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## Forum

# “Thinking About Tomorrows”: Scenarios, Global Environmental Politics, and Social Science Scholarship

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Unlike many environmental scientists (and Fleetwood Mac), most social scientists do not think yesterday has gone and do not much want to think about tomorrow—at least not in their work. Yet, debate and analysis about global environmental change are often discussions about tomorrow. For example, discussions about climate change rely on projections of the future: of future greenhouse gas emissions, of future population growth, of future changes in energy use, of future technological innovation, and of future biophysical impacts.

Those who grapple with the challenge of “thinking about tomorrow” do so by producing scenarios. Scenarios are commonly defined as “plausible, challenging and relevant stories about how the future might unfold.”<sup>1</sup> Environmental change scenarios generally combine quantitative biophysical models and qualitative storylines of social and political trends. They are also explicitly interventionist. Scenario analyses are commissioned with the stated goal of aiding decision-makers in envisioning, understanding, and planning for the future.

Many engage in “futurizing.” In the climate change arena, the Nobel Prize-winning Intergovernmental Panel on Climate Change (IPCC), the US Global Change Research Program, and the UK Climate Impacts Programme have all generated multiple scenarios envisioning potential climate futures.<sup>2</sup> The IPCC scenarios have been used further in settings as varied as the Millennium Ecosystem Assessment’s (MEA) projections of changes in global ecosystem services<sup>3</sup> and the Union of Concerned Scientists’ Climate Choices campaign which seeks

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1. Raskin 2005.

2. Hulme and Dessai 2008a; Leggett 1992; Nakicenovic et al. 2000; and Parson et al. 2007.

3. Carpenter et al. 2005.

to mobilize regional climate action in the United States.<sup>4</sup> Moreover, climate scenarios are just one example of what has become a ubiquitous knowledge product in global (and local) environmental politics.<sup>5</sup>

At stake in scenario efforts are choices about present-day realities and future possibilities. Every scenario embeds a unique set of social relations, making visible some options and hiding others. For example, the IPCC greenhouse gas emissions scenarios have been challenged as based on overly optimistic assumptions regarding future transformation of energy infrastructure.<sup>6</sup> Others have shown that by focusing on national emissions, the IPCC scenarios obscure the differential burdens of climate change distributed by socio-economic class.<sup>7</sup> Yet, despite the prevalence and high stakes of scenario efforts in climate and other global environmental change arenas, systematic analysis of the political and social aspects and impacts of scenarios is in its early stages.<sup>8</sup> Social science has yet to offer an analysis of why scenarios have become so common in environmental politics. Nor have scenario exercises become a focus of research for those interested in the relationship of politics and policy making to scientific and technical knowledge (and its production) or vice versa. Even basic questions of scenario audience and utility remain unanswered. Well known scenarios such as those developed by the IPCC and the MEA simultaneously seem to be widely used by actors and for analyses for which they were not explicitly designed and seem to not be significantly shaping global policymaking to date. This alone might be of interest to those trying to understand the creation of "usable" scientific and technical knowledge for policymaking and other types of decisions.

Our goal here is three-fold: to demonstrate the ubiquity of scenarios in environmental politics; to document the relative absence of social science scholarship in an otherwise burgeoning area of research; and, most importantly, to lay out a series of research questions on the emergence, effects, and effectiveness of scenarios of interest to global and comparative environmental politics researchers.

## The Prevalence of Scenarios in Environmental Politics

A survey of current global environmental issues, from biodiversity to climate change to water security, reveals the popularity of scenarios as tools used to strategize about the future. As Table 1 illustrates, scenarios are part of the research programs for each issue area that animates global environmental politics. Among these, the IPCC's Special Report on Emissions Scenarios, the Millennium Ecosystem Assessment, and the United Nations Environment Program's periodic Global Environmental Outlook (GEO) assessments rank as the

4. UCS 2006.

5. Alcamo 2001.

6. Pielke Jr. et al. 2008.

7. Baer 2007.

8. Garb et al. 2008; and O'Neill et al. 2008.

most prominent global environmental scenarios of the past decade;<sup>9</sup> yet they are simply leading examples of a widely employed informational product (and potential decision support tool) in global environmental governance.

*Global* environmental scenarios moreover capture only one sub-set of this burgeoning field. Scenarios are prevalent at regional, national, and sub-national scales. For example, scenarios are employed in settings ranging from the assessment body associated with the Convention on Long-Range Transboundary Air Pollution, within the Regional Greenhouse Gas Initiative involving US states in the Northeast, and by city planners in Armenia.<sup>10</sup> Nor are scenarios the exclusive domain of governmental initiatives. One branch of scenario analysis was pioneered in the private sector and large oil companies like Royal Dutch/Shell continue use scenario analysis to strategize about the company's business and environmental policies and practices.<sup>11</sup> The US National Intelligence Council uses scenarios to organize thinking, debate and analysis about the next two decades of US national security interest.<sup>12</sup> Likewise, environmental research and advocacy organizations, like the Tellus Institute, use scenarios to assess critical environment and development issues<sup>13</sup> or to envision sustainability transitions.<sup>14</sup>

## Scenarios Scholarship to Date<sup>15</sup>

Mirroring the rising popularity of scenarios in the public and private sectors, scenarios scholarship has burgeoned, particularly over the past fifteen years. Our definition of scenarios scholarship includes both research on the practices of scenario production and use as well as the use of scenario techniques in research efforts. An analysis of peer-reviewed journal articles on scenarios tracks the dramatic increase in scholarly work in this area. Between 1970 and 1990, the number of journal articles with the word "scenario" in their titles archived in Science Direct and EBSCO Academic Search Premier averaged at 9 and 1.5 articles per year, respectively. By 2006, the annual number of articles in these databases had risen to 157 and 247. Likewise, in the EBSCO Environment Index—which archives environmentally-themed publications—there were 133 scenario articles published in 2006, up from 29 in 1996 (see Figure 1).<sup>16</sup>

9. Nakicenovic et al. 2000; Raskin 2005; and UNEP 2006.

10. Hughes 2004; RGGI 2008; and UNECE 2008.

11. GBN 2004; and Shell 1990, 2008.

12. National Intelligence Council (NIC) 2008.

13. Raskin et al. 2002.

14. Weaver et al. 2008.

15. We would like to thank Brett Heeger for his assistance in compiling the data presented in this article.

16. These data were compiled by conducting a search for peer-reviewed, academic journal articles with the word scenario in their titles in the three databases. We include both ScienceDirect and Academic Search Premier to insure that the results are not artifacts of the selection of journals included in each database. While there is extensive overlap between the two databases and both include natural and social science journals, certain leading scenarios journals, including *Futures* and *Technological Forecasting and Social Change*, are only available through ScienceDirect.

**Table 1**  
Scenarios across Global Environmental Issue Areas

<i>Focus</i>	<i>Organization</i>	<i>Date</i>	<i>Study</i>
Air Quality	European Environment Agency	2006	Air Quality and Ancillary Benefits of Climate Change Policies
Biological Diversity	International Geosphere-Biosphere Programme	2000	Global Biodiversity Scenarios for the Year 2100
Biological Diversity	Millennium Ecosystem Assessment	2005	Ecosystems and Human Well-being, Volume 2: Scenarios
Climate Change	Intergovernmental Panel on Climate Change	2000	Special Report on Emissions Scenarios
Desertification	Millennium Ecosystem Assessment	2005	Ecosystems and Human Well-being, Volume 2: Scenarios
Energy	World Business Council for Sustainable Development	2005	Energy and Climate: Facts and Trends to 2050
Energy	Royal Dutch/Shell	2008	Shell Energy Scenarios to 2050
Fish Stocks	Food and Agriculture Organization	2005	Gloom and Doom? The Future of Marine Capture Fisheries
Forests	Food and Agriculture Organization	1997	Asia-Pacific Forestry Towards 2010
Forests	European Forest Institute	2000	Forest Scenario Modeling
Human-Ecosystem Interactions	US National Intelligence Council	2004	Global Trend 2020: Mapping the Global Future
Ozone	World Meteorological Organization	2006	Scientific Assessment of Ozone Depletion
Population	The World Bank	2006	The Road to 2050: Sustainable Development in the 21st Century
Water	World Commission on Water for the 21st Century	2000	World Water Vision

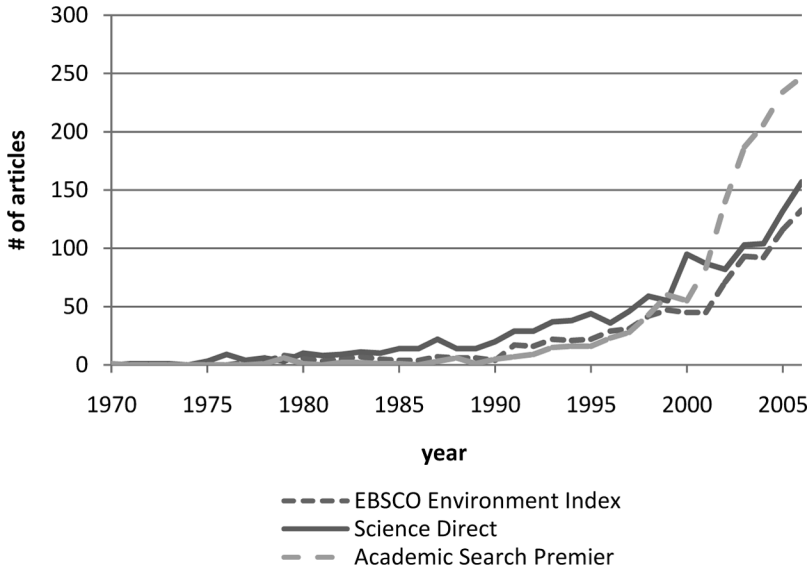
**Table 1 Continued**

<i>Focus</i>	<i>Organization</i>	<i>Date</i>	<i>Study</i>
Water	International Food Policy Research Institute/ International Water Management Institute	2002	Global Water Outlook to 2025: Averting an Impending Crisis
Wetlands	Millennium Ecosystem Assessment	2005	Ecosystems and Human Well-being, Volume 2: Scenarios
Environment— General	United Nations Environment Program	2007	4th Global Environmental Outlook
Environment— General	Global Scenario Group	2002	Great Transition: The Promise and Lure of Times Ahead

Analysis of the 1241 scenario articles published between 2002–2006, again drawn from both the EBSCO Academic Search Premier and ScienceDirect databases, shows that the leading scenarios journals include the topic-specific, multidisciplinary journals *Futures* (29 articles) and *Technological Forecasting and Social Change* (17 articles). Other leading journals publishing scenarios research include *The American Institute of Physics Conference Proceedings* (21 articles), *Energy Policy* (20 articles), *Physics Letters B* (19 articles), the *Journal of Hydrology* (18 articles), and *Climatic Change* (17 articles). The list of the top fifteen journals publishing research on scenarios is noteworthy for the absence of social science publications (see Table 2). While scenarios as a research technique and product are being embraced in natural science, modeling and engineering-related fields, the power, politics and social relations associated with scenarios products and processes have generated little attention in the social sciences.

This pattern holds not only in the wider domain of scenarios scholarship but also in scenarios research focused on environmental issues. Over the five-year period from 2002 to 2006, the EBSCO Environment Index database tracks almost 500 articles about or incorporating scenarios in over 200 different journals. The leading environmental scenarios journals are *Energy Policy*, *Climatic Change*, *Climate Research*, *Journal of Hydrology*, and *Global Environmental Change*. Grouping these journals by subject category<sup>17</sup> reveals that over 80 percent of the journals publishing environmental scenarios research are engineering, physical science, and natural science journals (see Figure 2). Only 25 of the 204 environmental journals that published scenarios articles are categorized as social science journals, and the majority of these are technically-oriented environmental management journals. For example, the leading environmental social science

17. We used the subject categories defined by the Brown University Library system.



**Figure 1**  
Journal Articles with “Scenarios” in Title

journals publishing scenarios research are *Energy Policy* (20 articles), *Global Environmental Change Part A: Human & Policy Dimensions* (15 articles), *Environment & Planning B: Planning and Design* (8 articles), and the *Journal of Environmental Management* (7 articles).

## A Social Science Research Agenda

The power, politics, and social relations of scenarios in global environmental politics call out for study. We argue that a set of social science approaches familiar to GEP theorists and analysts, including approaches from political science, sociology, and science and technology studies (STS), are central to assessing the emergence, effects, and effectiveness of scenarios in global environmental governance.

An analysis of the *emergence* of scenarios might focus on both the macro rise of scenario analysis and the micro organizational environments within which scenarios are produced. Research could investigate how and with what effects scenario techniques have travelled across social fields, from their origins in military planning, to business strategy, to global environmental governance.<sup>18</sup> What are the patterns and means of diffusion? Scholarship posits multiple possible diffusion mechanisms, including functional efficiency, pro-

18. Raskin 2005.

**Table 2**

Journals Publishing Scenarios-Related Research Catalogued in Academic Search Premier and Science Direct (2002–2006)

<i>Journal</i>	<i># of articles</i>
<i>Futures</i>	29
<i>AIP Conference Proceedings</i>	21
<i>Energy Policy</i>	20
<i>Physics Letters B</i>	19
<i>Journal of Hydrology</i>	18
<i>Technological Forecasting and Social Change</i>	17
<i>Climatic Change</i>	17
<i>European Physical Journal C—Particles &amp; Fields</i>	14
<i>Fusion Engineering &amp; Design</i>	12
<i>Agriculture, Ecosystems &amp; Environment</i>	12
<i>Forest Ecology and Management</i>	11
<i>European Journal of Teacher Education</i>	11
<i>Ecological Modelling</i>	11
<i>Climate Dynamics</i>	11
<i>Atmospheric Environment</i>	11

motion by powerful actors, and institutional isomorphism.<sup>19</sup> Transfer across social fields also raises questions of legitimacy. In particular, what Evans and Kay call the “architecture of field overlap” may explain how key actors, situated in multiple strategic action fields, leverage information and status from one social arena in another.<sup>20</sup> A second set of questions might explore the micro-environments in which scenarios are produced. Scenarios embed the social contexts in which they are commissioned and developed. Social scientist might be interested in how the various institutional contexts within which scenario analysis is employed matter for the production, dissemination, and use of the scenarios themselves or their results. Whose values and assumptions are being embedded or excluded in scenario analysis? Whose interests? Likewise, research could explore the conditions under which modern bureaucratic organizations, both public and private, enable the deliberative processes that drive effective scenario analyses.<sup>21</sup> How do organizations open/close channels of communication<sup>22</sup> and facilitate learning?<sup>23</sup>

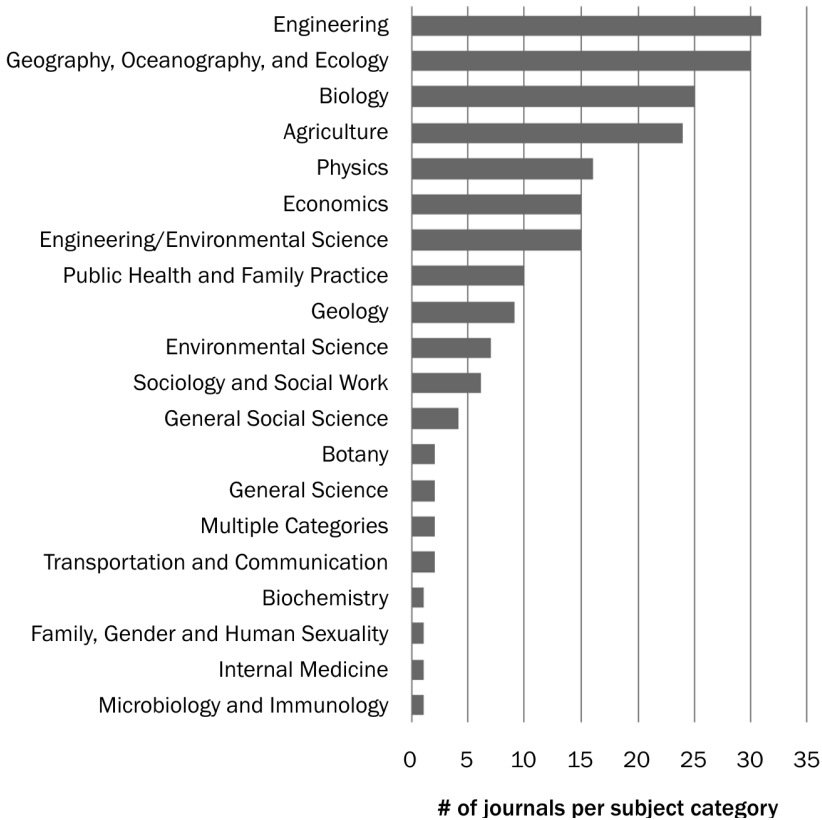
19. Hoffman and Ventresca 2002; North 1990; and Weyland 2007.

20. Evans and Kay 2008.

21. Wilkinson and Eidinow 2008.

22. Vaughn 1996.

23. March and Olsen 1975; and Wack 1985a, b.



**Figure 2**

Subject Categories of EBSCO Environment Index Journals Publishing Scenarios-Related Research (2002–2006)

The shared starting point of a social science analysis of the *effects* of scenarios is the recognition that scenarios are social processes that shape the governance processes they are (at least in part) intended to support. The discipline of science and technology studies (STS) offers a number of ways to understand scenario building and reporting as knowledge production processes. Scenarios can be understood as “boundary objects” that link different social worlds, such as science and non-science.<sup>24</sup> Individuals and organizations within each social sphere use scenarios for specific purposes. Yet, the scenario maintains its identity and creates a sphere in which the science and non-science social worlds can collaborate and co-exist. Thus, perhaps scenarios provide an organized context

24. Star and Griesemer 1989.

for the confusion, contestation, or conflict that often accompanies boundary work. This function, like Shackley and Wynne's "boundary ordering devices," produces consistency, despite the fact that boundaries between science and policy are inconsistent and dynamic.<sup>25</sup> One might seek to analyze the "boundary work" involved with scenario development and use, or to see scenarios as "boundary spanning" artifacts.<sup>26</sup> One might also ask how scenarios interact with and organize the various levels of scientific understanding and modeling underlying them. These concepts help us to explore how tensions and debates endemic within and between scientific research agendas and policymaking agendas are contested and, perhaps, settled (or temporarily stabilized) through the use of scenarios.

Other STS scholars, such as Latour and Jasanoff, might understand scenarios as spheres of "co-production," where knowledge and social order are produced simultaneously.<sup>27</sup> Scenarios, in this framework, may co-produce knowledge and social order by facilitating collaboration between scientific and technical experts of various types and policymakers and other non-scientists. Co-productionist approaches also call attention to audiences for information and knowledge. One could explore how scenarios participants create knowledge and how or whether their audiences are trained to understand scenarios information (images, texts, etc.) in particular ways that link their social reality or world views with particular knowledge sets. One might ask about the ways may scenarios frame debate and collective understanding, through discourse, participation patterns, and the use of images? For example, images of air pollution transport and deposition patterns across the European continent common in air pollution assessments and in policy documents and debates also help frame European airsheds as transnational, rather than national, and thus beyond the ability of an individual national government to protect national air quality on its own.<sup>28</sup> In the climate change arena, the ubiquitous graph of carbon dioxide concentration measurements at the Mauna Loa Observatory and the so called "hockey stick" portrayal of global average surface temperature have become iconic images associated with global warming. How do projections of such trends out into the future shape understanding of current policy or social challenges?

Finally, GEP scholars may be interested in the *effectiveness* of scenarios, i.e. the extent and nature of the influence of scenario development processes and products on political discourse and/or the actions or knowledge of political actors.<sup>29</sup> For example, recent work on the influence of scientific and technical assessment on politics focused inquiry on the changes (if any) induced in particular environmental "issue domains" by organized assessment processes and

25. Shackley and Wynne 1996.

26. Gieryn 1999; Guston 1999; and Jasanoff 1990.

27. Garb et al. 2008; Jasanoff 2004; and Latour 1987.

28. VanDeveer 2004.

29. Hulme and Dessai 2008b.

reports.<sup>30</sup> Such work argues that scenarios’ influence, where identifiable, might be traced to changes scenario products or processes induce in actors’ knowledge or understandings of particular issues, because of processes of social learning and/or because particular “problems” or “solutions” were framed or reframed by scenario development. Actors’ interests, values or behavioral expectations may be affected. In other words, scenarios in global environmental politics also intersect with questions of social change. Scenarios can be used to frame and mobilize social action.<sup>31</sup> An environmental justice research agenda might ask how scenarios engage, reproduce, and/or challenge global patterns of inequality, representation, and resource consumption.<sup>32</sup>

Questions of influence and effectiveness can also be approached via a focus on the various networks created through scenario development processes.<sup>33</sup> Network characteristics such as network density and network structure may explain the extent to which certain scenario analyses are evaluated as more or less useful by decision-makers.<sup>34</sup> For example, scenario users can be categorized according to their proximity to the scenario production process. Scenario users include those that both generate scenario outputs and use those outputs in subsequent analyses, i.e. producer-users. Other users can be characterized as recipient-users, operating in national and sub-national policy arenas. Different users with differing interests and perspectives are likely to attribute varying levels of technical credibility, relevance (to them) and legitimacy to particular scenario development processes and outputs.<sup>35</sup>

## Don’t Stop Thinking about Tomorrows

Many a social science student has been reminded that the problem with research about how things will turn out in the future is that there is so little available evidence to test one’s ideas and hypotheses. Perhaps this is why, beyond the specialized subfield of future studies, social science scholarship has ignored the dramatic growth in the number of scenario analyses and exercises in international environmental politics over the last few years. Global and comparative environmental politics scholarship has much to contribute and much to learn from greater analytical attention to the roles and impacts of scenario analysis in environmental politics and policy making. While such scholarship has expanded to include a broad set of themes,<sup>36</sup> it has yet to engage scenario development in its role in politics and policymaking.

Examining these futures-oriented social processes and their influences on politics and policy does not mean that social scientists should forget about the

30. Farrell and Jaeger 2005; and Mitchell et al. 2006.

31. Snow and Benford 1988; and Szasz 1994.

32. Roberts and Parks 2007.

33. Haas 1992; and Litfin 1994.

34. Canan and Reichman 2002.

35. Mitchell et al. 2006.

36. Dauvergne 2005; and Clapp and Dauvergne 2005.

past. In a world where pollutants like carbon and radioactive waste stay with us for decades or centuries, and social institutions may shape human organization, identity and behavior for similarly long periods, yesterday is not gone. Yet, greater attention to scenarios clearly offers an additional area for research on the relationships between politics and policy, the construction and distribution of scientific and technical knowledge, and action for social change. Moreover, scenario analysis is a tool for grappling with the roles that our expectations about the future (should or could) play in our decisions in the present. It offers ways to systematically analyze the shadow of the future—in part because it may shape others' expectations about various tomorrows. Social scientists should pay more attention, before the future passes us by. Tomorrow will soon be here.

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