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Analysis of Global Change Assessments: Lessons Learned

Global change assessments inform decision makers about the scientific underpinnings of a range of environmental issues. With dozens of assessments conducted to date by various U.S. and international groups, there is an opportunity to draw on these experiences to improve future efforts. This report identifies 11 essential elements of effective assessments and provides recommendations on evolving the process to better support decision making.

Assessments convey scientific information to decision makers. Global change assessments are a deliberative process through which experts come to consensus, based on available scientific information, on specific questions related to the environment. Assessments can have a significant impact on public policies, technology development, and future research directions.

During the last four decades, many assessments have been conducted to address questions such as stratospheric ozone depletion, climate change, and the loss of biodiversity. Many of them have been conducted at the international level, providing the scientific basis for the creation and elaboration of international agreements. Examples include The Vienna Convention for the Protection of the Ozone Layer and its Montreal Protocol on Substances That Deplete the Ozone Layer, and the United Nations Framework Convention on Climate Change and its Kyoto Protocol. In the United States, the first national assessment focused on climate change was conducted under the auspices of the U.S. Global Change Research Program and completed in the fall of 2000. The U.S. Climate Change Science Program (CCSP) initiated a second round of assessments in 2002 with 21 planned products; the first of these products was completed in May 2006 and the others are expected to be finished in 2007 and 2008.

A wealth of experience now exists on how to conduct effective global change assessments. Because of an increasing number of international and national mandates, it is likely that even more assessments will be initiated in the coming decades, placing further demands on the resources devoted to these activities and the number of scientists involved. This National Research Council report draws on the experiences of past global change assessments to provide guidance for the CCSP and other future assessment activities.



Photo courtesy Jay Labov

Essential Elements of Effective Assessments

This report presents a comparative analysis of eight past global change assessments, highlighting their strengths and weaknesses (see Box 1). Common components of effective assessments include superior leadership, extensive and well designed engagement with interested and affected parties, a transparent and effective science-policy interface, and well articulated communication strategies. The report identifies 11 essential elements that increase the probability that an assessment will effectively inform decision makers and other target audiences:

1. Clear strategic framing of the assessment process, including a well-articulated mandate, realistic goals consistent with the needs of decision makers, and a detailed implementation plan;
2. Adequate funding that is both commensurate with the mandate and effectively managed to ensure an efficient assessment process;
3. A balance between the benefits of a particular assessment and the opportunity costs (e.g., commitments of time and effort) to the scientific community;
4. A timeline consistent with assessment objectives, the state of the underlying knowledge base, the resources available, and the needs of decision makers;
5. Engagement and commitment of interested and affected parties with a transparent science-policy interface and effective communications throughout the process;
6. Strong leadership and an organizational structure in which responsibilities are well articulated;
7. Careful design of interdisciplinary efforts to ensure integration, with specific reference to the assessment's purpose, user needs, and available resources;
8. Realistic and credible treatment of uncertainties;
9. An independent review process monitored by a balanced panel of review editors;
10. Tools to support use of assessment results in decision-making at differing geographic scales and decision levels; and
11. Use of an assessment approach that nests targeted local-to-regional data and analysis into the broader context of global changes.

Common Challenges in Assessments

Perhaps the greatest challenges for those initiating future assessments will be to carefully design the assessments so that key objectives will be met, and then to create appropriate opportunities for meaningful interaction with a range of interested and affected parties. In addition, as the demand for assessments grows, it will be necessary to ensure that the community of scientists and other experts are not overtaxed.

Framing the Assessment. A well-formulated mandate, or directive, for the assessment is necessary to ensure that the process is demand-driven and effectively supports a particular set of decisions. A guidance document prepared in advance should clearly state the goals and objectives for the assessment, including the kinds of decisions that the assessment should inform, how the assessment will be implemented, and how progress toward goals will be measured. The goals should be agreed upon in advance by those requesting the assessment and those conducting the assessment, and should be modified only through use of a transparent process.

Identifying, Engaging, and Responding to Interested and Affected Parties. Properly engaging stakeholders—including those who request and fund an assessment, experts who participate in the assessment process, and target audiences or users of the assessment—is vital if the assessment is to be viewed as fair and credible. Effective engagement requires identifying and addressing the needs of specific target audiences, establishing appropriate boundaries at the science-policy interface, reaching beyond target audiences, building the capacity for people to engage in assessments, and developing a comprehensive communication strategy. The process also requires sufficient human and financial resources to communicate assessment products to relevant audiences.

Weighing Assessment Benefits Against Time and Resources Spent. Decisions about the scope of, and participation in, an assessment should consider whether the burden on the scientific community is commensurate with the public benefits provided by the assessment. Many assessments employ the world's leading scientists, often on a volunteer basis. Although assessments often result in new research opportunities and interdisciplinary fields, they also divert time and resources from research. To minimize such costs, regularly scheduled assessments could be limited to examining only new developments and providing succinct summaries of the previous state of knowledge. As appropriate, U.S. assessments should acknowledge

Box 1. Selected Past Assessments

(a more complete discussion is provided in Chapter 4 of the report)

A series of international **Stratospheric Ozone Assessments** were initiated in the mid 1980s to examine ozone-depleting chemicals and the current and projected state of the stratosphere. These assessments benefited from excellent leadership, succeeded at meeting the needs of decision-makers, and proved effective in mobilizing participants to render scientific and technical judgments. More recently, however, the frequency of these assessments (every four years) has become somewhat burdensome; periodic updates highlighting new findings would likely suffice. In addition, participation from industry has waned as the scale of economic implications declined.

The **Intergovernmental Panel on Climate Change (IPCC)** conducts periodic assessments (1990, 1995, 2001, 2007), mandated by the UN Framework Convention on Climate Change, on the scientific basis of climate change, impacts of climate change on natural and human systems, and options for mitigation and adaptation. With a well-developed organizational structure and strong ties to scientists and governments, IPCC assessments are highly credible and effectively communicate to multiple audiences. The process could be improved by strengthening the coordination among individual working groups and rethinking the assessment strategy to take into consideration the rate at which new knowledge becomes available and the burden on the scientific community.

The **Global Biodiversity Assessment (GBA)**, published in 1995, provided a synthesis of available science to support the work of the United National Convention on Biological Diversity. Covering the many dimensions of biological diversity, the GBA achieved high scientific credibility due to involvement of the world's leading scientists. However, the lack of an authorizing environment limited its acceptance by governments. Further, efforts at outreach and interaction among working groups were hindered by a limited budget.

A **National Assessment of Climate Change Impacts** on the United States released in 2000 by the U.S. Global Change Research Program, as mandated by the 1990 Global Change Research Act (GCRA). Benefiting from a well-defined mandate and clearly articulated questions, the National Assessment succeeded in involving a broad range of stakeholders, in part through its well planned communication strategy. However, it was the subject of considerable criticism and had limited impact on U.S. policy or in funding new directions in research. Specific shortcomings included problems with the phasing of different assessment steps and uneven funding availability.

The **Arctic Climate Impact Assessment** was conducted in response to growing concern about how global warming and other associated changes could affect the Arctic environment. The assessment, completed in 2004, had a clear and strong mandate, with support from decision makers, a well-planned communication strategy, and a transparent model for the science-policy interface. However, it could have been stronger if economic impacts had been considered and if follow-up activities had been better defined.

The **Millennium Ecosystem Assessment** was designed to answer a question fundamental to various UN conventions: what are the consequences of environmental change on the functioning of ecosystems and their continuing capacity to deliver services that are essential to human well-being? Published in 2005, strengths included broad participation from business, industry, academia, non-governmental organizations, UN agencies, and indigenous groups, and a conceptual model that was well designed to answer the central question. It could have been improved with more direct government interaction and plans for follow-up activities.

The **German Enquete Kommission on "Preventive Measures to Protect the Earth's Atmosphere"** was set up by the German Parliament (Bundestag) to assess the importance and consequences to the country of stratospheric ozone depletion and of climate change. Strengths included good support and participation from political decision makers, broad participation by stakeholders and a wide range of experts, and a good communication strategy. In some cases, the involvement of parliamentarians hindered the assessment process, for example, because they had little expertise on the subject or political differences made it hard to agree on specific resolutions.

A set of 21 **U.S. Climate Change Science Program (CCSP) Synthesis and Assessment Products**, addressing various aspects of climate change, are currently being conducted to meet the requirements of the 1990 GCRA. The first product, released in May 2006, appears to have authoritatively resolved a long-standing discrepancy in the scientific community regarding global temperature trends in the lower atmosphere. Although individual products may be effective, it is not clear that the collection of assessment products will provide an integrated view of climate change impacts and possible response options.

the work of the international community and avoid redundant efforts.

Evolving Assessments to Meet Future Needs

Assessment reports can go only so far to support decision making. To become even more valuable to society, assessments should develop decision support tools. These tools should make use of scientific analysis at the regional and local level where decisions are made.

Developing Decision Support Applications.

Assessments should provide tools that enable decision makers to link the information provided with their specific needs. Decision-support applications include a range of tools and models that link analyses, environmental and social data, and information about potential decisions and outcomes. They help decision makers understand relevant systems, assess vulnerabilities, identify management alternatives, characterize uncertainties, and plan for implementation. These tools should provide useful,

policy-neutral information, targeted for specific applications in certain sectors. Stakeholder involvement can facilitate the development of these tools.

Bringing Assessments to the Local and Regional Level. Although it would be ideal to address climate change impacts and responses for each sector at local, regional, and national scales, it is unlikely that sufficient resources will be available to accomplish this. The report recommends that one way to tackle this challenge is to develop an approach that links local, sector-specific information to the larger-scale climate changes (a “nested matrix” approach). For example, the impacts of climate change on individual watersheds could be assessed by using global-scale projections of future changes in temperature and precipitation as input to regional-scale hydrological models. Using such an approach, those areas or sectors that are highly vulnerable could be selected for a more focused assessment that also take into account pertinent local information such as projected changes in population and land use.

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This report brief was prepared by the National Research Council based on the committee’s report. For more information, contact the Board on Atmospheric Sciences and Climate at (202) 334-3512 or visit <http://dels.nas.edu/basc>. Copies of *Analysis of Global Change Assessments: Lessons Learned* are available from the National Academies Press, 500 Fifth Street, NW, Washington, D.C. 20001; (800) 624-6242; www.nap.edu.