfall on a finer scale may be more difficult due to*

topographical or other features. On a regional or subregional level, quantifying what is known and unknown, and any improvements in our knowledge of precipitation changes, will be helpful for water resource managers.

- 3. Part 4 of the framework proposes evaluating at a regional scale the topic areas of human health and welfare, societal, and environmental areas that are vulnerable to a changing climate. We think it's important to provide regional (and sub-regional) analysis of current observed trends and future projections (Part 2), not just a presentation of vulnerabilities (Part 3). As essential service providers we are best able to assess our own vulnerabilities, but those vulnerabilities depend on the projected changes anticipated for our region in the future. Previous NCAs (NCA3 & NCA4) provided some regional analysis of projected changes. This information is a useful reference to put local projections into a regional context. Additionally, it is useful to see how regional trends and projections change from previous NCAs as climate models evolve.*

Part V: Information to support climate adaptation, increased resilience and risk reduction

Part 5 will identify needs and opportunities for adaptive measures and resiliency planning in the face of observed and projected changes in climate. NCA5 is not a policy document, and therefore will not evaluate policy measures, actions, instruments, or mechanisms to deliver or incentivize either adaptation or mitigation responses at any level of government. Rather, the intention of NCA5 is to inform the Nation, and different regions within the Nation, about near-term adaptation and resiliency needs over the next few decades that are likely to persist regardless of emissions pathway. Adaptation and resiliency needs and opportunities will be drawn from relevant information from Parts 2, 3, and 4 as outlined above, including evidence of successful measures, and discussed in the context of literature described below.

Review of the following is proposed for inclusion in Part 5:

- Recent literature on economic impacts across sectors, regions, and levels of warming.
- Recent literature on the potential for greenhouse gas emissions mitigation through natural and technological solutions.
- Recent literature describing case studies (see Part 4), where relevant.

Links to U.S. government decision-support tools (e.g., the U.S. Climate Resilience Toolkit, [toolkit.climate.gov](https://www.climate.gov/toolkit)) will also be included here, where relevant.

- 1. This is an important section to include – as it is applied information to build on the assessment for the future. Identification of near-term adaptation needs will flow well from adaptation progress that will be detailed in Sections 3 and 4 of NCA5. USGCRP should continue to link to information already available in the Climate Toolkit is appropriate.*
- 2. AMWA and WUCA support showcasing case studies with local specificity, trends and risks. Regarding resilience planning, if information about what has worked and what has not and key implementation approaches (not just planning approaches) can be included, this would make for a stronger discussion. By now many areas have moved beyond the*

planning stage and have taken steps to implement these plans. Some of this information is in the Climate Toolkit as well as in the Engineering Case Studies report from the Water Utility Climate Alliance (<https://www.wucaonline.org/adaptation-in-practice/engineering-case-studies/index.html>)

3. *AMWA and WUCA also recommends that this chapter include information for how to measure risk reduction across the country on regional and sectoral scales.*
4. *NCA5 should consider developing benefit-cost ratios for mitigating the effects of hazards caused by climate change through adaptation planning and highlighting the work of organizations that have already done this. For example, the National Institute of Building Sciences released a [report](#) (12/2019) that builds on their 2017 report that suggests a 4:1 cost: benefit ratio for hazard mitigation work. In addition, [work by FEMA](#) suggests that every dollar spent on resiliency equals \$6 in future cost avoidance/savings.*