

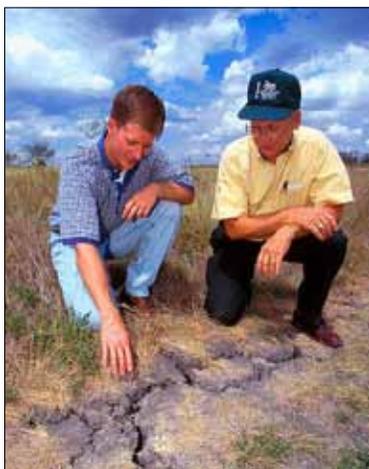
## Informing an Effective Response to Climate Change

**Demand for information to support climate-related decisions has grown rapidly as people, organizations, and governments have moved ahead with plans and actions to reduce greenhouse gas emissions and to adapt to the impacts of climate change. Today, however, the nation lacks comprehensive, robust, and credible information systems to inform climate choices and evaluate their effectiveness. This report examines information needs and recommends ways the federal government can better inform responses by enhancing climate change and greenhouse gas information and reporting systems and by improving climate communication and education.**

**A**cross the nation, people, businesses, organizations, and governments are making decisions in response to climate change. As of June 2010, twenty-three states have established targets for reducing greenhouse gas emissions. A number of major cities, including Los Angeles and New York, have also announced strong emission reduction plans. Private companies are taking significant steps to reduce their carbon footprints and pursue new low-carbon markets. Citizens are making decisions about whether to make their homes and transportation modes more energy efficient, and also whether to support climate and energy policies.

Similarly, plans to adapt to the impacts of climate change are also underway. Municipal managers and resource managers are among those on the front lines, considering how a range of potential climate impacts might affect the resources, infrastructure, and people they protect and manage. Alaskans face imminent adaptation choices as some villages threatened by sea-level rise and other consequences of climate change consider relocating. Industries that will be affected by climate change—for example, insurance and agriculture—are assessing potential effects on operations, supply chains, and products.

The diverse climate change responses to date have resulted in a patchwork of regional,



SOURCE: USDA, photo by Scott Bauer

state, and local policies that has prompted many state and business leaders to call for the development of a more predictable and coherent policy environment at the federal level. This report, part of the congressionally requested America's Climate Choices suite of studies, identifies the types of decisions that need to be made about climate change and assesses the information and reporting systems needed to both inform and evaluate responses.

### Framework for Measuring Progress

Although the many non-federal efforts to reduce emissions and/or adapt to future climate changes carry considerable potential to reduce risks related to climate change, there is currently no comprehensive way to assess the effectiveness of those efforts. Even the federal response is difficult to evaluate as there is no clear, accessible, and coordinated roadmap on federal responsibilities and policies. In addition, the number of agencies beginning to respond to climate change has expanded far beyond the core research functions of the U.S. Global Change Research program to include agencies such as those with responsibility for infrastructure, security, and housing. The federal government should learn from the different approaches to climate related decision-making used by other levels of government and the private sector, and

avoid unnecessarily preempting effective measures already taken.

***To provide a policy framework that promotes effective responses at all levels of American society, the federal government should build on its existing efforts and establish clear federal leadership, responsibility, and coordination for climate related decisions, information systems, and services.*** This could include aggregating and disseminating “best practices” through a web-based clearinghouse, and creating ongoing assessments to enable regular exchange of information.

## Need for Adaptive Management

Because many climate-related decisions must address and incorporate uncertainty and the expectation of surprises, decision makers need to assess the level of acceptable risk, much as they do with other personal or business decisions, such as saving for retirement, buying insurance, investing in infrastructure, or launching new products. Most people recognize the need to act despite uncertainty. Decision makers can benefit from a systematic and iterative framework for responding to climate change, in which decisions and policies can be

revised in light of new information and experience; information and reporting systems allow for ongoing evaluation of responses to climate risks. ***The report recommends that decision makers implement an iterative risk management strategy to manage climate decisions. Federal agencies should review and revise risk insurance programs; private firms should consider climate change risk disclosure.***

## Systems and Services to Support Decision Making

There is a growing demand for better information on climate change. Some of this demand is the result of new regulatory or reporting structures, such as state and regional greenhouse gas trading schemes or EPA requirements. In addition, there is increasing concern that climate change may already be affecting local water resources, ecosystems, and health.

To meet this demand, good information systems and services are needed. Without such systems, decision makers cannot evaluate whether particular policies and actions are achieving their goals or should be modified. Unfortunately, dissemination of climate information is often inadequate. ***This report emphasizes that information should be tailored to user needs, provided at space and timescales to support decision-making, communicated clearly, and accompanied by decision support tools that allow exploration of alternative pathways.***

### Climate Services

Decision makers are now expecting and demanding up-to-date and reliable climate information to integrate into management decisions, such as those listed in Box 1. Climate services should provide the essential information on climate conditions, variability, and change needed for effective decision making. Various forms of climate services are already planned or provided by federal agencies, including climate service and outreach programs at NOAA, DOI and USDA, as well as information provided by private consultants and state climatologists.

***In order to meet National needs for state-of-the-art information on climate change, its impacts, and response options, a coordinated system of climate services is needed.*** Core elements of such a service are outlined in Box 2. In the panel’s judgment, no single government agency or centralized unit can perform all the functions required; a system that involves multiple agencies and regional expertise is needed. Aligning the roles of federal agencies for successful climate services will require very clear leadership at the highest level of government and ongoing evaluation.

### Box 1. Examples of Climate Information Needs

#### Hydroelectric dam managers

- Impacts of climate change on traditional planning parameters, for example, the “100-year flood”
- Impacts of projected changes in temperature and precipitation on local watersheds

#### Fisheries managers

- Impacts of modest changes or shifts in climate conditions on fisheries resources and productivity
- Impacts of climate change in conjunction with other environmental stressors

#### U.S. Navy

- Ongoing and rapid changes in the Arctic region
- Higher spatial and temporal resolution of climate information

#### Transportation managers

- Linkages between sea level rise and erosion, flooding, and damage to infrastructure, to support 10 to 30 year planning efforts

#### Businesses

- Effects of climate change on risk disclosure; product supply chain

#### Public Health Officials

- Long-term climate impacts on major disease vectors, air quality, and extreme weather forecasts.

### Box 2. Summary of Core Climate Service Functions

1. A user-centered focus that responds to the decision making needs of government and other actors at national, regional, and local scales;
2. Research on user needs, response options, effective information delivery mechanisms, and processes for sustained interaction with multiple stakeholders;
3. Enhanced observations and analyses designed specifically to provide timely, credible, authoritative, and regionally useful information on climate change and vulnerability, and effectiveness of responses;
4. Trustworthy and timely climate modeling to support federal decision making about limiting emissions and adaptation;
5. A central and accessible web portal of information that includes a system for sharing response strategies and access to decision support tools;
6. Capacity building and training for linking knowledge to action across the nation;
7. An international information component.

### Greenhouse Gas Information Systems

A key issue in climate negotiations and climate policy is the ability to monitor, report, and verify emissions of greenhouse gases. Today, the diversity of greenhouse gas standards, methods, and reporting systems, which are often geared toward specific applications, has created confusion for consumers, businesses, and policy makers. High-quality, harmonized information on emissions is needed to detect trends, verify emissions reduction claims by public and private organizations, develop policies to manage greenhouse gases, and to inform citizens.

**The report recommends a federally supported system for greenhouse gas monitoring, reporting, verification, and management from multiple sources and at multiple scales.** The system should build on existing efforts and include a unified greenhouse gas emission accounting protocol and registry. The system should be supported and verified through high quality scientific research and monitoring systems, and be designed to support evaluations of policies implemented to limit greenhouse gas emissions.

### Consumer Information on Reducing Emissions

Consumers and businesses play an important role in the national response to climate change by choosing to reduce their energy use and selecting products or services with lower emissions of greenhouse gases. Tools for informing consumer decisions include smart billing and meters that provide feedback, and appliance ratings that predict

energy use. Those tools, coupled with incentives, can foster changes in behavior. **The federal government should review and promote credible and easily understood standards and labels for energy efficiency and carbon/greenhouse gas information.**

### Information about the International Context

The world is connected by the flow of goods, materials, food products, and more. Climate-related information from other countries is essential to U.S. climate choices for reasons that include: 1) the economic and market couplings of the U.S. with the rest of the world; 2) shared water and other natural resources; 3) disease spread and human health; 4) humanitarian relief efforts; and 5) human and national security. For example, many U.S. farmers' incomes are sensitive to climate impacts on export markets. **The federal government should support the collection and analysis of relevant international information about climate change and its impacts.**

### Improving Communication and Education

The climate-related decisions that society will confront over the coming decades will require an informed and engaged public and an education system that provides students with the knowledge to make informed choices. Although nearly all Americans have now heard of climate change, many have yet to understand the full implications of the issue and the opportunities and risks that lie in the solutions. Nonetheless, national surveys demonstrate a clear public desire for more information about climate change and how it might affect local communities. A majority of Americans want the government to take action in response to climate change and are willing to take action themselves.



The Carbon Counter, a 20-meter billboard in New York City, displays an estimate of increasing global greenhouse gas emissions. SOURCE: Deutsche Bank.

Although communicating about climate change and choices is vitally important, it can be difficult. Communication challenges include the invisibility of greenhouse gases; the time lag between emissions and climate impacts; the range of projections; the impact of the media, special interests, and advocacy groups in polarizing the debate; and the difficulties scientists have establishing bridges to the public and policy makers. Table 1 summarizes some simple guidelines for more effective communications.

Much more could be done to improve public understanding of climate change. *The federal government should establish a national task force that includes formal and informal educators, government agencies, policymakers, business leaders, and scientists, among others, to set national goals and objectives, and to develop a coordinated strategy to improve climate change education and communication.*

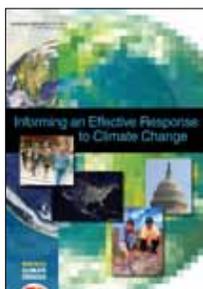
**Table 1. Guidelines for Effective Climate Change Communication**

Know your audience: Learn what people (mis)understand and their information needs.
Understand social identities and affiliations: Effective communicators often share an identity and values with the audience.
Get the audience's attention: Use appropriate framing to make information relevant to different groups
Use the best available, peer-reviewed science: Use recent and locally relevant research.
Translate scientific understanding and data into concrete experience: Use imagery, analogies, and personal experiences.
Address scientific and climate uncertainties: Specify what is known with high confidence and what is less certain.
Avoid scientific jargon and use everyday words: degrees F rather than degrees C, <i>human caused</i> rather than <i>anthropogenic</i> .
Maintain respectful discourse: Climate change decisions involve diverse perspectives and values.
Provide choices/solutions: Present options and discuss alternatives.
Encourage participation: Listen to audience concerns and ideas. Don't overuse slides and one-way lectures.
Use popular channels: Use new social media and the internet.
Evaluate communications: Assess and revise as needed.

**America's Climate Choices** is a congressionally requested suite of studies from the National Research Council designed to inform and guide the nation's response to climate change. Experts representing various levels of government, the private sector, nongovernmental organizations, and research and academic institutions were selected to provide advice in peer-reviewed reports on limiting the magnitude of climate change, adapting to the impacts of climate change, advancing the science of climate change, and informing effective decisions related to climate change.

**Panel on Informing Effective Decisions and Actions Related to Climate Change:** **Diana Liverman** (*Co-Chair*), University of Arizona, Tucson and University of Oxford, UK; **Peter Raven** (*Co-Chair*), Missouri Botanical Garden; **Daniel Barstow**, Challenger Center for Space Science Education, Alexandria, Virginia; **Rosina M. Bierbaum**, University of Michigan. **Daniel W. Bromley**, University of Wisconsin, Madison; **Anthony Leiserowitz**, Yale University; **Robert J. Lempert**, The RAND Corporation, Santa Monica, California; **Jim Lopez\***, Department of Housing and Urban Development; **Edward L. Miles**, University of Washington; **Berrien Moore, III**, Climate Central, Princeton, New Jersey; **Mark D. Newton**, Dell, Inc., Round Rock, Texas; **Venkatachalam Ramaswamy**, Geophysical Fluid Dynamics Laboratory, Princeton, New Jersey; **Richard Richels**, Electric Power Research Institute, Inc., Washington, D.C.; **Douglas P. Scott**, Illinois Environmental Protection Agency, Springfield, Virginia; **Kathleen J. Tierney**, University of Colorado, Boulder; **Chris Walker**, The Carbon Trust LLC, New York, New York; **Shari T. Wilson**, Maryland Department of the Environment; **Martha McConnell** (*Study Director*), **Lauren M. Brown** (*Research Associate*), **Ricardo Payne** (*Program Assistant*), **David Reidmiller** (*Christine Mirzayan Science and Technology Fellow*), National Research Council.

\* Asterisks denote members who resigned during the study process to take policy-making positions in government.



The National Academies appointed the above panel of experts to address the specific task, sponsored by the National Oceanic and Atmospheric Administration. The members volunteered their time for this activity; their report is peer-reviewed and the final product signed off by both the committee members and the National Academies. 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) 334-3426 or visit <http://nationalacademies.org/basc> or America's Climate Choices at [americasclimatechoices.org](http://americasclimatechoices.org). Copies of *Informing an Effective Response to Climate Change* are available from the National Academies Press, 500 Fifth Street, NW, Washington, D.C. 20001; (800) 624-6242; [www.nap.edu](http://www.nap.edu).

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