

EPA's GLOBAL CHANGE RESEARCH PROGRAM

The environment is constantly changing. Both natural processes and human activities are contributing to this change. Some of the processes, such as climate change and variability, population growth, and changes in land-use patterns, are occurring on a global scale. These global changes are already having adverse impacts on human health, ecosystems, and socio-economic well being, and are challenging our traditional systems for protecting natural resources and reducing risks to public health.

Faced with the potential consequences of these global changes, policy-makers recognize that decisions made today may have important long-term ramifications. Providing timely and useful scientific information, data, models, and decision-support tools may help them anticipate, avoid, or adapt to coming changes. The purpose of EPA's Global Change Research Program (GCRP) is to provide scientific information to stakeholders and policy-makers to support them as they decide whether and how to respond to the risks and opportunities presented by global change.

GCRP is assessment-oriented, with a primary focus on understanding the potential impacts of global change on air quality, water quality, ecosystems, and human health. GCRP uses the results of its assessments to investigate adaptation options to improve society's ability to effectively respond to global change (particularly, climate variability and change), and to develop decision-support tools that can be used by resource managers coping with change.

Climate Change Science Program

EPA is one of 13 federal agencies and departments that comprise the U.S. Climate Change Science Program (CCSP), which coordinates and integrates scientific research on global change and climate change across the federal government. All of the work conducted in GCRP is consistent with and closely coordinated with the other participating federal departments and agencies.

GCRP is committed to supporting the research and assessment activities called for in the *2003 CCSP Strategic Plan*, which includes assessments uniquely focused on EPA's mission and statutory requirements (e.g., assessments of the impacts of global change on air and water quality), and support for statutory mandates on the CCSP to produce periodic assessments of the potential impacts of climate change for Congress. As an example of the latter, the program played a leading role in the production of three regional assessments—the Great Lakes, Mid-Atlantic, and Gulf Coast regions—and a health sector assessment, as part of the First U.S. National Assessment delivered to Congress in November 2000. More recently, the program has the lead role in developing two synthesis and assessment products required under the 1990 Global Change Research Act.

A Stakeholder-Oriented Approach

GCRP is stakeholder-oriented. The success of the program in providing timely and useful decision support hinges on the inclusion of stakeholders throughout the assessment process. Stakeholders ensure that the program's work is informative and timely by identifying their specific information needs, contributing their own expertise, and providing data and information on a variety of topics (e.g., equity considerations, relevant decision processes, and willingness to accept risk).

Much of the work GCRP does in partnership with stakeholders is focused on particular locations. The impacts of global change and their solutions often are unique to a location such as a watershed or municipality. Establishing relationships with stakeholders at regional, state, and community levels ensures that the program is responsive to their unique scientific information needs and the socio-economic realities of their locales. And the place-based partnerships encourage a sense of ownership by the stakeholders in the scientific results and a readiness to employ assessment outcomes to inform decision-making.

'Mainstreaming' Climate Change

Resource managers, public health officials, and others who have the responsibility to protect the environment and public health are grappling with how best to adapt to climate change. They are facing many new challenges that require innovative science to find solutions. Climate change may affect the ability of decision-makers and resource managers to attain their goals. Fortunately, opportunities exist to anticipate and adapt to a changing climate, and tools are being developed to support adaptive management decisions. But if resource managers fail to incorporate considerations of climate change into their day-to-day operations, they may fail to meet their long-term goals.

Similarly, climate change may affect EPA's ability to fulfill its own statutory, regulatory, and programmatic requirements under the Clean Air Act, Clean Water Act, Safe Drinking Water Act, and other statutes. GCRP's assessments help the agency evaluate the extent to which climate change will affect its ability to fulfill statutory requirements, and explore opportunities available within the provisions of these acts to address the anticipated impacts of climate change.

Air Quality Assessments

Improving air quality is a major goal of EPA. The agency administers the Clean Air Act, which requires EPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. GCRP recently completed an "interim assessment" that evaluates the effects of climate change on air quality across the United States. The assessment explores how a changing climate will affect air quality for a given metropolitan area, and its future success in attaining and maintaining the NAAQS. The draft interim assessment is currently undergoing peer review.

The program has also committed to producing a more comprehensive assessment by 2012 that evaluates the effects of global change on air quality across the United States. In

addition, the program is beginning to explore the health implications of projected changes in air quality due to climate change.

Water Quality and Aquatic Ecosystems Assessments

Pollutants and pathogens and alterations in freshwater habitats, stream flow, and water temperatures threaten water quality. These threats could be exacerbated or ameliorated by climate change, climate variability, and land-use changes.

GCRP is assessing the impacts of global change on water quality and aquatic ecosystems in the United States, including the provision of clean and safe drinking water, the protection of surface waters, and the treatment of wastewater. A major focus is sensitivity to climate change of goals articulated in the Clean Water and Safe Drinking Water Acts, and the opportunities available within the provisions of these acts to address the anticipated impacts. The program is also exploring the health implications of projected changes in water quality due to climate change.

The program's efforts have already yielded substantial benefits. For example, the program recently developed a climate assessment tool that has been incorporated into EPA's watershed management system called BASINS. The tool enables managers to explore how water resources could be affected by a range of potential changes in climate and evaluate the effectiveness of different management practices for increasing the resilience of water resources to climate change. The program also completed an assessment of the implications of climate change for combined sewer systems in 182 communities in the Great Lakes region that may have to be redesigned and rebuilt. The assessment demonstrated that redesigned systems might not satisfy EPA's policies for controlling combined sewer overflow events if they are rebuilt without considering climate change. But it also empowered the communities by demonstrating that it is possible to manage the risks posed by climate change and

adapt new designs to increase their effectiveness.

Decision-Support Research

GCRP is investing in research to improve the scientific community's understanding of how best to provide decision support. GCRP and the National Oceanic and Atmospheric Administration are currently cosponsoring a new study of decision-support science by a panel organized under the National Research Council's Committee on Human Dimensions of Global Change. The objectives of the study are to develop a framework for considering climate-related decision-support objectives and activities; assess the strengths and limitations of various strategies, activities and tools; and recommend strategies that the sponsors might use for organizing decision-support activities.

Making a Difference

EPA's independent Board of Scientific Counselors reviewed GCRP in 2006 and evaluated the extent to which the program has been successful. The Board concluded that "the program has provided substantial benefits to the nation and that it is on course to make significant further contributions to societal outcomes by informing and facilitating decisions by the public and private sector actors who must consider the prospects of global change."

This month's column is contributed by Joel D. Scheraga, Ph.D., National Program Director for the Global Change Research Program, and Ann Brown in EPA's Office of Research and Development. **em**

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