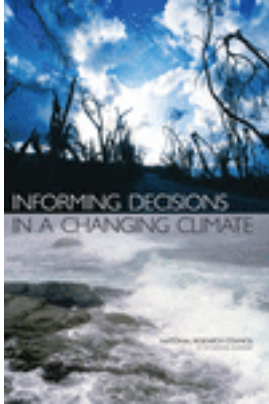


Free Executive Summary



Informing Decisions in a Changing Climate

Panel on Strategies and Methods for Climate-Related Decision Support; National Research Council

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Climate change will create a novel and dynamic decision environment that cannot be envisioned from past experience. Moreover, climatic changes will be superimposed on social and economic changes that are altering the climate vulnerability of different regions and sectors of society, as well as their ability to cope. Decision makers will need new kinds of information and new ways of thinking and learning to function effectively in a changing climate. Climate change also poses challenges for federal agencies and for the scientific community. Scientific priorities and practices need to change so that the scientific community can provide better support to decision makers in managing emerging climate risks. The information that is needed is not only about climate, but also about changes in social and economic conditions that interact with climate change. Informing Decisions in a Changing Climate provides a framework and a set of strategies and methods for organizing and evaluating decision support activities related to climate change. Based on basic knowledge of decision making; past experiences in other fields; experience with early efforts in the climate arena; and input from a range of decision makers, the book identifies six principles of effective decision support and recommends a strategy for implementing them in a national initiative to inform climate-related decisions.

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Summary

Government agencies, private organizations, and individuals whose futures will be affected by climate change are unprepared, both conceptually and practically, for meeting the challenges and opportunities it presents. Many of their usual practices and decision rules—for building bridges, implementing zoning rules, using private motor vehicles, and so on—assume a stationary climate—a continuation of past climatic conditions, including similar patterns of variation and the same probabilities of extreme events.

That assumption, fundamental to the ways people and organizations make their choices, is no longer valid. As a result of human activity, the average temperature of Earth will soon leave the less-than-1° Celsius range that it has maintained for more than 10,000 years. Moreover, despite 15 years of intense international climate negotiations, atmospheric CO₂ concentrations have been growing 33 percent faster during the last 8 years than they did in the 1990s.

Climate change will create a novel and dynamic decision environment. The parameters of the new climate regime cannot be envisioned from past experience. Moreover, climatic changes will be superimposed on social and economic changes that are altering the climate vulnerability of different regions and sectors of society, as well as their ability to cope. Decision makers will need new kinds of information and new ways of thinking and learning to function effectively in a changing climate.

Many decision makers are experiencing or anticipating a new climate regime and are asking questions about climate change and potential responses to it that federal agencies are unprepared to answer. Anticipating a

continuing increase in the demand for such “decision support,” the U.S. Environmental Protection Agency and the National Oceanic and Atmospheric Administration asked the National Academies to undertake this study, to provide a framework and a set of strategies and methods for organizing and evaluating decision support activities related to climate change. In response to this charge, the Panel on Strategies and Methods for Climate-Related Decision Support examined basic knowledge of decision making; past experiences in other fields, such as hazard response, public health, and natural resource management; experience with early efforts in the climate arena; and input from a range of decision makers.

Our study found that climate change poses challenges not only for the many decision makers it will affect, but also for federal agencies and for the scientific community. The end of climate stationarity requires that organizations and individuals alter their standard practices and decision routines to account for climate change. Scientific priorities and practices need to change so that the scientific community can provide better support to decision makers in managing emerging climate risks. Decision support—that is, organized efforts to produce, disseminate, and facilitate the use of data and information in order to improve the quality and efficacy of climate-related decisions—is essential for developing responses to climate change. The information that is needed is not only about climate, but also about changes in social and economic conditions that interact with climate change and about the state of knowledge and uncertainty about these phenomena and interactions.

Considering the great diversity of climate-affected decisions and decision makers, it is useful to organize decision support around constituencies. We identify four roles for the federal government in climate-related decision support. Federal leadership is essential in serving the constituencies of federal agencies, participating in international efforts related to climate decision support, providing decision support services and products that serve a public good that would not otherwise be provided, and facilitating distributed responses to climate change. The last of these is important because central management is neither feasible nor effective for providing decision support for the many climate-affected constituencies in the nation. All four roles are consistent with federal responsibilities under the U.S. Global Change Research Act of 1990 and can be pursued under that mandate.

We found that the same core principles that characterize effective decision support in such areas as public health, natural resource management, and environmental risk management apply to informing decisions about responses to climate change.

Recommendation 1: Government agencies at all levels and other organizations, including in the scientific community, should organize their decision support efforts around six principles of effective decision sup-

port: (1) begin with users' needs; (2) give priority to process over products; (3) link information producers and users; (4) build connections across disciplines and organizations; (5) seek institutional stability; and (6) design processes for learning.

Recommendation 2: Federal agencies should develop or expand decision support systems needed by the climate-affected regions, sectors, and constituencies they serve.

- The National Oceanic and Atmospheric Administration (NOAA) should expand its Regional Integrated Sciences and Assessments (RISA) Program and Sectoral Applications Research Program (SARP) centers to serve the full range of regions and sectors of the nation where NOAA has natural constituencies.

- The U.S. Environmental Protection Agency (EPA) should expand its climate-related decision support programs to serve more regional and sectoral constituencies.

- Other federal agencies should take similar steps for their climate-affected constituencies.

- The federal government should selectively support state and local governments and nongovernmental organizations to expand their efforts to provide effective decision support to their climate-affected constituencies.

Learning poses difficult challenges for climate-related decision making, especially by public agencies, because frequently there are multiple participants with varied and changing objectives interacting with uncertain and evolving knowledge. We found that the most appropriate model for learning under such conditions combines participatory deliberation with expert analysis in an iterative manner. This model is quite demanding in its needs for leadership and other resources.

Recommendation 3: Federal agencies in their own decision support activities and in fostering decision support by others should use the approach of deliberation with analysis when feasible. This is the process most likely to encourage the emergence of good climate-related decisions over time. The federal government should also fund research on decision support efforts that combine deliberation with analysis and that use other appropriate learning models, with the aim of improving decision support for a changing climate.

Recommendation 4: Federal agencies and other entities that provide decision support should monitor changes in science, policy, and climate-

related events, including changes outside the United States, that are likely to alter the demand and opportunities for effective decision support. Knowledge of such changes will help them to learn and to improve more rapidly.

Recommendation 5: Federal agencies should promote learning by supporting decision support networks to share lessons and technical capabilities. This may include support for expanding the capacity of boundary organizations and distributed entities for learning, such as internet sites. The federal investment should be selective and guided by the reality that networks operate satisfactorily only when their members see concrete benefits from participation.

Achieving decision support objectives requires research to understand, assess, and predict the human consequences of climate change and of possible responses to climate change. That research must be closely integrated with basic and applied research on climate processes.

Recommendation 6: The federal agencies that manage research activities mandated under the U.S. Global Change Research Act (USGCRA) should organize a program of research for informing climate change response as a component of equal importance to the current national program of research on climate change processes. This program should include research *for* and *on* decision support, aimed at providing decision-relevant knowledge and information for climate responses.

The research for decision support should have five substantive foci:

1. understanding climate change vulnerabilities: human development scenarios for potentially affected regions, populations, and sectors;
2. understanding the potential for mitigation, including anthropogenic driving forces, capacities for change, possible limits of change, and consequences of mitigation options;
3. understanding adaptation contexts and capacities, including possible limits of change and consequences of various adaptive responses;
4. understanding how mitigation and adaptation interact with each other and with climatic and ecological changes in determining human system risks, vulnerabilities, and response challenges associated with climate change; and
5. understanding and taking advantage of emerging opportunities associated with climate variability and change.

The research on decision support should have five substantive foci:

1. understanding information needs;
2. characterizing and understanding climate risk and uncertainty;
3. understanding and improving processes related to decision support; including decision support processes and networks and methods for structuring decisions;
4. developing and disseminating decision support products; and
5. assessing decision support “experiments.”

Recommendation 7: The federal government should expand and maintain national observational systems to provide information needed for climate decision support. These systems should link existing data on physical, ecological, social, economic, and health variables relevant to climate decisions to each other and develop new data and key indicators as needed. The effort should be informed by dialogues among potential producers and users of the indicators at different levels of analysis and action and should be coordinated with efforts in other parts of the world to provide a stronger global basis for research and decision support.

Recommendation 8: The federal government should recognize the need for scientists with specialized knowledge in societal issues and the science of decision support in the field of climate change response. There should be expanded federal support to enable students and scientists to build their capacity as researchers and as advisers to decision makers who are dealing with the changing climate.

Fulfilling the federal roles in climate-related decision support will require coordinated efforts involving many federal agencies.

Recommendation 9: The federal government should undertake a national initiative for climate-related decision support under the mandate of the U.S. Global Change Research Act (USGCRA) and other existing legal authority. This initiative should include a service element to support and catalyze processes to inform climate-related decisions and a research element to develop the science of climate response to inform climate-related decisions and to promote systematic improvement of decision support processes and products in all relevant sectors of U.S. society and, indeed, around the world.

The service element of the initiative should support demonstration and development activities to promote the emergence of decision support

systems, support networks to link decision support activities and facilitate learning among them, and help nonfederal actors develop decision support services (see Recommendations 2–5). The research element of the initiative should include research for and on decision support (see Recommendation 6). The initiative should also expand national observational and data systems, develop indicators, and invest in human resources (see Recommendations 7 and 8).

The initiative can and should be pursued under the authority of the USGCRA. However, the federal government, through the National Science and Technology Council, will need to comprehensively reformulate its plan for implementation of the act. Our recommendations imply significant change in the ways many federal agencies serve their constituencies, coordinate with each other and with nonfederal decision makers, and set research priorities. The panel notes that it does not recommend centralizing the initiative in a single agency. Doing so would disrupt existing relationships between agencies and their constituencies and formalize a separation between the emerging science of climate response and fundamental research on climate and the associated biological, social, and economic phenomena.

The recommended national initiative will require unusually effective collaboration among many federal agencies, since a great variety of agencies—many more than now participate in the Climate Change Science Program (CCSP)—need decision support, provide information needed for decision support, or serve constituencies that need decision support. The new initiative will demand strong leadership from the Executive Office of the President, including the science adviser and the new coordinator of energy and climate policy. For many of the agencies that need to be involved, decision support research or services are not part of their current missions, and they lack offices and personnel with the responsibilities and expertise needed to manage the research. In responding to demand for decision support, those responsible for the national research effort will need to induce the relevant agencies to find the needed funds and staff and ensure that appropriate managers in the agencies are given the responsibilities and resources needed to run the programs. The needs are especially acute in the social sciences, which include many of the historically undersupported research areas and for which many environmental agencies lack staff with the requisite expertise and organizational commitment.

Another National Research Council report identifies future priorities for the CCSP as a whole (National Research Council, 2009b). Together, these two studies call for significant change in research activities being conducted under the authority of the USGCRA, including developing underdeveloped areas of research and finding appropriate organizational homes for research that is now not being done.

The idea of a national climate service in or led by NOAA has received considerable attention in recent years. As of this writing, there is no agreed description of the purview, mandate, or organizational location of such a service. Yet it is clear that any form of national climate service should implement the principles of effective decision support. Thus, it should develop decision support products by means of communication between information providers and users that is likely to shape research agendas in ways that yield useful and usable research products. If a national climate service is created, it should be part of the decision support initiative we recommend and be closely linked to its research element. We believe that a national climate service located in a single agency and modeled on the weather service would by itself be less than fully effective for meeting the national needs for climate-related decision support.¹

¹This text was changed from the prepublication version to clarify the panel's meaning.