



DEVELOPING DECISION SUPPORT RESOURCES

The Global Change Research Act of 1990 directs the USGCRP to support research to “produce information readily usable by policymakers attempting to formulate effective strategies for preventing, mitigating, and adapting to the effects of global change” and to undertake periodic scientific assessments. In order to fulfill the decision support and scientific assessment requirements of the Global Change Research Act and to enhance the utility of the extensive body of observations and research findings developed by the USGCRP since 1990, the CCSP is adopting a structured approach to coordinate and extend resources developed through the research activities to the support of policy and adaptive management decisionmaking.

The CCSP Decision Support Resources activities will build on the scientific foundation established by the USGCRP, the CCRI, and related international programs, as well as the lessons learned from other assessments and stakeholder interaction projects conducted during the last decade. CCSP research activities and the development of new synthesis and assessment products and other decision support resources will evolve in partnership, as scientific research progresses and as new questions related to policymaking, planning, and adaptive management arise.

THE ROLE OF DECISION SUPPORT

Prepare scientific syntheses and assessments to support informed discussion of climate variability and change and associated issues by decisionmakers, stakeholders, the media, and the general public.

Develop resources to support adaptive management and planning for responding to climate variability and climate change, and transition these resources from research to operational application.

Develop and evaluate methods (scenario evaluations, integrated analyses, and alternative analytical approaches) to support climate change policymaking and demonstrate these methods with case studies.

See Chapter 11 of the *Strategic Plan for the U.S. Climate Change Science Program* for detailed discussion of decision support resources development.

Expected outcomes from the CCSP Decision Support Resources activities include:

- Improved scientific syntheses and assessments for informing public discussion of climate change issues
- Expanded adaptive management capacity to facilitate the responses of resource managers to climate variability and change
- Assessment information for evaluating options for mitigation of and adaptation to climate variability and change
- Identification of information needs to guide the evolution of the CCSP science agenda.

Syntheses and Assessments

Assessments are an effective means for integrating and analyzing CCSP research results with other knowledge, and communicating useful insights in support of a variety of applications for decision support. Assessments also help identify knowledge gaps and thus provide valuable input to the process of focusing research.

The Global Change Research Act of 1990 directs the program to prepare periodically an assessment that:

- Integrates, evaluates, and interprets the findings of the program and discusses the scientific uncertainties associated with such findings
- Analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity
- Analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years.” (from Section 106).

To comply with the terms of Section 106, the CCSP will produce assessments that focus on a variety of science and policy issues important for public discussion and decisionmaking. The assessments will be composed of syntheses, reports, and integrated analyses that the CCSP will complete over the next 4 years. The subjects to be addressed are listed in Table 1. CCSP cooperating agencies will sponsor or carry out the analyses within the “Guidelines for Producing CCSP Synthesis and Assessment Products” (see <<http://www.climate-science.gov>>) to ensure that resources from the entire program are best utilized. This approach will cover the full range of CCSP goals and will provide a “snapshot” of knowledge concerning the environmental and socio-economic aspects of climate variability and change. The program has begun the process of developing the first of these reports on climate science findings.



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Table 1: Summary of Synthesis and Assessment Products

CCSP GOAL 1	TOPICS FOR PRIORITY CCSP SYNTHESIS PRODUCTS	SIGNIFICANCE	COMPLETION
	Temperature trends in the lower atmosphere —steps for understanding and reconciling differences.	Inconsistencies in the temperature profiles of different data sets reduce confidence in understanding of how and why climate has changed.	within 2 years
	Past climate variability and change in the Arctic and at high latitudes.	High latitudes are especially sensitive and may provide early indications of climate change; new paleoclimate data will provide long-term context for recent observed temperature increases.	within 2 years
	Reanalyses of historical climate data for key atmospheric features. Implications for attribution of causes of observed change.	Understanding the magnitude of past climate variations is key to increasing confidence in the understanding of how and why climate has changed and why it may change in the future.	2-4 years
CCSP GOAL 2	TOPICS FOR PRIORITY CCSP SYNTHESIS PRODUCTS	SIGNIFICANCE	COMPLETION
	Updating scenarios of greenhouse gas emissions and concentrations, in collaboration with the CCTP. Review of integrated scenario development and application.	Sound, comprehensive emissions scenarios are essential for comparative analysis of how climate may change in the future, as well as for analyses of mitigation and adaptation options.	within 2 years
	North American carbon budget and implications for the global carbon cycle.	The buildup of CO ₂ and methane in the atmosphere and the fraction of carbon being taken up by North America's ecosystems and coastal oceans are key factors in estimating future climate change.	within 2 years
	Aerosol properties and their impacts on climate.	There is a high level of uncertainty about how climate may be affected by different types of aerosols, both warming and cooling, and thus how climate change might be affected by their control.	2-4 years
	Trends in emissions of ozone-depleting substances, ozone layer recovery, and implications for ultraviolet radiation exposure and climate change.	This information is key to ensuring that international agreements to phase out production of ozone-depleting substances are having the expected outcome (recovery of the protective ozone layer).	2-4 years
CCSP GOAL 3	TOPICS FOR PRIORITY CCSP SYNTHESIS PRODUCTS	SIGNIFICANCE	COMPLETION
	Climate models and their uses and limitations, including sensitivity, feedbacks, and uncertainty analysis.	Clarifying the uses and limitations of climate models at different spatial and temporal scales will contribute to appropriate application of these results.	within 2 years
	Climate projections for research and assessment based on emissions scenarios developed through CCTP.	Production of these projections will help develop modeling capacity and will provide important inputs to comparative analysis of response options.	2-4 years
	Climate extremes including documentation of current extremes. Prospects for improving projections.	Extreme events have important implications for natural resources, property, infrastructure, and public safety.	2-4 years
	Risks of abrupt changes in global climate.	Abrupt changes have occurred in the past and thus it is important to evaluate what we know about the potential for abrupt change in the future.	2-4 years

Table 1 (continued)

CCSP GOAL 4			
TOPICS FOR PRIORITY CCSP SYNTHESIS PRODUCTS	SIGNIFICANCE	COMPLETION	
Coastal elevation and sensitivity to sea-level rise.	Evaluation of how well equipped society is to cope with potential sea-level rise can help reduce vulnerability.	within 2 years	
State-of-knowledge of thresholds of change that could lead to discontinuities (sudden changes) in some ecosystems and climate-sensitive resources.	This approach seeks to determine how much climate change natural environments and resources can withstand before being adversely affected.	2-4 years	
Relationship between observed ecosystem changes and climate change.	Earlier blossoming times, longer growing seasons, and other changes are being observed, and this report will explore what is known about why these events are happening.	2-4 years	
Preliminary review of adaptation options for climate-sensitive ecosystems and resources.	Understanding of adaptation options can support improved resource management—whether change results from natural or human causes—and thus helps realize opportunities or reduce negative impacts.	2-4 years	
Scenario-based analysis of the climatological, environmental, resource, technological, and economic implications of different atmospheric concentrations of greenhouse gases.	Knowing how well we can differentiate the impacts of different greenhouse gas concentrations is important in determining the range of appropriate response policies.	2-4 years	
State-of-the-science of socioeconomic and environmental impacts of climate variability.	This product will help improve application of evolving ENSO forecasts by synthesizing information on impacts, both positive and negative, of variability.	2-4 years	
Within the transportation sector, a summary of climate change and variability sensitivities, potential impacts, and response options.	Safety and efficiency of transportation infrastructure—much of which has a long lifetime—may be increased through planning that takes account of sensitivities to climate variability and change.	2-4 years	
CCSP GOAL 5			
TOPICS FOR PRIORITY CCSP SYNTHESIS PRODUCTS	SIGNIFICANCE	COMPLETION	
Uses and limitations of observations, data, forecasts, and other projections in decision support for selected sectors and regions.	There is a great need for regional climate information; further evaluation of the reliability of current information is crucial in developing new applications.	within 2 years	
Best-practice approaches to characterize, communicate, and incorporate scientific uncertainty in decisionmaking.	Improvements in how scientific uncertainty is evaluated and communicated can help reduce misunderstanding and misuse of this information.	within 2 years	
Decision support experiments and evaluations using seasonal to interannual forecasts and observational data.	Climate variability is an important factor in resource planning and management; improved application of forecasts and data can benefit society.	within 2 years	



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The CCSP agencies and scientists funded by these agencies also will continue to participate in the principal international scientific assessments, including the Intergovernmental Panel on Climate Change assessment reports and the World Meteorological Organization (WMO)/United Nations Environment Programme (UNEP) assessments of stratospheric ozone depletion and associated environmental impacts. CCSP research programs and CCSP-supported scientists provide scientific and technical leadership in coordinating, authoring, and reviewing international assessment reports. The CCSP coordinates the U.S. Government's scientific and technical review of the products of international assessments, and in so doing, the program invites input from a wide variety of sources, both inside and outside the government.

Recent international scientific assessments include the IPCC Third Assessment Report (2001), the Scientific Assessment of Ozone Depletion (2002), and the Arctic Climate Impact Assessment (Scientific Report and Overview Report forthcoming 2004). The largest assessment program to date focused on the United States was the National Assessment of the Potential Consequences of Climate Variability and Change (Overview Report, 2000; Foundation Report, 2001; and 17 regional and sectoral reports).

The IPCC Fourth Assessment Report is currently in the early stages of preparation and is scheduled to be completed in 2007. A U.S. scientist at NOAA serves as co-chair of the IPCC Working Group I on the scientific aspects of the climate system and climate change. The CCSP provides resources to support this working group. CCSP participating agency representatives also have played a significant role in nominating



U.S. experts for various roles as authors and reviewers for the IPCC Fourth Assessment Report.

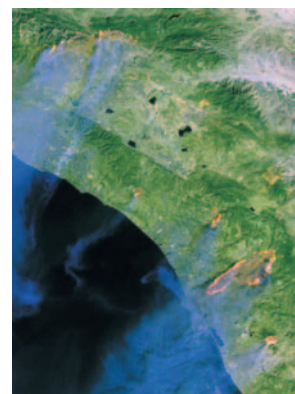
During the next decade, the CCSP will continue to support assessment analyses. Given the broad set of policy, planning, and operational decisions that would benefit from climate and global change information, there are a wide variety of candidates for CCSP assessments. The decision support approach adopted by the CCSP builds upon the “lessons learned” from earlier USGCRP-supported assessments, as well as other sectoral, regional, national, and international assessments. The CCRI will place enhanced emphasis on the extraction of mature, peer-reviewed scientific knowledge from the core research program for use in assessment and decision support.

Resources to Support Adaptive Management and Planning


Adapting to climate variability and change and their potential impacts poses challenges and opportunities for management of resources, infrastructure, and the economy. The pressures of increased population densities and intensified land use, common throughout much of the United States and other nations, increase the demand for effective management of resources sensitive to climate in many regions. For example, information on short-term climate variability (i.e., weekly, monthly and seasonal forecasts) is relevant for the development of state and regional drought action plans, agricultural operations management, water resource system management, and fishery management.

CCSP decision support resource activities will play an important role in the “transition from research to operations” for major elements of the underlying research. CCSP research results, data products, forecasts, and model results are already being applied to adaptive management decision support in a limited number of regional and sectoral case studies. Elements of climate and associated ecosystem observations from satellite, ground-based, and *in situ* platforms are also being synthesized into useful data products for decisionmakers. Examples include a variety of maps for crop management, water quality management, and urban planning, and integrated products illustrating snowpack, precipitation, streamflow, and potential for drought conditions.

Observations and increased understanding of El Niño-Southern Oscillation (ENSO) have led to useful predictions of El Niño events at lead times of up to several months. These climate forecasts have provided information for state and local emergency preparedness organizations; water resource management plans for the western regions; agricultural planning for the U.S. Southeast; and fire management for



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drought-stricken regions. Decision support tools are also employed by federal agencies to serve the public in local and regional decisionmaking and include applications in the management of carbon, water, disasters, invasive species, and coastal ecosystems along with information on public health, agriculture efficiency, and energy use. All of these products have been co-developed by scientists and users after extensive dialogues.

The CCSP will play an important role in generating improved processes and products relevant to adaptive management decisionmaking. Decision support for adaptive management requires advances in basic knowledge and progress in applying scientific information within adaptive management settings. Conducting research within a decision support framework is intended to provide multiple benefits for both managers and scientists. Ideally, users of research information are served so that new options exist for minimizing negative impacts or pursuing opportunities, and researchers benefit from refinement and prioritization of research agendas through the identification of the uncertainties most relevant to decisionmaking.

Methods to Support Climate Change Policymaking

Policy-related questions regarding climate change typically arise from numerous sources, for example from:

- Consideration of climate change policy within the Federal government
- Proposals advanced by private and nongovernmental organizations
- Preparation for international negotiations
- Consideration of legislative proposals
- Priority setting processes for science and technology programs.

The CCSP will work in close collaboration with the Climate Change Technology Program to develop evaluations of relevant policy questions that incorporate up-to-date knowledge of both scientific and technology issues. The CCSP will focus on two objectives in this area: (1) developing scientific syntheses and analytical frameworks (“resources”) to support integrated evaluations, including explicit characterization of uncertainties to guide appropriate interpretation; and (2) initially conducting a limited number of case studies with evaluation of the lessons learned, to guide future analyses.