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Supporting adaptation decisions through scenario planning: Enabling the effective use of multiple methods

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ABSTRACT

Scenario planning is a technique used to inform decision-making under uncertainty, and is increasingly applied in the field of climate change adaptation and policy. This paper describes applications that combine previously distinct scenario methods in new and innovative ways. It draws on numerous recent independent case studies to illustrate emerging practices, such as far stronger connections between researcher-driven and participatory approaches and cycling between exploratory and normative perspectives. The paper concludes with a call for greater support for, and collaboration among, practitioners with the argument that mixed methods are most effective for decision-making in the context of climate change challenges.

1. Introduction

Projecting likely changes in climate and their consequent effects on resources and facilities is a significant focus for climate scientists and adaptation specialists. Using this information, managers can assess threats and more effectively allocate resources. However, projecting future climate always has a degree (sometimes large) of uncertainty, given current capabilities and the realities of complex systems (Kirtman et al., 2013). And while tempting, choosing only to focus on more certain projections limits decision-makers' abilities to effectively and appropriately prepare for climate change. Consequently, decision-makers are embracing scenario planning (SP), a technique that recognizes the limits of projections, acknowledges

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deep uncertainty, and helps managers prepare for future conditions outside currently observed trends (Maier et al., 2016; Walker et al., 2003).

SP is a practical way to explore a range of future states and consider alternative response options (Peterson et al., 2003). The process creates a limited set of alternative futures (scenarios) that span key uncertainties, providing a foundation for discussions about policy development, the relative efficacy of management options, innovation, and community visions. Scenarios are not predictions, and the process does not assign likelihoods to particular future conditions. Rather, SP broadens conversations to include a range of potential responses, encouraging organizations to act despite uncertainty and retain flexibility in preparing for an unpredictable future (Maier et al., 2016; Weeks et al., 2011).

Scenario approaches have proved beneficial to organizations and communities grappling with climate and other global forces (Means et al., 2005), and SP is increasingly recommended in climate change adaptation planning and policy (NFWPCAP 2012, USGCRP 2011). Simultaneously, the diversity of scenario methods poses challenges for practitioners and scientists, creating confusion and often hindering more extensive application. To address this need for clarity and guidance, SP researchers and practitioners from the US and Canada gathered at the University of Arizona in March 2015 to discuss varied and emerging methods of scenario development in climate adaptation planning (Garfin et al., 2015).

Case studies (Table 1) revealed that previously distinct approaches to SP are evolving as practitioners integrate them with other tools to address strategic issues relating to climate change. Participants concluded that scenarios are most effective when they incorporate both divergent and convergent processes, encouraging the generation of multiple possible futures as a prelude to focusing on a preferred future or set of options.

2. Distinct scenario approaches

Given the scope of scenario work and variety of methods, much effort has been placed on creating typologies that emphasize distinctions between scenario approaches (Wilkinson and Eidinow, 2008; van Notten, 2006). We review the essential features of these distinctions, then demonstrate their blending in recent climate change adaptation efforts.

Table 1
SP methods highlighted at the March 2015 workshop.[1]

Organization/agency/lead	Method(s)/ownership of process	Purpose of scenarios
A. National Park Service/Jonathan Star, Leigh Welling (Weeks et al., 2011; Rose and Star, 2013)	Climate Change Response Program: Combines expert climate analysis (development of a climate drivers table and synthesis of projected impacts) with participatory engagement to create, assess, and identify responses to scenarios	Describe several plausible futures that facilitate the definition of goals (desired conditions) and management options under changing circumstances to inform existing planning/decision processes
B. Adirondacks Futures/David Mason & Kathy Hornbach (Mason and Herman, 2012)	Futures Mapping: Participatory process, involving diverse sectors, built from intensive input solicited in advance to develop events used to create pathways to desirable and undesirable end-states	Determine desired outcome(s) for a chosen planning horizon to enable monitoring of events that must occur to lead to that outcome and identify corrective actions to counter undesirable outcomes
C. Southwest Climate Change Initiative/Multiple Applications (Cross et al., 2012, 2013)	Adaptation for Conservation Targets (ACT): Draws on existing climate projections, climate experts and topical research to develop scenarios that are applied in a practitioner-dominated participatory process	Consider impacts of multiple climate change scenarios on species, habitats, processes and their existing conservation goals to determine if and how to alter management
D. New Mexico Mid-region Council of Governments/Aaron Sussman (MTB, 2015)	Land Use & Transportation Planning: Combines normative land-use SP with travel-demand and land-use models (e.g., UrbanSim), plus participatory climate change SP, building from U.S. Bureau of Reclamation projections of future regional climate conditions (2013) (e.g., changes in water supply/demand, flooding, fire risk)	Generate a preferred scenario for 20-year growth that is also resilient to climate impacts, produces low GHG emissions, and improves air quality in the Albuquerque, NM area
E. Utilities in City of Colorado Springs, CO/Casey Brown (Brown et al., 2011; Moody and Brown, 2012)	Decision Scaling: Employs a decision-analysis framework (often participatory) to identify a subset of climate scenarios based on climate sensitivity (stress test) of the decision model from the complete set of GCM projections. Combines quantitative techniques of stochastic analysis to test system performance under a wide range of conditions (decision thresholds) to determine which climate projections to apply in risk estimation	Identify best option for water resource systems, conditioned on the weight of climate-projection-based evidence. Climate projections are used to develop risk-based weightings for prioritizing among options (consequence analysis), rather than characterizing risk
F. Communities in Vancouver Canada area/Stephen Sheppard (Sheppard et al., 2011)	Participatory, community-level involvement in scenario building using structured visualization supported by expert integration of data and modeling, including climate-change projections and local geospatial information	Visualize future climate-change scenarios and their impacts, and explore alternative solutions to facilitate community engagement and build awareness/capacity to support decisions

[1] Presentations are available at the workshop website: http://ccass.arizona.edu/spworkshop.