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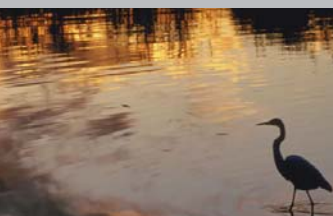
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Preliminary Review of Adaptation Options for Climate-Sensitive Ecosystems and Resources

Final Report, Synthesis and Assessment Product 4.4
Report by the U.S. Climate Change Science Program
and the Subcommittee on Global Change Research

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June 20, 2008

Members of Congress:

On behalf of the National Science and Technology Council, the U.S. Climate Change Science Program (CCSP) is pleased to transmit to the President and the Congress this Synthesis and Assessment Product (SAP), *Preliminary Review of Adaptation Options for Climate-Sensitive Ecosystems and Resources*. This is part of a series of 21 SAPs produced by the CCSP aimed at providing current assessments of climate change science to inform public debate, policy, and operational decisions. These SAPs are also intended to help the CCSP develop future program research priorities. This SAP is issued pursuant to Section 106 of the Global Change Research Act of 1990 (Public Law 101-606).

The CCSP's guiding vision is to provide the Nation and the global community with the science-based knowledge needed to manage the risks and capture the opportunities associated with climate and related environmental changes. The SAPs are important steps toward achieving that vision and help to translate the CCSP's extensive observational and research database into informational tools that directly address key questions being asked of the research community.

This SAP focuses on adaptation options for climate-sensitive ecosystems and resources on Federally owned and managed lands. It was developed with broad scientific input and in accordance with the Guidelines for Producing CCSP SAPs, the Federal Advisory Committee Act, the Information Quality Act, Section 515 of the Treasury and General Government Appropriations Act for fiscal year 2001 (Public Law 106-554), and the guidelines issued by the Environmental Protection Agency pursuant to Section 515.

We commend the report's authors for both the thorough nature of their work and their adherence to an inclusive review process.

Sincerely,

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National Forests Case Studies

Tahoe National Forest

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Olympic National Forest

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Uwharrie National Forest

Steven G. McNulty, USDA Forest Service

National Parks Case Study

Rocky Mountain National Park

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National Wildlife Refuges Case Study

Alaska and the Central Flyway

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Wild and Scenic Rivers Case Studies

Wekiva River

Rio Grande River

Upper Delaware River

Margaret A. Palmer, Univ. Md.; Dennis Lettenmaier, Univ. Wa.; N. LeRoy Poff, Colo. State Univ.; Sandra Postel, Global Water Policy Project; Brian Richter, The Nature Conservancy; Richard Warner, Kinni Consulting

National Estuaries Case Study

The Albemarle-Pamlico Estuarine System

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Marine Protected Areas Case Studies

The Florida Keys National Marine Sanctuary

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We would like to thank the many individuals who provided useful comments during the public review period. The draft manuscript, public review comments, and response to public comments are publicly available at: <http://www.climate-science.gov/Library/sap/sap4-4/default.php>

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US Environmental Protection Agency Internal Reviewers

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It was an honor and a pleasure to work with all of the people above as well as the many other colleagues we have encountered in the science and management communities who are working to address climate change impacts. We hope that this document will be a positive step forward in our collective effort to apply adaptation principles for climate-sensitive ecosystems and resources.

¹ Currently with CTG Energetics.

RECOMMENDED CITATIONS

For the Report as a Whole:

CCSP, 2008: *Preliminary review of adaptation options for climate-sensitive ecosystems and resources*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Julius, S.H., J.M. West (eds.), J.S. Baron, B. Griffith, L.A. Joyce, P. Kareiva, B.D. Keller, M.A. Palmer, C.H. Peterson, and J.M. Scott (Authors)]. U.S. Environmental Protection Agency, Washington, DC, USA, 873 pp.

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The U.S. Government's Climate Change Science Program (CCSP) is responsible for providing the best science-based knowledge possible to inform management of the risks and opportunities associated with changes in the climate and related environmental systems. To support its mission, the CCSP has commissioned 21 "synthesis and assessment products" (SAPs) to advance decision-making on climate change-related issues by providing current evaluations of climate change science and identifying priorities for research, observation, and decision support. This Report—SAP 4.4—focuses on federally managed lands and waters to provide a "Preliminary Review of Adaptation Options for Climate-Sensitive Ecosystems and Resources." It is one of seven reports that support Goal 4 of the CCSP Strategic Plan to understand the sensitivity and adaptability of different natural and managed ecosystems and human systems to climate and related global changes.

The purpose of SAP 4.4 is to provide useful information on the state of knowledge regarding adaptation options for key, representative ecosystems and resources that may be sensitive to climate variability and change. As its title suggests, this report is a preliminary review, defined as "the process of collecting and reviewing available information about known or potential adaptation options." The Intergovernmental Panel on Climate Change (IPCC) notes that there are few demonstrated examples of ecosystem-focused adaptation options (see IPCC Fourth Assessment Report, 17.4.2.1 and 4.6.2). Thus, the authors of this SAP found it necessary to examine adaptation options in the context of a desired ecosystem condition or natural resource management goal, as set forth by the resource management entity. Therefore, this report explores potential adaptation options that could be used by natural resource managers within the context of the legislative and administrative mandates of the six systems examined: National Forests, National Parks, National Wildlife Refuges, Wild and Scenic Rivers, National Estuaries, and Marine Protected Areas. Case studies throughout this report examine in greater detail some of the issues and challenges associated with implementation

of adaptation options, but are not intended to be geographically comprehensive or representative of the full breadth of ecosystems that exist or adaptation options that are available.

The management systems selected for this report are meant to be representative of a variety of ecosystem types and management goals, in order to be useful to managers who work at different spatial and organizational scales. Time and resource constraints do not allow for a comprehensive coverage of all federally owned and managed lands and waters, which means that some important management systems (e.g., Bureau of Land Management lands, Department of Defense lands, tribal lands, research reserves) are not featured in this report. However, this preliminary review of existing adaptation knowledge does contain science-based adaptation strategies that are broadly applicable to not only other federal lands, but also state, local, territorial, tribal, and non-governmental holdings. Adaptive Management, a key tool recognized in this report, is an important concept within the Department of the Interior, and an Adaptive Management Technical Guide¹ was released in the spring of 2007. It provides a robust analytical framework that is based on the experience, in-depth consultation, and best practices of scientists and natural resource managers. The information in this SAP combined with Interior's Technical Guide is available for managers to consider and discuss. Additional work is needed to refine and add to this body of knowledge, including conducting detailed analyses of adaptation options on a case-by-case basis.

It must be noted that a discussion of the cost and benefits of implementing the adaptation options, either individually or collectively, was not a component of the SAP prospectus and is not included in this report. Relative to ecosystems, the IPCC noted that information is very limited on the economic and social costs and benefits of adaptation measures, especially the non-market costs and benefits of adaptation measures involving ecosystem protection, among others. Since this is a preliminary report, additional information on the costs and benefits is certainly warranted.

¹ Williams, B.K., R.C. Szaro, and C.D. Shapiro. 2007. Adaptive Management: The U.S. Department of the Interior Technical Guide. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC.

While SAPs 4.1, 4.2 and 4.3 analyze the impacts literature, this report focuses on the current science available on adaptation responses. This report synthesizes climate change research with the experience of on-the-ground ecosystem and resource managers to suggest adaptation options that consist of: 1) adjustments to current practices to ensure their effectiveness given climate change interactions with “traditional stressors,” and 2) creation of new practices. The level of confidence in each of the adaptation approaches was evaluated by the authors based on their experience and assessment of the peer-reviewed literature on climate change impacts, current management techniques, and ecological responses. The adaptation approaches and measures suggested in this report are presented as options, not as prescriptive directives, standards, or rules.



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