



## 10 | International Research and Cooperation

During FY 2007, CCSP will continue to cooperate and coordinate its research with its international partners, particularly through international programs and related activities of wide agency interest that are intended to advance understanding of climate and global change. Individual agencies also support international programs and activities that aid the agency in addressing its mission and, in many cases, also contribute to national objectives. To promote effective international coordination of these programs and activities, CCSP provides from distributed costs a U.S. share of multilateral support for such coordination.

Additional activities supported by CCSP, updated here, include capacity building, a wide variety of international assessment and decision-support activities, bilateral arrangements in climate change science and technology, and a wide range of additional climate-related cooperative and coordination activities.

CCSP participates in and provides input to four major international scientific and related organizations on behalf of the U.S. Government and scientific community. It does so in part through its working groups, including the Interagency Working Group on International Research and Cooperation. In addition, CCSP promotes and encourages the broadest possible participation of U.S. scientists and scientific institutions in international climate science.

These international global change research programs—the World Climate Research Programme (WCRP), the International Human Dimensions Programme (IHDP), the International Geosphere-Biosphere Programme (IGBP), and DIVERSITAS—are now coordinating and integrating their activities through the Earth System Science Partnership (ESSP). The SysTem for Analysis, Research, and Training (START) also receives strong U.S. support for its activities to promote outreach and capacity building that support the WCRP, IGBP, IHDP, and DIVERSITAS. The United States also actively encourages regional cooperation in climate change research, especially through its support of regional global change research networks such as the Inter-American Institute for Global Change Research (IAI), and the Asia-Pacific Network for Global Change Research. Most recently, with cooperation from ESSP, the United States

provided support for a successful workshop to explore needs and opportunities for more formal cooperation in global change research in Africa.

The United States continues to encourage international cooperation in the development of observing systems through its continued participation in the Global Earth Observation System of Systems (GEOSS).

The United States also continues to cooperate with its partners in a number of international scientific assessment and decision-support activities such as the Intergovernmental Panel on Climate Change (IPCC), the World Meteorological Organisation (WMO)/United Nations Environment Programme (UNEP) ozone assessments, and other applications-related programs such as the International Research Institute for Climate Prediction (IRI).

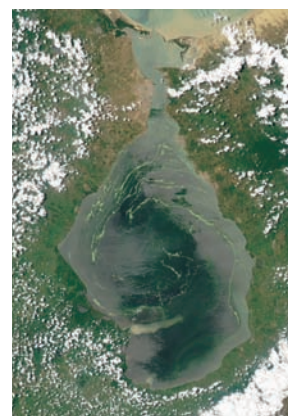
The United States, through CCSP agencies, supports advancement of several Presidential international initiatives including the suite of 15 climate change bilateral agreements coordinated by DOS.

Updates regarding these and other key international activities follow. For more detailed background information on these international activities, see Chapter 15 of the *Strategic Plan for the U.S. Climate Change Science Program*.

### COOPERATION IN SUPPORT OF INTERNATIONAL RESEARCH PROGRAMS

**World Climate Research Program.** WCRP focuses on fundamental understanding of the physical climate system, improvement of predictions, and understanding the extent of human influence on global change. In so doing, WCRP's activities are closely tied to the goals of CCSP, especially Goals 1, 2, and 3. WCRP has made significant progress this year in planning for implementation of its new cross-cutting multidisciplinary strategic framework for Coordinated Observation and Prediction of the Earth System (COPES). A WCRP team recently made a series of visits to a number of CCSP agencies to explain their planning and proposed implementation of COPES.

The WCRP Coordinated Enhanced Observing Period (CEOP) has developed a prototype observing system of systems for the global water cycle, involving 35 reference sites, national and international space agencies, and 11 operational numerical weather prediction centers. Composite CEOP products are being used to assess the quality of operational numerical weather forecasts and climate models. Researchers and scientists involved in operational climate forecasting systems are also making considerable use of



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data from the tropical observing system, first developed in the Pacific under the auspices of the WCRP Tropical Ocean Global Atmosphere project and now expanded into the Atlantic and planned for the Indian Ocean.

The WCRP Climate Variability and Predictability (CLIVAR) project has launched a study to determine the extent to which seasonal prediction across the globe is possible and useful with currently available models and data. It is coordinating ongoing activities in about 10 research and forecast centers around the world, evaluating and comparing the performance of the present systems, encouraging the exchange of model results, and organizing joint pilot numerical experiments.

WCRP's longer term strategy is to organize coordinated prediction and predictability experiments with ocean-land-atmosphere models that will ultimately lead to seamless weekly, seasonal, interannual, and decadal forecasts. This requires that the roles of the atmosphere, ocean, land, and cryosphere be properly simulated in comprehensive models of the climate system, which are also capable of assimilating weather and climate observations. This calls for a sustained research effort in validating and developing climate models and data assimilation techniques. An important test of success will be the validation of climate models through their ability to simulate past climate variability, including abrupt climate changes.

Major scientific progress in studies of the water cycle, precipitation regimes, and water resources was summarized at the fifth International Global Energy and Water Cycle Experiment (GEWEX) Conference, held in June 2005, in California. Continental-scale experiments are still underway to study the components of the water cycle over the major continents, including North and South America, Eastern Asia, and Australia, and a new experiment in Africa has been launched with the support of WCRP. The African Monsoon Multidisciplinary Analysis (AMMA) has begun a multi-year field campaign over West Africa and the tropical Atlantic, designed to improve understanding of the West African Monsoon and its influence on regional and global climate. It includes physical, atmospheric chemistry, and biological studies of interest for sustainable development in Africa, and includes components dealing directly with health, water resources, food security, and demography.

WCRP expects to focus in the coming year on areas of particular interest to the United States. These include research on improving seasonal-to-interannual prediction through CLIVAR; on the water cycle, precipitation regimes, and water resources; on monsoon processes and forecasting; on atmospheric chemistry, stratospheric processes, and climate,



especially through a new joint WCRP-IGBP Task Force on Atmospheric Chemistry and Climate; and on the cryosphere, polar research, and the International Polar Year (IPY).

**International Geosphere-Biosphere Programme.** IGBP, with its focus on the interactions between biological, chemical, and physical processes and human systems, contributes to CCSP Goals 1, 2, 4, and 5. The IGBP's core and joint projects involve a number of leading U.S. global change scientists. U.S. scientists are represented throughout the leadership of IGBP.

Key IGBP objectives for the coming year of substantive interest to the United States include finalization and publication of the science plan and implementation strategy for the next decade of IGBP research; planning for two integrative IGBP projects (the new project on Analysis, Integration, and Modeling of the Earth System and the second phase of the study of Past Global Changes); launching of a new ESSP cross-cutting study of global change and human health; further development and implementation of the Monsoon Asia Regional Study that will be carried out together with WCRP, IHDP, and DIVERSITAS; and expansion and improvement of IGBP's scientific contributions to efforts of the United Nations Commission on Sustainable Development and to the next IPCC assessment report.

**International Human Dimensions Programme on Global Environmental Change.** U.S. scientists play a lead role in planning and implementation of IHDP projects. IHDP develops and provides important inputs to CCSP efforts, including decision support as well CCSP Goals 1 and 5. IHDP held an Open Science Conference in 2005 that was attended by over 900 participants from across the globe and provided valuable input for the IHDP's development of a strategic plan and framework for its activities from 2007 to 2012. This plan is expected to call for expansion of South-North and South-South dialogs in order to more fully involve scientists from developing countries in IHDP and its individual projects.

IHDP intends in the coming year to introduce two new projects: a new IHDP core project on Urbanization and Global Environmental Change and a new cross-cutting Global Land Project, the latter to be co-sponsored by IGBP. IHDP will also play a major role in the new ESSP program on global change and human health. A new task force has been established to identify needs for and approaches to modeling related to the human dimensions of global change. IHDP is also working in conjunction with IGBP to implement the new phase of studies of land-ocean interactions in the coastal zone.

IHDP has also been involved in capacity building—for example, by hosting four training seminars involving 60 scientists and 20 trainers in conjunction with their Open Science Conference. IHDP is planning the 5th International Human Dimensions Workshop on the International Dimensions of Global Environmental Change that will focus on “Water, Trade, and the Environment” in October 2006 in Chiang Mai, Thailand.



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**DIVERSITAS.** The DIVERSITAS program focuses on advancing the science of biodiversity, including quantification of biodiversity, the effects of global environmental change on biodiversity, and the effects of loss of biodiversity on ecosystem function. Through its activities, DIVERSITAS contributes to CCSP Goal 4, as well as other programs of high priority for the United States. U.S. scientists play an important role in developing and implementing DIVERSITAS research and syntheses.

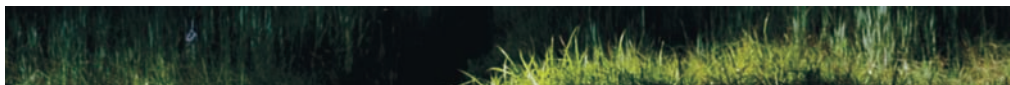
The DIVERSITAS scientific program is evolving and the program itself is just now maturing. DIVERSITAS convened an Open Science Conference in November 2005 that included 42 sessions and symposia and was attended by more than 600 participants from 60 countries, one-third of whom were from developing countries. DIVERSITAS was also involved in the preparations, especially in assembling the scientific program, for the international conference on “Biodiversity: Science and Government” held in January 2005 in Paris, which attracted about 2,000 participants from diverse sectors of society and from about 100 countries.

DIVERSITAS activities planned for the coming year that are of particular interest include the efforts of its bioDISCOVERY project that is directed to systematics, monitoring, and drivers of biodiversity change. Activities in this area are expected to contribute substantially to four of the specific elements of the GEOSS Work Plan.

The ecoSERVICES project is developing an agenda for the next generation of field experiments on the impacts of biodiversity changes on ecosystem functioning. Its bioSUSTAINABILITY project has convened a series of workshops and symposia directed at decisionmaking under uncertainty, urban bio-sustainability, and biodiversity measures for sustainable development in Southeast Asia.

In addition, DIVERSITAS is developing three new networks on biodiversity and agriculture, freshwater diversity, and biodiversity assessments in mountainous regions. DIVERSITAS is making major contributions to improving scientific input to the international Convention on Biological Diversity (CBD). Five new countries have joined the DIVERSITAS program over the past year and have contributed to the DIVERSITAS core budget.

**System for Analysis, Research and Training.** The START program is sponsored by WCRP, IGBP, and IHDP, and seeks to establish regional networks of collaborating scientists and institutions in developing countries, thereby augmenting the capacity of those countries to conduct research on global change, including climate change. By establishing research networks and partnerships in developing countries, including areas where observations and data are sparse, the START program increases global capacity to conduct research on global change and thereby contributes to CCSP goals.



The United States continues to host the international START Secretariat in Washington, DC. START intends in the coming years to address the following challenges and developments in global change science:

- Moving beyond thematic/sectoral studies toward integrated regional studies that couple biophysical and human components; that coordinate observations, modeling, and process studies; and that address the two-way linkages between regional and global-scale change
- Promoting investigation of the biophysical impacts of urbanization (including the rise of mega-cities) and the effects of alternative development pathways on the carbon cycle
- Stimulating a second generation approach to impact assessment, with emphasis on vulnerabilities and risks posed by combined regional and global environmental change, which employs methods of risk assessment to better link science to policy formulation
- Acting to address the need for a vast increase in research-driven capacity building and research partnerships between science communities in the developed and developing world.

To this end, START plans over the coming year to:

- Initiate a new project on Advancing Capacity to Support Climate Change Adaptation that will involve as many as nine regional studies in developing areas of the world (with support provided by the European Union and the United Kingdom)
- Complete its program on Assessments of the Impacts of and Adaptations to Climate Changes, including preparation and submission of final reports to UNEP and the Global Environmental Facility
- Plan and convene its 2nd International Young Scientists' Conference to be held 7-8 November 2006, in Beijing, China, to immediately precede the ESSP Open Science Conference
- Convene a synthesis workshop in India on risk and vulnerability
- Convene an initial training session of an advanced study institute on water in the context of climate change
- Support capacity building for global change research in developing countries, especially in Asia and Africa.

**Earth System Science Partnership.** ESSP brings together researchers from diverse fields and across international boundaries to investigate multidisciplinary problems such as carbon, food, health, and water that cut across the objectives of its member programs. ESSP has established four joint projects: the Global Carbon Project, Global Environmental Change and Food Systems (GECAFS; see below), the Global Water System Project, and Global Change and Human Health. All of these programs draw from expertise of the U.S. scientific community and are expected to make substantive contributions to CCSP goals.



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ESSP will convene its first Open Science Conference on 9-12 November 2006, in Beijing, China. The objectives of the conference are to:

- Present the results of the last 5 years of global environmental change research, emphasizing the Earth system science approach, in particular as it relates to ESSP joint projects on carbon, food, health, and water
- Highlight the variety of research conducted by the global environmental change community, particularly the core projects of the four international environmental change programs, and how that research contributes to and supports the objectives of ESSP
- Point the way for the next decade of Earth system science.

Themes selected thus far for the conference include:

- *Earth System Science Approach*. Advances in studies of the physical, biogeochemical, biodiversity, and human dimensions aspects of global environmental change
- *Integrated Regional Studies*. The dynamics, impacts, and consequences of the interactions between natural and social systems (including extreme events) at regional scales and how they connect with global-scale phenomena
- *Global Change in Monsoon Asia*. Global environmental change research in monsoon-affected areas of Asia
- *Science for Sustainability*. Global environmental change research relating to carbon, food, human health, and water as reflected in the ESSP joint projects.



**The Global Environmental Change and Food Systems Project.** GECAFS is an interdisciplinary research project spanning the natural and social sciences. It is developing a science agenda with direct inputs into policymaking. The new science agenda explicitly includes both how food systems could be adapted to cope with the impacts of global environmental change, and how different adaptation strategies could affect socioeconomic and environmental conditions. Of particular interest are possible feedbacks to the Earth system from efforts to improve food security relating to the dynamics of carbon, nitrogen, phosphorus, and water.

GECAFS brings together the agendas of global environmental change science and international development and will form partnerships between the environmental change research community and a broad range of other organizations, including national and international research bodies, national and international assessment units, national and regional civil society stakeholders and governmental authorities, intergovernmental organizations and United Nations agencies, and national and international donor agencies. This wide range of scientists and stakeholders working together will build upon and add value to the individual research agendas of the international environmental change research programs.

GECAFS' goal is to determine strategies to cope with global environmental change impacts on food systems and to assess environmental and socioeconomic

consequences of adaptive responses aimed at improving food security. This goal will be achieved by improved understanding of interactions between food systems and the Earth system’s key socioeconomic and biogeophysical components. The research agenda will be specifically targeted toward delivering new information necessary to underpin policy formulation for improving food security in the face of global environmental change.

The long-term aims of GECAFS are to understand how global environmental change will affect food security in different regions and among different socioeconomic groups; to determine how different societies might adapt their food systems to cope with both global environmental change and changing demands for food; to assess how strategies designed to cope with global environmental change and changing demands for food will affect the environment, societies, and economies; and to provide information and research findings in formats that help improve policymaking for food systems in the context of global environmental change.

GECAFS aims to deliver a number of science-based products in the medium-term (3 to 5 years) to help achieve the long-term aims. GECAFS, which is a joint project of IGBP, IHDP, and WCRP, builds on ongoing ESSP research, helps set new ESSP agendas, and helps set IGBP, IHDP, and WCRP core project research in the broader context of economic development. This requires innovative research partnerships and, to this end, GECAFS has established formal research partnerships with the Consultative Group on International Agricultural Research, the United Nations Food and Agriculture Organization, and WMO. These partnerships are intended to help set a precedent for formal collaboration between science and development agendas in environmental change research to mutual benefit. It also raises the priority of environmental change issues in development agencies.

**Inter-American Institute for Global Change Research.** IAI is an intergovernmental treaty organization established in 1994 to promote collaborative research on global change in the Americas. IAI encourages hemispheric collaboration on projects that would otherwise not be possible, and has developed a rigorous scientific review process for proposals it receives. IAI requires every project to be a closely integrated effort of physical and social scientists so that projects, in addition to undertaking research on important scientific issues, provide information for local, national, and/or regional decisionmakers.

From among over 30 IAI networks, a network focused on “biogeochemical cycles under land-use change in the semi-arid Americas” was formed between research





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institutions in Argentina, Brazil, Canada, Mexico, and Venezuela which provides an example of the type of work typically carried out with IAI support. This network integrates biogeochemical and socioeconomic data at the farm and regional scales within different land-use and soil management systems in order to evaluate and predict regional changes in resource quality. Often, information resulting from global change research does not reach rural communities; however, this IAI network successfully distributed scientific information to farmers within the study regions (municipalities) and supported predictions at a regional scale. Several national extension service bulletins included recommendations for soil management and conservation developed during this project.

The network's researchers participated in the consultant group for the new Argentine provincial soil conservation law that was passed in 2004, and the Provincial Secretary for the Environment made use of network-generated publications to raise consciousness about soil degradation in agricultural and natural ecosystems. In Mexico's Yucatan Peninsula, the network studied the decline of corn productivity after the second year of cultivation, and determined that corn production can be maintained with the use of cover crops and green manures. The Mexican state government adopted these recommendations as a formal policy.

The network found that the removal of native vegetation for establishment of pastures or agricultural fields in the study areas of northeastern Brazil and the La Pampa area of Argentina consistently led to severe decreases in soil fertility. The increasing area of cash-crop production in Argentina caused higher stocking rates in the savanna ranching region, with farmers moving their cattle to less productive regions while intensifying agricultural production in more humid regions. This phenomenon caused overstocking and overgrazing of natural grasslands and depletion of soil carbon.

The network developed a spatially explicit land-use model for agricultural ecosystems in northeastern Brazil and the La Pampa area of Argentina that takes into account varying climatic scenarios. The network developed an indicator of soil degradation and productive potential that is being used for soil management recommendations as well as for land-use policy decisions on a regional scale. The network also identified strong competition for water between trees and crop species, and proposed the adoption of other agroforestry practices to avoid competitive interactions. Understanding of the relationship between the quality of organic fertilizer available within the farms, nitrogen mineralization, and synchronization to crop demand allowed fertilization practices that increased crop productivity up to 300%.



**INTERNATIONAL COOPERATION IN OBSERVING SYSTEMS**

**Group on Earth Observations.** On 31 July 2003, 33 nations plus the European Commission adopted a declaration that signifies political commitment to move toward development of a comprehensive, coordinated, and sustained Earth observation system. The Earth Observation Summit was hosted by three Cabinet Secretaries and attracted a distinguished group of ministers and other dignitaries from around the world who were committed to significantly advancing our collective ability to gather and apply Earth observation data.

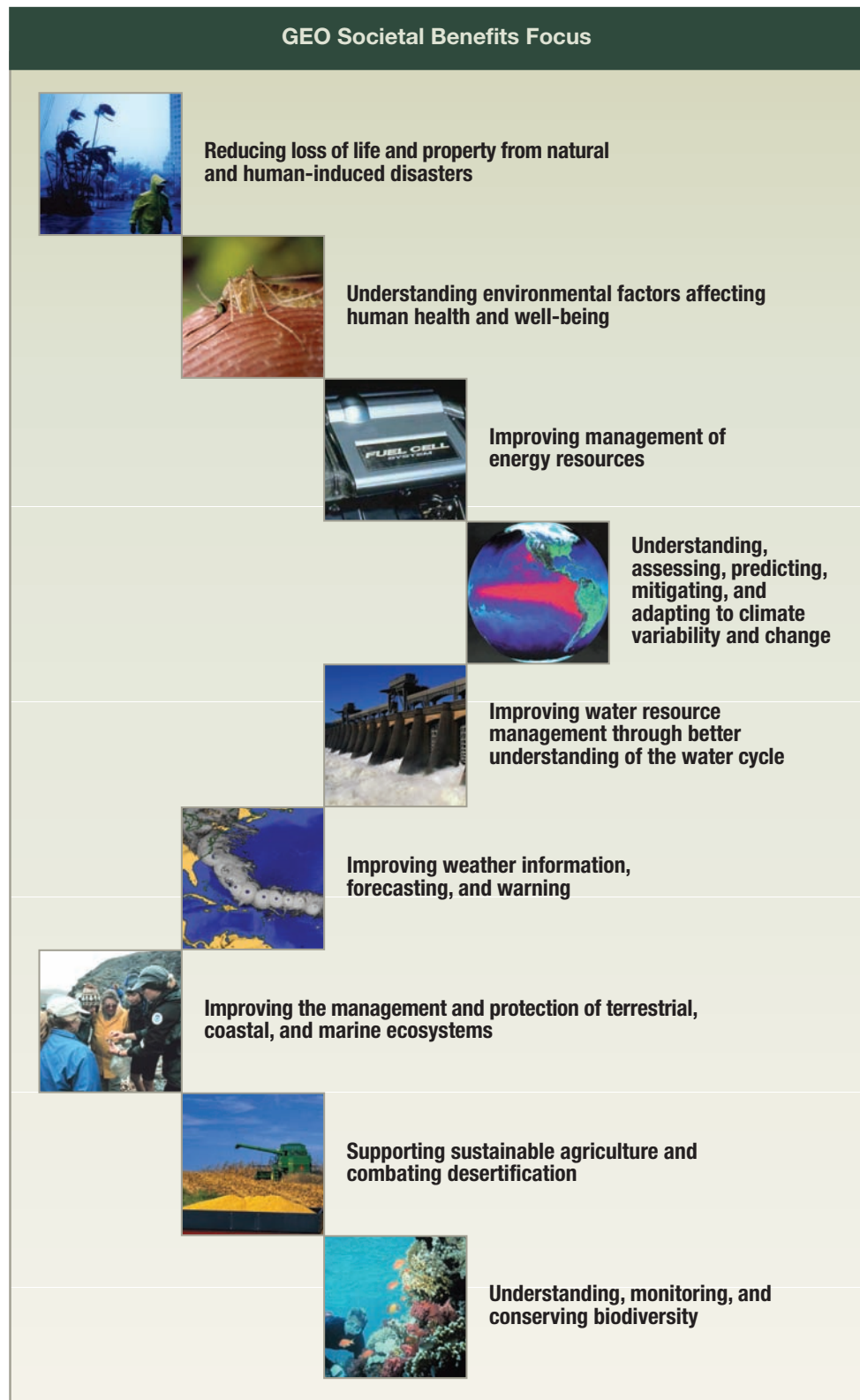
Summit participants affirmed the need for timely, quality long-term global information as a basis for sound decisionmaking. In order to monitor continuously the state of the Earth, to increase understanding of dynamic Earth processes, to enhance prediction of the Earth system, and to further implement environmental treaty obligations, participants recognized the need to support the creation of a comprehensive, coordinated, and sustained Earth observing system of systems.

To further this goal, Summit participants launched the intergovernmental *ad hoc* Group on Earth Observations (GEO) to develop a 10-Year Implementation Plan. At the third Earth Observation Summit in Brussels, Belgium, on 16 February 2005, ministers from almost 60 countries and the European Commission established GEO on a long-term basis to take the steps necessary to implement GEOSS. Participants endorsed the GEOSS 10-Year Implementation Plan, which describes collective targeted actions for establishing GEOSS, and stated their intention to provide the support necessary to execute the plan.

The first meeting of the newly established GEO took place in May 2005, at which China, the European Commission, South Africa, and the United States were selected as GEO Co-Chairs and an Executive Committee was created to facilitate and implement decisions of the GEO Plenary between meetings. At its second plenary-level meeting in December 2005, GEO formally established committees and agreed to embark on an ambitious 2006 work plan that encompasses all nine societal benefit areas (see Figure 46) identified in the GEOSS Implementation Plan.



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**Figure 46: GEO Societal Benefits Focus.** This illustration highlights the areas of societal benefit identified in the GEOSS Implementation Plan.  
*Credit: U.S. Group on Earth Observations.*

While GEOSS benefits the climate community, it also addresses a wide range of other priority applications—for example, agricultural management, biodiversity, disasters, ecosystems, energy resources, health, water, and weather. GEO currently includes 60 countries and the European Commission, as well as 43 international organizations.

### SELECTED INTERNATIONAL ASSESSMENTS AND DECISION-SUPPORT PROGRAMS

**Sector Applications Research Program.** The Sector Applications Research Program (SARP) seeks to bridge the gap between science and decisionmaking through the focused creation, dissemination, and exchange of climate-related research findings critical for understanding and addressing resource management challenges in vital social and economic sectors (e.g., coastal and water resources, agriculture, health).

SARP fosters decision-support research and applications activities that link science and technology to economic development, sustainable management needs, and policymaking processes. The program builds upon a 10-year NOAA endeavor in human dimensions research and climate research applications, and recent advances in research, assessment, and decision-support systems for climate and global change.

The programs from which SARP evolved entailed international activities that advanced the use of science in decisionmaking, such as Regional Climate Outlook Forums, interdisciplinary human dimensions research, pilot applications projects, workshops, training sessions, capacity building, and technical assistance in Africa, Southeast Asia, Latin America and the Caribbean, and the Pacific. Partners included the World Bank, WMO, USAID, IRI, and regional institutions in Africa, Latin America and the Caribbean, Southeast Asia, and the South Pacific. In the coming year, SARP will continue to build upon and expand these partnerships and activities as appropriate, including the funding of targeted applications research activities in key sectors (e.g., water resources, coastal management).

**Arctic Climate Impact Assessment.** The full underlying scientific document was published as planned at the end of 2005. The 1,042-page scientific report stands as the most comprehensive document to date addressing the state of the Arctic climate. It will serve the scientific and policy communities as an important reference on Arctic climate, its changes, and potential impacts. The report is available for download from the ACIA Secretariat (<[www.acia.uaf.edu/pages/scientific.html](http://www.acia.uaf.edu/pages/scientific.html)>) and for purchase from Cambridge University Press.



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**Millennium Ecosystem Assessment.** The technical volumes of the Millennium Ecosystem Assessment—a \$21 million, four-year effort involving 1,500 of the world's leading scientists—were released on 19 January 2006. These are the working group reports that examine Current State and Trends, Scenarios, Policy Responses, and Multi-Scale Assessments. A summary for decisionmakers of the four technical volumes was also released. These reports should advance natural resource management by providing peer-reviewed, policy-relevant information to decisionmakers in the government and the private sector. This information is of high relevance to a variety of international ecosystem-related conventions, including the CBD.

**International Research Institute for Climate and Society.** In October 2005, the Trustees of Columbia University added “Society” to IRI’s name to better reflect the work of the Institute. The mission of IRI is to enhance society’s capability to understand, anticipate, and manage the impacts of seasonal climate fluctuations, in order to improve human welfare and the environment, especially in developing countries. IRI’s international efforts involve research in climate prediction, monitoring, and analysis targeted to address problems of climate risk in agriculture and food security; water resources; public health; disasters; and cross-cutting issues such as drought management. A combination of scientific rigor, problem-centered analysis, and partner teamwork is beginning to yield successful approaches to climate risk management.

IRI has several ongoing projects in Africa, Asia, and Latin America. Many of these projects will continue in FY 2007. These include implementing an agricultural pilot project in the Southern Province of Zambia as part of the WMO implementation of the USAID project for Southern Africa; development of user-friendly climate information for the malaria control service and support for the operation of integrated Malaria Early Warning Systems in South Africa; linking climate forecasts with crop simulation models to predict field-scale maize yields at sites in southern Kenya and southern Zambia; incorporating climate forecasts into season-ahead decisionmaking on rice imports in Indonesia; and research on the impact of droughts on livelihoods in Rajasthan, India.

In addition, IRI has launched an effort to raise institutional and societal awareness of climate vulnerability and risk as an arena for action. IRI initiated institutional and policy research at two demonstration sites in Southeast Asia through a framework of collaborative research programs with two key socioeconomic research institutes in the region. The Angat Reservoir in the Philippines supplies water for Manila, and provides water for irrigation and hydropower needs. IRI is studying the institutional setting and decisionmaking process for the Angat Reservoir to explore opportunities to use climate forecasts of streamflow to improve management of limited water resources. In Nusa Tenggara Timur, Indonesia, IRI has undertaken institutional and policy research to understand the dynamics and decisionmaking related to food security in this remote and poor province of Indonesia, which experiences highly variable rainfall.

**Intergovernmental Panel on Climate Change.** The U.S. Government is the leading contributor to the IPCC and has played an active role in the IPCC process since its inception. The United States currently chairs IPCC's Working Group I (which focuses on the physical basis of climate change) and provides support for its Technical Support Unit (TSU).

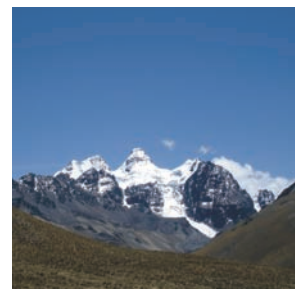
In FY 2005, the Working Group I TSU played a lead role in the coordination and publication of a Special Report on Ozone and Climate (SROC), entitled *Safeguarding the Ozone Layer and the Global Climate System: Issues Related to Hydrofluorocarbons and Perfluorocarbons*. The report covers scientific aspects of ozone-depleting substances and their substitutes as they pertain to radiative forcing, as well as issues involved in addressing atmospheric emissions of these substances. The Summary for Policymakers was approved and the underlying report accepted in April 2005. A Special Report on Carbon Capture and Storage (SRCCS), overseen by the Working Group III TSU in the Netherlands, was approved and accepted in September 2005. On behalf of DOS, CCSP coordinated the U.S. Government review of the SROC, including the final concurrence check of the summary documents. CCSP assisted the CCTP with like responsibilities for the SRCCS. Both reports involved extensive participation from U.S. scientists and technical experts.

The IPCC is now focusing all effort on development and production of its Fourth Assessment Report (AR4). CCSP supports participation of experts to serve as Coordinating Lead Authors, Lead Authors, and Review Editors, and to participate in workshops that contribute to the IPCC process. At present, 79 U.S. scientists serve as AR4 authors and 14 as Review Editors.

During FY 2006, first drafts were revised taking into consideration the very large number of comments received during the staggered Expert Reviews (held from September to November 2005 for Working Groups I and II, and November 2005 to January 2006 for Working Group III). CCSP coordinated the U.S. Government review of the second drafts of the Working Group I and II contributions to AR4 (April to June 2006 for Working Group I and May to July 2006 for Working Group II) and CCTP coordinated the U.S. Government review of the second draft of the Working Group III contribution (July to September 2006). IPCC authors are using government and expert inputs to prepare a final draft by late 2006. CCSP and CCTP also will be involved in the review of the respective Summaries for Policymakers and Technical Summaries. All working group contributions to the AR4 are expected to be completed by May 2007.

#### **The North American Regional Climate Change Assessment Program.**

The North American Regional Climate Change Assessment Program (NARCCAP) is part of a U.S.-Canadian-European collaborative regional climate modeling study. NARCCAP joins, as a new U.S. and Canadian component, the EU Prediction of



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Regional scenarios and Uncertainties for Defining European Climate Change Risks and Effects project. NARCCAP's primary objective is to develop, and make openly available, multiple high-resolution regional climate change scenarios for use in impact and risk assessments.

Analyses of the scenarios, with a focus on North America, will be conducted in FY 2007 in order to understand critical regional climate change issues, such as the effects of increased greenhouse gases on the frequency of various types of extreme weather events; to enhance understanding of key issues in regional climate modeling, including methodological approaches; to conduct a limited examination of uncertainties in projections of future regional climate by regional and global climate models; and to create greater collaboration between U.S., Canadian, and European climate modeling groups to leverage the diverse modeling capability across these nations.

**Famine Early Warning System Network.** The efforts of USAID's Famine Early Warning System Network (FEWS NET) to provide short- and long-term climate forecasting in the developing world is helping to enhance the adaptive capacity of developing countries to climate variability and change. For instance, in August 2005, FEWS NET released a report, *Recent Drought Tendencies in Ethiopia and Equatorial Subtropical Eastern Africa*, that demonstrated how warming in the Indian Ocean and changes in the monsoonal circulation pattern could reduce rainfall across large areas of the Greater Horn of Africa. This information will allow development agencies and regional and local institutions to direct appropriate resources and support toward strengthening the adaptive capacity of affected groups and the food production systems upon which they depend. This work relates closely to CCSP Goal 5, focus 5.2.

**Radio and Internet for the Communication of Hydro-Meteorological and Climate Information for Development.** The USAID Office of Foreign Disaster Assistance and NOAA have supported the Radio and Internet for the Communication of Hydro-Meteorological and Climate Information for Development (RANET) program in order to improve remote community access to and use of hydro-meteorological and climate information such as forecasts, observations, and warnings. RANET is an international collaboration of meteorological services and nongovernmental partners

to develop communication tools and networks appropriate for rural and resource-poor communities. The program integrates a variety of satellite- and terrestrial-based communication technologies, and the networks RANET establishes help national agencies receive critical information from regional and international partners. These networks also enable national meteorological services and related agencies to disseminate their own information to remote communities in their country. RANET currently works in Africa, Asia, and the Pacific (see <[www.ranetproject.net](http://www.ranetproject.net)>).



## BILATERAL COOPERATION IN CLIMATE CHANGE SCIENCE AND TECHNOLOGY

In June 2001, President Bush committed the United States to developing with our international partners an effective and science-based response to the issue of climate change. Today the United States remains committed to working with others, including both developed and developing country partners, to promote cooperative and collaborative approaches to address the global challenge of climate change.

To that end, DOS is leading a major interagency effort to advance international cooperation in climate change science and technology. Since June 2001, the United States has launched bilateral climate partnerships with 15 countries and regional organizations that, combined with the United States, account for almost 80% of global greenhouse gas emissions. Partnerships have been established with Australia, Brazil, Canada, China, Central America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama), the European Union, Germany, India, Italy, Japan, Mexico, New Zealand, Republic of Korea, Russian Federation, and South Africa. These bilateral initiatives seek to build on key elements of CCSP and CCTP, including research, observations, data management and distribution, and capacity building.

Substantive project-level work plans are now in place with each of these countries. Successful joint projects have been initiated in areas such as climate change science; clean and advanced energy technologies; carbon capture, storage, and sequestration; and policy approaches to reducing greenhouse gas emissions. The United States is also assisting key developing countries in efforts to build the scientific and technological capacity needed to address climate change.

Over the coming year, two key objectives for the bilateral activities will be continued advancement of results-oriented programs and the fostering of substantive policy dialogs within all 15 of the bilateral climate change partnerships. In order to broaden U.S. cooperative efforts to advance a practical and effective global response to climate change, the United States will expand outreach and support to the developing country community, utilizing a regional approach where feasible.

**U.S.-India Bilateral Stakeholder Meeting.** EPA sponsored a stakeholder workshop in India to bring together U.S. and Indian researchers and decisionmakers to examine possible adaptation strategies for coping with climate change, variability, and natural disasters. The project grew out of the initiation of the U.S.-India climate bilateral agreement. The workshop constitutes the contribution of the EPA's Office of Research and Development to the U.S. Government's climate bilateral activities with





## Highlights of Recent Research and Plans for FY 2007

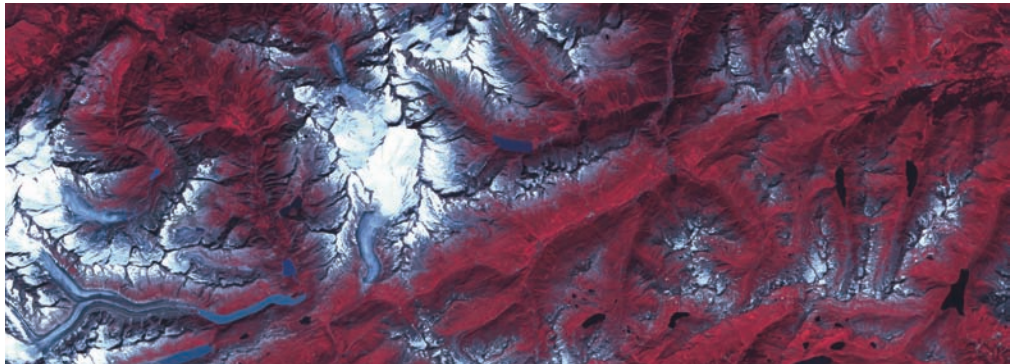
India. EPA and NOAA have the lead within CCSP for research on the impacts of climate change and on adaptive response.

The workshop was held in New Delhi on 5-7 January 2006, and brought together stakeholders from the science and management communities to engage in information-sharing on the effects of, and anticipatory adaptation to, climate change and variability; to develop an understanding of the roles and responsibilities among various government and nongovernmental actors in the area of adaptation to climate variability and disaster response; and to develop specific recommendations for further investigations by Indian researchers and for pilot implementation activities.

### ADDITIONAL CLIMATE-RELATED INTERNATIONAL ACTIVITIES

**International Polar Year.** IPY will be an intense, coordinated campaign of polar observations, research, and analysis that will be multidisciplinary in scope and international in participation. IPY will use today's powerful research tools, such as high-powered computers, automated observatories, satellite-based remote sensing, autonomous vehicles, and genomics, to better understand the key roles of the polar regions in global processes. IPY 2007-2008 will be fundamentally broader than the IPYs held in 1882-1883 and 1932-1933 or the International Geophysical Year of 1957-1958. This IPY will explicitly incorporate multidisciplinary and interdisciplinary studies, including biological, ecological, and social science elements.

A goal of IPY 2007-2008 is to undertake projects that any single nation could not normally achieve. The polar regions—both the Arctic and the Antarctic—are inherently international terrain, both because of the many nations who share these regions and because what happens in these regions affects nations around the globe. The science challenges we face far exceed the capability of any one nation, so international collaboration is expected to be a key component of IPY projects. It is hoped that the



international collaborations started during IPY will build relationships and understanding that will bring long-term benefits.

IPY also provides an opportunity to think beyond traditional disciplinary constraints toward a new level of integrated, cooperative science. In addition, IPY will serve as a mechanism to attract and develop a new generation of scientists and engineers with the versatility to tackle complex global issues. IPY is an opportunity to organize an exciting range of education and outreach activities designed to excite and engage the public, with a presence in classrooms around the world and in the media in varied and innovative formats.

**The International Group of Funding Agencies for Global Change Research.**

The United States, through its membership in the International Group of Funding Agencies for Global Change Research (IGFA), engages representatives from 20 national funding agencies with responsibility for funding global change research in discussions related to funding climate and global change research. Through annual plenary meetings, regular steering committee and staff group meetings, and other activities, member agencies regularly exchange information and views regarding global change research programs, new initiatives, research infrastructure, and related issues.

Topics of mutual interest are identified and solutions determined and implemented through the relevant national processes, and, in some cases, through coordinated international efforts. One such topic that IGFA is currently addressing is the connection between global environmental change and development-oriented research. The United States has chaired IGFA for the past 2 years.

**The Atmospheric Brown Cloud Program.** U.S. scientists are participating in an initial field experiment this year centered around the Maldivian Atmospheric Brown Cloud Program observatory, which is co-funded by NSF, NOAA, NASA, and the Government of the Maldives. If successful, this Maldives Autonomous Unmanned Aerial Vehicles (AUAV) Campaign will be the first time three AUAVs are flown simultaneously above, within, and below clouds in a polluted environment (the Indian Ocean) to collect concurrent aerosol and cloud microphysical data, aerosol chemistry data, meteorological data, and radiation data so that the indirect effect of aerosols on cloud radiative properties can be calculated. Scientists expect to analyze the field data in 2007.



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**African Network of Earth System Science.** Building on the success of its September 2005 workshop assessing needs and opportunities for regional cooperation on global change research, the African Network of Earth System Science (AFRICANESS) intends to provide a regional platform for the study of global environmental change. This has the objective of enabling African scientists to communicate more effectively and set priorities and agendas for research in Africa. It will also allow African scientists to better coordinate and communicate with the rest of the world. An organizing committee with extensive regional representation has been established. In its initial efforts, AFRICANESS will focus on water and climate modeling, desertification, land degradation, biodiversity and food security, health and pollution, and marine ecosystems.

