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Background for Workshop on Methods for Characterizing Risk in Climate Change Assessment

The Global Change Research Act of 1990 requires a quadrennial report to inform the Nation about global changes and anticipated trends for the future. The National Climate Assessment (NCA) responds to this mandate. It is intended to be "used by the U.S. Government, citizens, communities, and businesses as they create more sustainable and environmentally sound plans for the future." An emerging area of focus for USGCRP is strengthening the capacity to conduct assessments on a sustained basis.[1] A sustained assessment process facilitates continuous and transparent participation of scientists and stakeholders across regions and sectors, enabling new information and insights to be synthesized as they emerge.

Decision making in the face of climate change is ultimately about understanding and managing risk. Among the NCA's objectives are to create awareness of the risks of climate change (including both likelihoods and anticipated consequences of climate-related events), interactions of climate trends with other trends in American economy and society, and potential impacts over coming decades on the Nation's key human and natural systems. The NCA highlights risks within regions and sectors of the country, and connections among risks to different sectors and between the adaptation and mitigation options implemented to reduce risks. For example, actions to reduce risks to water resources can affect the vulnerability of agricultural and energy systems to climate change.

Decision makers turn to the scientific community for information about the climate-related hazards and opportunities they may face, and about best practices for managing climate-related risks. They want information that is accessible, useful, and understandable, and that can be easily used as inputs to decisions they currently – or are about to – face. They want to know about individual hazards, and about the possible consequences of particular choices on risks overall. They want a sense of the certainty and accuracy of the information they receive. And they want information that facilitates comparisons – e.g., between alternative actions they are considering, or between the past, present, and the anticipated future – so that they thoughtfully and explicitly confront tradeoffs.

As the NCA moves further into the domain of evaluating *risks*, rather than mainly cataloguing recent and projected future *impacts*, it needs to be cognizant of the wide range of contexts that will attend specific decisions. Decision makers vary greatly in terms of characteristics of place (geography, environmental challenges, etc.), the kinds of decisions they seek to inform or make, their values and degree of risk tolerance, their socioeconomic circumstances, and the ways climate change and its effects might influence the choices they make. For example, they may want information to help in efforts to reduce greenhouse gas emissions; to help reduce vulnerability or increase resilience to climate change in the regions, sectors, or entities for which they are responsible; to undertake long-term monitoring or planning; to identify new economic opportunities; to estimate the magnitude of potential losses; or for other purposes. Because of all these differences, the NCA's varied audiences seek many different kinds of information to support their planning and decision-making.

Clearly, the NCA cannot tailor products and information appropriate to each decision. It can, however, build a foundation to support and enable decision-makers to make better informed choices. In working to characterize risks in decision-relevant ways, a key challenge for the NCA is to develop approaches that generalize without losing too much of the content that makes risk assessment, communication, management, and governance useful.

The NCA has mainly addressed risk in two ways: (1) through explicit or implicit statements about the probabilities of future changes in key climate variables, such as temperature or precipitation, for example by showing ranges of future changes in these variables across multiple climate models and emissions scenarios; and (2) by qualitative, narrative connections (e.g., in the 'water' or 'agriculture' chapters) between a given climate change under discussion, associated biophysical impacts of that climate change, and potentially affected socioeconomic systems. The NCA3 provided guidance to authors about identifying and evaluating key risks as part of constructing these chapter narratives.

The purpose of this workshop is to help the designers of and participants in the NCA process identify and implement methods for characterizing the risks of climate change, which will help the highly varied users of the NCA better understand the range of risks—environmental, social, and economic—they face, including what is known about these risks and what is uncertain.

Standard risk assessments are unlikely to be adequate for characterizing climate change risks because the assumptions that underlie these techniques typically do not account for multiple, interacting factors that change over time, and that vary over spatial scales because of differing vulnerabilities and capacities. For climate change risks, approaches that account for linked decisions and cumulative effects will be needed to consider how risks and the consequences of risk management choices could evolve over time with continued climate change and development.

Some useful methods for assessing climate risks might involve the use of formal tools to represent the socioeconomic effects of biophysical outcomes quantitatively,[2,3] or otherwise to convert quantitative and qualitative risk information from technical analyses into terms and metrics that will be helpful to decision makers.[4] Other methods might involve communication processes that foster depth and breadth of understanding about climate risks by engaging producers and users of risk information in analysis, deliberation, and dialogue.[5,6]

In the first part of the workshop, we are asking speakers to discuss key issues regarding how to conduct a national assessment of the risks of climate change that has risk management as its core purpose:

- Approaches for framing a climate change risk assessment that could inform how author teams approach writing their chapters;
- Challenges of representing the range of biophysical consequences of climate change and their interactions with social and economic changes that matter to decision makers;
- Challenges of representing how development pathways (and the vulnerabilities and capacities they influence) could alter the context for decisions and thereby affect their appropriateness and effectiveness;
- The state of knowledge about the likelihoods of risks being realized as impacts across spatial and temporal scales under different assumptions of climate and development, and the degree of confidence in our scientific understanding;

- Available methods and processes for making information about the knowledge and uncertainties understandable, credible, and useful to decision makers.

Ultimately, the NCA needs to address these issues for the wide variety of relevant consequences, affected regions, social and economic sectors, decision makers and participants in decision-making processes, and time frames within which choices affected by global change must be made. We intend that workshop participants will consider the above issues in the specific and the general. For example, are there specific metrics of risk, or other ways of characterizing risk, that may be applied broadly across decision types and contexts? How might the NCA take into account the strengths and limitations of existing and novel ways of characterizing risk to support a broad range of risk management decisions? How might the NCA engage with other non-federal and non-governmental entities concerned with informing climate-affected decisions so as to make understandable, credible, and useful information available to the great variety of affected decision makers from readily accessible and trusted sources?

To help workshop participants consider these questions, the workshop will include sessions focused on three case examples intended to bring to life the concepts outlined above. This part of the workshop will help make more concrete the benefits and challenges of creating a risk-based climate information system that will be understandable, credible, and useful to a wide range of decision makers.

The last several hours of the workshop will provide time for discussion of ideas about how the NCA can meet the challenges it has devised for itself.

Resources

(1) US Global Change Research Program, What we do/assessment. http://www.globalchange.gov/what-we-do/assessment
(2) Climate Change in the United States: Benefits of Global Action (CIRA report) http://www.epa.gov/cira
(3) Risky Business: The Economic Risks of Climate Change in the United States http://riskybusiness.org/site/assets/uploads/2015/09/RiskyBusiness_Report_WEB_09_08_14.pdf
(4) Valuing the Protection of Ecological Systems and Services http://yosemite.epa.gov/sab%5CSABPRODUCT.NSF/F3DB1F5C6EF90EE1852575C500589157/$File/EPA-SAB-09-012-unsigned.pdf
(5) Understanding Risk (executive summary) http://www.nap.edu/read/5138/chapter/2
(6) Informing Decisions in a Changing Climate (executive summary) http://www.nap.edu/read/12626/chapter/2