Scenario Planning Workshop March 31-April 1
Tucson, Arizona
Background Materials

Center for Climate Adaptation Science and Solutions
University of Arizona
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Introduction

This introductory paper is intended to outline the goals of the March 31-April 1 workshop, "Scenario Planning for Climate Change Adaptation Decision Making: The State of the Art." In this brief paper, we define terms that will be used in the workshop, introduce a few of the types of scenarios to be examined, and identify initial relevant resources from the literature.

Decision-makers and managers are increasingly being asked to make decisions in the context of uncertainty, with climate change adding new sources of complexity. We've observed that scenario planning is being used as means of providing managers with insights into options for responding appropriately to change in the near and long term. The increasing use of scenario planning prompts some questions, such as:

- What is the state-of-the-art in scenario development?
- How can uncertainty within scenarios be communicated effectively to stakeholders and what types of scenarios are appropriate and beneficial to pursue in a given context?
- In using scenario planning methods: What works where, when, and why?
- How can the effectiveness and utility of scenario planning processes be enhanced?

This workshop will explore lessons learned in applications of specific techniques as well as connections between the different methods that have emerged, with respect to how they frame uncertainty and how they function in a decision support context.

The workshop will focus on several alternative science-based approaches and modes of engaging stakeholders in scenario planning, while promoting scholarly work to assess the state of the art. We hope to address the challenge posed by Pahl et al. (2014): "If there is a genuine desire for an integrative negotiation of our climate change futures it is imperative to improve how we engage people and practitioners in envisioning the future, acknowledging the future implications of their current lifestyles and community choices, and getting involved in decision-making and action."

Some of our key concerns include:

- To what extent is scenario planning the answer to this challenge?
- What is needed to move scenario planning forward in various contexts?
- How can what is learned be better integrated into organizations, programs, and agencies?
- How can we best provide a broader understanding of methods, their respective value, and their appropriateness to particular decisions or problems encountered by prospective users of scenario planning methods?
- What other resources are needed to improve scenario planning processes?

Motivation and objectives for workshop:

- Gain a better collective understanding of scenario planning methods, the value of various methods, and the suitability of various methods to different types of decisions or problems.

- Clarify theoretical and practical issues about methods.
- Demonstrate, through case studies and discussion, the methods and processes that are used and useful.
- Articulate the characteristics of each method and derive a typology of scenario planning methods for use by scenario planning practitioners, researchers, and potential users of scenario planning. The proposed typology will include assessment of synergies between methods and information flows from method to method, from those that characterize uncertainty (e.g., originating from climate models) to those that embrace uncertainty.
- Describe their application to decision making, including experiments and mixing methods.
- Work toward providing practitioners with a broader toolkit of scenario methods and techniques for decision makers and improve connections with local and regional planners.
- Produce a co-authored paper on the state of using scenarios in climate adaptation planning. The proposed audience for the paper includes climate science translators, adaptation practitioners, scenario planning practitioners, and scholars of climate change adaptation.
- Identify research, institutional, and resource needs to improve the information available and the flow of information across methods in specific applications.
- Contribute to curriculum and training opportunities broadly.

Definitions

In general, scenarios are plausible descriptions of the future used to envision unpredictable future conditions. They range from verbal descriptions of future circumstances (often called 'narratives' or 'storylines') to complex quantitative representations of socioeconomic, climate, or environmental conditions. Some scenarios combine both narrative and quantitative aspects.

Scenarios are not predictions or forecasts. Typically they are used when uncertainties are so substantial that they cannot be assessed using standard probability methods. When applied in climate change research, scenarios help to evaluate uncertainty about human contributions to climate change, the response of the Earth system to human activities, the impacts of a range of future climates, and the implications of different mitigation and adaptation measures.

For our purposes at the workshop, we can group scenarios into several broad categories by their primary use, including (1) scenarios for helping groups to plan goals and strategies, (2) scenarios used to coordinate research, and (3) those that integrate planning and climate research. Scenarios for participatory adaptation planning, as described in may projects and case studies that will be discussed at the workshop, often combine both visioning and information from climate-related research.

Here we provide a few definitions, mostly to remind participants of the need to use a 'modifier' in front of the word 'scenario' to be clear about what type of scenario you are referring to. The 'outputs' of one scenario activity can be seen by someone else as 'inputs' to another, and without stating clearly what type of scenario we're each talking about, confusion could mount quickly. Please note that these groups are not in any sense mutually exclusive – increasingly, mixed methods are adopted in many research and planning applications.

General:

- **Bottom-up approaches**: analysis or scenario methods that begin with analysis of the details of a system or decision that is of interest and then identifies general contextual trends or conditions that affect the system or decision.

- **Mixed-method approaches:** methods for scenario development that use elements of both a scenario planning approach, in which participants determine the purpose, substantive focus, and character of a scenario development effort, and other planning methods or scientifically derived scenarios, which can be used at points in the process to identify broader socioeconomic, climate, or other conditions that could affect relevant aspects of the future.
- **Top-down approaches:** methods that analyze general trends or properties of a system (e.g., global socioeconomic trends that give rise to emissions, then climate scenarios) to depict the broad context of future conditions which impact specific places, entities, or how decisions play out.
- **Uncertainty**: a description of the extent to which something is unknown. Uncertainty can arise because of a lack of information and/or disagreement about how to interpret the available information. It can also arise from ambiguous definitions, lack of understanding of underlying processes, errors in observations, lack of model skill, and other sources. Uncertainty can be represented both qualitatively (e.g., terms used by experts to describe the state of knowledge) or quantitatively (ranges of future variables as well as other statistical properties).

Visioning or planning-related definitions (including a few mixed methods approaches)

- **Exploratory scenario –** a scenario that is used to explore the implications of a possible future on predetermined goals and values (Holway et al. 2012).
- **Interactive and immersive visualization tools –** consist of a range of visual and spatial media derived from modeling, data, scenarios, and descriptive narratives used to contextualize and communicate climate change information in two and three dimensions at the local or regional level (Sheppard et al. 2011).
- **Mental model testing –** making a group's mental model of how things work based on their successes explicit so it can be discussed and compared to other scenarios.
- **Normative scenario** – a scenario used to help identify a desired future (Holway et al. 2012).
- **Participatory process –** "a purposefully designed set of activities structured around framing (including clarifying objectives and identifying participants), a set of participatory activities that can include workshops and engagement of participants through other means such as social media or technology such as decision theaters, and a set of outcomes that could be a decision, a community plan, a report, films/audios, or other forms of knowledge sharing or exchange" (Moss et al. 2011).
- **Wind-tunneling –** after building the event or endstate scenarios, the testing of alternative decisions for robustness. In this case, the scenarios are used for context.
- **Decision scaling**: "a new approach to using climate information within a decision making framework that links bottom-up, stochastic vulnerability analysis with top down use of GCM projections " (Brown et al. 2011a). Decision-scaling begins with a bottom-up analysis to identify a climate condition that impacts a decision and then uses sources of climate information such as GCMs to identify how often such conditions occur under different climate scenario.

Climate-science related definitions:

- **Socioeconomic scenarios**: narrative and/or quantitative descriptions of plausible patterns or pathways of demographic change (fertility, mortality, migration, and other factors that affect the size and location of human populations), economic development (patterns of trade, employment, economic development, etc.), technology (for energy, agriculture, water resources, etc., considering factors such as efficiency, fuel sources, and others), and

institutions (types and effectiveness of governance arrangements, patterns of association in civic organizations, etc.). These factors are important for understanding human contributions to climate change as well as the vulnerability or resilience of society. Historically, these scenarios have been developed to inform emissions scenarios.

- **Emissions scenarios:** descriptions of potential future emissions to the atmosphere of greenhouse gases and other radiatively important gases and particles that are used to explore the implications of alternative energy and technology futures and provide inputs to climate models (Moss et al. 2011).
- **Climate scenarios:** plausible representations of future climate conditions (temperature, precipitation, and other factors) produced using a variety of techniques including scaling of observed climate, spatial and temporal analogues in which climates from other locations or periods are used as example future conditions, extrapolation and expert judgment, and mathematical climate and Earth system models. All of these techniques continue to play a useful role in development of scenarios, with the appropriate choice of method depending on the intended use of the scenario (Moss et al. 2011).
- **Environmental scenario –** these **"**focus on changes in environmental conditions such as water availability and quality, sea level rise (incorporating geological and climate drivers), land cover and use, and air quality. Climate change can drive changes in these factors, or scenarios can represent independently caused variations. The potential impact of climate change and the effectiveness of adaptation options cannot be understood without examining interactions of changes in climate, environmental conditions, and human responses."(Moss et al. 2011).
- **Climate model ensemble**: a group of climate model simulations that use the same assumptions. Large ensembles are used to generate information about natural climate variability and to characterize uncertainty from different sources, such as different initial conditions or model differences.

Case studies – (PowerPoint summaries will be accessible in advance of the workshop. These are primarily intended to stimulate discussion. Other methods and approaches will also be discussed throughout the workshop).

- *NPS Climate Change Response Program* (embracing uncertainty) (Star, Welling) **–** The traditional NPS approach was to follow a preferred alternative future for 15 to 20 years and pursue that outcome. NPS is beginning to use a series of plausible futures in its Climate Change Response Program and has initiated a set of workshops to assist landscape adaptation efforts and other responses. Under guidance of the Global Business Network, NPS has focused on educating staff and partners on the utility of climate change scenario planning. (Weeks et al. 2011; NPS 2013).

- *Structured scenario planning/ Future Mapping/participatory scenario creation* (visioning, management) (Hornbach, Mason) **–** This approach seeks to establish event roadmaps for flexible planning, using highly prepared meetings, with all participants interviewed in advance, and scenarios divided into end states (outcome at planning horizon) and events that must occur or not occur to lead to that outcome. (Mason et al. 2012)

- *Adaptation for Conservation Targets* (ACT) (develop actions, break paralysis) – piloted by the Southwest Climate Change Initiative (SWCCI) at workshops in 4 southwestern U.S. landscapes. The workshops fostered cross-jurisdictional and multidisciplinary dialogue on climate change through participation of scientists and managers in assessing climate change effects, discussing the implications of those effects for determining

management goals and activities, and cultivating opportunities for regional coordination on adaptation of management plans (Cross et al. 2012).

- *Land use and transportation planning* (A. Sussman) – Through a pilot project and partnership with the FHA and US DOT Volpe Center, the New Mexico Mid-Region Council of Governments incorporated scenario planning and climate change analysis into its long-range transportation planning process for the Albuquerque area. The resulting policy document, *Futures 2040 Metropolitan Transportation Plan* (MTB 2015), identifies regional challenges ranging from congestion patterns, growth policy, and natural resource pressures, and analyzes how encouraging development in key centers and corridors results in a the region that is more resilient to climate change and produces less GHG emissions.

- *Decision scaling or thresholds approaches* (C. Brown) – risk analysis and management process designed for use in water resources planning and management under climate change. Brown has used decision scaling to incorporate climate information, in a process whereby information related to climate projections is tailored for use in a decision-analytic framework, as in in the International Upper Great Lakes Study (Brown et al 2011b; Moody and Brown 2012).

- *Visualization of qualitative scenarios and visioning processes* (S. Shepard) – Shepard has used a conceptual framework to generate alternative, coherent, holistic climate change scenarios and visualizations at the local scale, based on quantitative and qualitative information, in collaboration with local stakeholders and scientists.. It provides a template for a process to integrate emission scenarios with mitigation and adaptation strategies, and link local manifestations of impacts and responses with global climate change scenarios. (Sheppard et al. 2011)

Discussion sessions will address framing the issues, along with inputs and outputs; the planning process, applications, connecting approaches, and mixing methods; a typology of approaches (discussion to be initially guided by attached chart); and outputs, including guidance, scholarly articles, and future workshops. See workshop agenda for motivating questions for each discussion session.

Attachments: Starting place for discussion of frameworks

Attachment A: Draft Typology framework (developed by planning committee)
Attachment B: "Ways of Characterizing the Future" graphic
Attachment C: Ecology of scenarios (information flows from Hartmann)

References and Recommended Reading

(access to online versions on non-open-source material is dependent on agreements between the publisher and your home institution)

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