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EDITORIAL

Where next with global environmental scenarios?

Brian O'Neill

National Center for
Atmospheric Research
(NCAR), USA and
International Institute for
Applied Systems Analysis
(IIASA), Austria

Simone Pulver

Watson Institute for
International Studies,
Brown University, USA

Stacy VanDeveer

University of New
Hampshire, USA

Yaakov Garb

Ben Gurion University, Israel

Scenarios have become a standard tool in the portfolio of techniques that scientists and policy-makers use to envision and plan for the future. Defined as plausible, challenging and relevant stories about how the future might unfold that integrate quantitative models with qualitative assessments of social and political trends, scenarios are a central component in assessment processes for a range of global issues, including climate change, biodiversity, agriculture, and energy. Yet, despite their prevalence, systematic analysis of scenarios is in its beginning stages. Fundamental questions remain about both the epistemology and scientific credibility of scenarios and their roles in policymaking and social change.

Answers to these questions have the potential to determine the future of scenario analyses. Is scenario analysis moving in the direction of earth system governance informed by global scenarios generated through increasingly complex and comprehensive models integrating socio-economic and earth systems? Or will global environmental scenario analyses lose favour compared to more focused, policy-driven, regionally specific modelling? These questions come at an important time for the climate change issue, given that the scenario community, catalyzed by the Intergovernmental Panel on Climate Change (IPCC), is currently preparing to embark on a new round of scenario development processes aimed at coordinating research and assessment, and informing policy, over the next five to ten years.

These and related questions about where next to go with global environmental scenarios animated a workshop held at Brown University¹ that brought together leading practitioners and scholars of global environmental change scenarios from research, policy-making, advocacy, and business settings. The workshop aimed to provide an overview of current practices/best practices in scenario production and scenario use across a range of global environmental change arenas. Participants worked to bring the experience generated from over four decades of scenario development in other issue domains, including energy and security, to bear on environmental scenarios, and to bring into dialogue scenario practitioners, both producers and users, with social science scholars. The set of contributions to this focus issue of *Environmental Research Letters* arose out of this workshop and collectively examines key challenges facing the scenario community, synthesizes lessons, and offers recommendations for new research and practice in this field.

One theme that emerged in many of the discussions at the workshop revolved around the distinction between two broad perspectives on the goals of scenario exercises: scenarios as products and scenarios as processes. Most global environmental change scenario exercises are *product-oriented*; the content of the scenarios developed is the main goal of many participants and those who commission or organize the scenario development process. Typically, what is of most interest are the environmental outcomes produced, how they relate to the various factors driving them, and what the results tell us about the prospects for future environmental change, for impacts, and for mitigation. A product-oriented perspective assumes that once produced, scenario products have lives of their own, divorced from the processes that generated them and able to serve multiple,

¹ The workshop was held in March 2007, jointly sponsored by the Watson Institute for International Studies at Brown University, the International Institute for Applied Systems Analysis (IIASA) in Austria, and the US National Intelligence Council. See <http://www.watsoninstitute.org/ge/scenarios/> for more information.

often unspecified purposes. Thus, it is often assumed that the scenario products can be ‘taken up’ by a variety of users in a variety of fora. A contrasting scenario approach is *process-oriented* and self-consciously privileges the process of scenario development as the primary goal, for example as a means to motivate organizational learning, find commonalities across different perspectives, achieve consensus on goals, or come to a shared understanding of challenges. Focusing on scenarios as processes highlights the social contexts in which scenarios are created and used. Process-oriented scenario exercises also generate scenario products, but such products are recognized as meaningful mostly (or only) in the social context in which they were developed. It should be noted that those seeking to understand the functions, implications and utility of scenarios can approach analysis of scenarios and their impacts from either perspective—focusing attention on product outcomes and influence or assessing procedural and contextual dynamics and implications.

Papers in this issue examine various aspects of scenario products, scenario processes and their interactions, with specific reference to global environmental change scenarios. Hulme and Dessai (2008) use the product–process distinction as a starting point for developing a framework to evaluate the success of scenario exercises. They identify ‘prediction success’, ‘decision success’ and ‘learning success’ as three evaluation metrics for scenarios, with the first two most relevant to scenario products and the last emphasizing procedural aspects of scenarios. They suggest that viewing scenarios primarily as products implies examining how closely actual outcomes have matched envisioned outcomes, while viewing them primarily as processes suggests evaluating the extent to which scenarios engaged participants and enabled their learning.

O’Neill and Nakicenovic (2008) focus on Hulme and Dessai’s evaluation metric, learning. Based on a review of six scenario/assessment exercises, they ask if and how scenario products have incorporated comparative assessments of results in order to enable cumulative learning across scenario efforts. The authors conclude that, although participating modelling teams have benefited greatly from the process of scenario activities and applied that learning to other scenario exercises in which they engage, learning from comparative assessments of scenario products has been rather limited; the latter due to the limited time and resources invested in comparative analysis. Pitcher (2009) speaks to a similar audience, namely the emissions scenario communities that are organizing to undertake a new round of scenario development in the lead-up to the IPCC Fifth Assessment Report. His focus is primarily on a set of concerns that need to be addressed if the new set of socio-economic and emissions scenario products are to adequately support climate model runs, mitigation analyses, and impacts, adaptation and vulnerability research. Pitcher flags issues associated with assessment and measurement of economic growth, challenges associated with downscaling long-term, global scenarios to finer geographic and time scales, and possible ways to grapple with probability and uncertainty in scenario analyses.

Garb *et al* (2008) shift focus to the process aspects of scenarios, focusing on how scenarios simultaneously shape and embed their social contexts. They outline and give examples from a research agenda, drawing on concepts and methods from sociology, political science, and science and technology studies, aimed at redressing the growing imbalance between the increasing technical sophistication of the quantitative components of scenarios on the one hand, and the continued simplicity of our understandings of the social origins, linkages, and implications of the narratives to which they are coupled on the other. Focusing on the treatment of equity concerns in the IPCC Special Report on Emissions Scenarios, Baer (2009) offers a concrete example of how particular social assumptions and definitions of equity are built into scenarios which then create particular worldviews about rights and responsibilities. Baer argues that incorporating distributions of income within—and not only between—countries in quantitative

scenario exercises makes visible questions regarding the assignment of rights and the distribution of costs and benefits; such equity considerations, he argues, are central to engendering the cooperation necessary to address the climate crisis.

For Parson (2008), the product–process distinction serves to highlight the unique characteristics and challenges of scenarios for global environmental change, including their use in large-scale official assessments, basis in biophysical modelling, weak connections to decision-makers, and roles as sites of public controversy. Parson argues that these characteristics of global environmental change scenarios prohibit process-oriented approaches, which rely on pre-identifying intended users and engaging them in the scenario development process. Instead, he proposes ways in which scenario products can be enhanced to support use by multiple, non-participant user communities. Wilkinson and Eidinow (2008) reach a different conclusion. They too identify the particular challenges of grappling with global environmental change. They examine approaches to past scenario efforts and categorize them into two groups that map loosely onto the product–process distinction: ‘problem-focused’ and ‘actor-centric’ approaches. They propose that progress in global environmental issues can best be made through a new, third type of approach (‘reflexive interventionist or multi-agent based’) that would combine elements of problem- and actor-focused approaches, creating scenario processes that can simultaneously support longer-term thinking as well as more immediate actions.

Collectively, the papers in this issue range widely across issues associated with contemporary scenario processes and products. We can discern in them the outlines of an important set of suggestions for improving scenario development in the future, including, among others, the following:

- Focus scenario exercises on more specific questions so that results from multiple models can be more illuminating (O’Neill and Nakicenovic; Garb *et al* 2008).
- Enhance scenario transparency so as to enable extensions by users, rather than further expanding representation in global scenarios themselves (Parson 2008).
- Incorporate relatively simple measures (such as sub-national disaggregation of income distributions and climate change impacts) in order to boost the equity sensitivity of scenarios (Baer 2009).
- Recognize topics where social science inputs are becoming important for improving modelling and model relevance, such as providing a logic for how societies manage to transition from historical paths to the various future development paths foreseen in the scenarios, or developing measures of well-being which are independent of income levels, and include in global environmental scenario teams more representatives of social science professionals (Pitcher 2009; Garb *et al* 2008).
- Invest greater resources in assessing scenario results, and in understanding and overcoming the barriers to carrying out such assessment (Hulme and Dessai 2008; O’Neill and Nakicenovic, 2008).
- Disaggregate the variety of global change decision makers targeted as audiences for scenarios (Parson 2008; Garb *et al* 2008).
- Develop an additional ‘reflective interventionist’ scenarios approach that involves different epistemologies for active learning in the public interest (Wilkinson and Eidinow 2008).
- Draw on the extensive toolkit of social science research methods to analyze the social work of scenarios (Garb *et al* 2008).
- Create new institutions and scenario activities that can adapt and extend global scenarios to specific, often local or regional decision contexts (Parson 2008).
- Create fora in which scenario practitioners, modellers, decision-makers, and social scientists of various kinds can discuss the process of scenario construction and use (Garb *et al* 2008).

We do not mean to imply a consensus among the participants in the Brown University workshop or of contributors to this collection of papers. At the same time, we believe that these and other insights and suggestions from these contributions do have a certain coherence, and collectively point to a deepening and reinvigoration of the environmental scenario-modelling enterprise—an enterprise now facing environmental change processes that are emerging as some of the most pressing challenges of our time.

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