NATIONAL SCIENCE FOUNDATION

Principal Areas of Focus

NSF programs address global change issues through investments in challenging ideas, creative people, and effective tools. In particular, NSF global change research programs support research and related activities to advance the fundamental understanding of physical, chemical, biological, and human systems and the interactions among them. The programs encourage interdisciplinary activities and focus particularly on Earth system processes and the consequences of change. NSF programs facilitate data acquisition and information management activities necessary for fundamental research on global change, and promote the enhancement of models designed to improve understanding of Earth system processes and interactions, and to develop advanced analytic methods to facilitate basic research. NSF also supports fundamental research on the general processes used by organizations to identify and evaluate policies for mitigation, adaptation, and other responses to the challenge of varying environmental conditions. Through its investment, NSF contributes to CCSP by providing a comprehensive scientific foundation for many of the synthesis and analysis products identified in the *CCSP Strategic Plan*.

Program Highlights for FY 2006

Atmospheric Composition

NSF programs in tropospheric and stratospheric chemistry will continue to address the composition of the atmosphere and its relation to climate variability and change. Studies of the transformation and transport of gaseous constituents and aerosols provide insights into the radiative and cloud nucleating properties of the atmosphere. Studies of the global distributions of greenhouse gases will provide input for future scenarios of radiative forcing.

Climate Variability and Change

NSF programs continue to emphasize climate variability and change as a major issue. This research element supports observational campaigns and numerous analytical and modeling activities. Ocean science efforts will focus on changes in ocean structure, circulation, and interactions with the atmosphere to improve our current understanding of the processes and models that address future changes, particularly those that may happen abruptly. Major support will continue to permit the Community Climate System Model to improve model physics and parameterizations that will lead to more comprehensive models incorporating interactive chemistry and biology. Studies of paleoclimatology will continue to be supported as a means to provide baseline data on natural climate variability from the past and from key climatic regions. These studies will improve our understanding of the natural variability of the climate system and in particular will enable reconstructions and evaluations of past environmental change as inputs for model validations.

The Global Water Cycle

NSF supports a broad-based effort to understand all aspects of the global water cycle. Relevant programs will continue to explore ways to optimally and effectively utilize the wide range of hydrological data types—continuous and discrete time and space information from a variety of platforms for research purposes. Information from process studies will be used to refine models through scaling and parameterizations of sub-grid processes, particularly the fluxes of water through the Earth system. Planning for and the initiation of several prototype hydrologic observatories, both physical and virtual,

are being carried out. Science and Technology Centers will continue to work with stakeholders responsible for water management and with educators to translate research advances into useful products, particularly exploring issues related to decisionmaking in the face of uncertainty as applied to the urbanizing and drought-prone Southwest.

Land-Use and Land-Cover Change

Several NSF programs continue to address key aspects of land-use and land-cover change through studies in ecological rates of change and related species diversity; Arctic systems; temporal variability; water and energy influences on vegetative systems; and diverse human influences on land utilization.

Global Carbon Cycle

NSF supports a wide variety of carbon cycle research activities. Investigations examine a range of topics in terrestrial and marine ecosystems and their relations to the carbon cycle. Research in terrestrial settings will explore, for example, carbon storage, delivery of carbon by rivers, carbon fluxes from high-latitude soils, and carbon export from mountains and submarine groundwater discharge. In the oceans, clathrate stability, abiotic carbon cycling, and the upper ocean carbon budget will be addressed. Carbon cycle studies will integrate observational data into models to provide insights for understanding key aspects of the global carbon cycle.

Ecosystems

Several NSF programs address terrestrial and marine ecosystems through observational, experimental, modeling, and laboratory studies. The collection of ecosystem data in terrestrial and marine systems through the Long-Term Ecological Research (LTER) projects provide a major source of information. The Global Ocean Ecosystem Dynamics program will continue to study the impact of global ocean changes on marine ecosystems through specific synthesis activities focused on the North Atlantic and the North Pacific.

Human Contributions and Responses

NSF supports basic research on the processes through which people (individually, in groups, or through organizations) interact with natural environmental systems. Programs support projects that focus on decisionmaking under uncertainty associated with climate change. These projects are expected to produce new knowledge and tools that should facilitate improved decisionmaking by various stakeholder groups trying to deal with uncertainties associated with future climate variability and change.

Related Research

NSF will continue to support "contributing" research on broader topics that are closely related to global and climate change. These include, *inter alia*, studies of the atmosphere, ocean, land surface, ecosystems, paleoclimatology, and human dimensions, all of which add substantively to the specific programs supporting CCSP objectives. NSF has the computing infrastructure in place and under enhancement to enable more effective utilization of the research information. In addition, NSF supports projects that integrate research with education on global and climate change to demonstrate that scientific visualization—incorporated into inquiry-based learning—can enable students to develop an understanding of complex global change phenomena. Students address these issues by evaluating multimedia data at various spatial and temporal resolutions, reviewing scientific evidence, and considering social concerns that contribute to global and climate change debates.