



Professional Report Series – Number 11

Global Climate Change Creates New Environments and Organizational Challenges for National Parks

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Abstract

Climate change will present significant challenges to parks, for protecting and managing natural and cultural resources and basic infrastructure. In many of our national parks, the effects of climate change are already being noted. National Park Service policies require allowing natural processes to continue, minimally influenced by human actions. Because much of climate change is man-induced, the means and methods of complying with this policy are uncertain.

The National Park Service is trying to respond to the challenge with limited human and fiscal resources, but it must do more. The NPS should develop a specific response to the recommendations of the Climate Change Science Program, including those related to evaluating policies, developing scenarios on which to base planning and addressing climate change in general management plans, serving as landscape-level leaders, and using adaptive management based on good science. In addition, the National Park Service should take advantage of the spectrum of natural and managed landscapes contained in its parks to offer places where the progression of global warming and its effects can be documented at the continental landscape level. It can also use its unique assets to convey this information to the public. Finally, the National Park Service should develop specific policies or processes to ensure that infrastructure investments explicitly consider vulnerability to climate change impacts.

The Coalition

The Coalition of National Park Service Retirees (CNPSR) is an organization comprised of nearly 700 former National Park Service employees who, collectively, have served almost 20,000 years within the agency in every capacity and at all grades, including a substantial number of former Directors and Deputy Directors, former regional Directors or Deputy Regional Directors, former Associate or Assistant Directors at the national or regional office level, former Division Chiefs at the national or regional office level, and former Superintendents or Assistant Superintendents. In our personal lives, we come from the broad spectrum of political affiliations. As park managers, rangers and employees in the National Park Service's many disciplines, however, we devoted our professional lives to a common goal – maintaining and protecting our national parks for the benefit of all Americans, both living and those yet to be born. We remain committed to that goal.

This paper is one of a series on critical issues facing the National Park Service as it enters its second century. A complete listing of all current or planned papers appears at the end of this report.

The Author

The paper was prepared for and with the concurrence of CNPSR by Abigail Miller, Deputy Associate Director, Natural Resource Stewardship and Science, retired. Contributing to the paper were Cliff Martinka, Chief Scientist, Glacier National Park, Carroll Schell, Chief, Natural Resources Branch, Great Smoky Mountains National Park and Phil Brueck, Deputy Regional Director, Northeast Region, all retired.

Problem Statement

According to the Intergovernmental Panel on Climate Change (IPCC), “[a] global assessment of data since 1970 has shown it is likely that anthropogenic warming has had a discernible influence on many physical and biological systems....Much more evidence has accumulated over the past five years to indicate that changes in many physical and biological systems are linked to anthropogenic warming...” Rising sea levels; declining snow cover; melting glacial and Arctic ice; coral bleaching; changes in the timing, intensity, and amount of precipitation; changes in forest disturbance regimes, including fire; and species range changes are among the continuing and projected future impacts that can be expected to varying degrees in different areas. The stresses caused by climate can be expected to be exacerbated by existing stresses on ecosystems from such sources as pollution, human settlement, land-use change, and invasion by nonnative species. Together, climate change and ecosystem stresses significantly affect ecosystem resilience, which can lead to drastic effects on ecosystems and the extinction of species.”ⁱ

The effects of climate change are already being noted in many of our national parks. Global warming is causing glaciers to melt at an accelerated pace and it is now predicted that all of the glaciers of Glacier National Park will be gone by 2030. Rising ocean temperatures are now believed to be largely responsible for the declining health of coral reefs in Biscayne Bay and other marine parks. Resident animal breeding habits are being modified due to the earlier arrival of spring, and animals and plants are moving into regions where they never existed before due to changing habitats. Continued warming and related rising sea levels make cultural resources and infrastructure, as well as natural resources, vulnerable. Many of the ecosystems and resources set aside for future enjoyment in national parks are especially at risk, including Arctic, glacial, alpine, coastal and marine environments. The National Park Service (NPS) is charged with protecting all of the resources in parks, yet climate change will significantly affect virtually all natural resources in parks and many cultural resources as well, including those in vulnerable coastal areas and the natural resources that make up cultural landscapes.

National Park Service policies state that “The Service recognizes that natural processes and species are evolving, and the Service will allow this evolution to continue—minimally influenced by human actions.” However, when the natural processes themselves are severely impacted as a result of anthropogenic forces, both the means and the methods of complying with this policy are in question.

Current NPS Response

The National Park Service is trying to respond to the challenge with limited human and fiscal resources, but has appointed a climate change coordinator. A work group of staff from national natural resource program offices, along with the Environmental Leadership Office of the facilities program, is seeking to increase understanding of existing knowledge of climate change and impacts to parks, to assess current NPS contributions to climate change, and to focus the NPS message on climate change. The Service is also beginning to explore what it means for parks to be “natural” and “unimpaired for future generations” in light of a changing climate.

Climate Friendly Parks

In partnership with the Environmental Protection Agency (EPA), NPS is beginning to measure park emissions and develop sustainable strategies to mitigate them, as well as to provide education to park visitors. The initiative is known as the Climate Friendly Parks Program (<http://www.nps.gov/climatefriendlyparks/index.html>). Parks participating must first inventory and quantify their emissions using a computerized model developed for this use. Workshops are then used to identify emission reduction opportunities. Park Environmental Management System plans document emissions and strategies for their reduction. These plans are required for facility operations. Concessioners participate in the workshops and assist in planning for reduction of

emissions. As of May 2008, inventories and action plans were completed or nearly so at 16 parks. Some parks have gone further and developed broader sustainable operations plans that address energy and water use, sustainable planning design and construction of facilities, and intelligent transportation management. Forty parks are part of the program and are in some stage of implementation, from beginning an emissions inventory to completing a plan. While nationally coordinated, this effort has limited project funding, the majority from EPA, and assists only a few parks per year.

Research and Resource Management

There is no comprehensive coordinated research on climate change ongoing in parks. A \$3 million coordinated research program was in place in parks in 1993, but was transferred to U.S. Geological Survey (USGS) when Interior research functions were reorganized and there is no longer such a program focused exclusively on parks. Some climate change research is being undertaken in parks, but not coordinated through the National Park Service. An EPA-sponsored workshop on Adaptations of National Parks to Climate Change was held in December 2006, as part of the U.S. Climate Change Science Program's efforts to write a chapter of a larger report on adaptations for sensitive ecosystems. That workshop included several scientists with long affiliation with NPS, USGS or universities and the research undertaken in them that addresses climate change. The resulting reportⁱⁱ represents the best synthesis to date.

In addition, the NPS and FWS have funded creation of bioregional impact summaries for informing park and refuge management and interpretive staffs about current and expected climate change and how it affects resources and visitor experience. NPS project funding and fee monies allowed USGS to compile information and produce coastal vulnerability assessments on a park-by-park basis. Reports for 22 parks are available (<http://woodshole.er.usgs.gov/project-pages/cvi/>).

NPS held a pilot workshop in November 2007 to explore the use of Climate Change Scenario Planning for long-range planning in the face of uncertainty. Additional workshops are planned for the winter of 2009 for parks beginning planning processes that year.

The NPS Vital Signs Monitoring Program provides some capability for tracking and documenting changes to climate-sensitive park resources as they take place. Several inventory reports are available on a network basis (groups of parks that undertake inventories and monitoring cooperatively) that assess existing knowledge of climate itself and monitoring to measure changes in climate (<http://www.wrcc.dri.edu/nps/reports.php>). All of the NPS Inventory and Monitoring networks considered climate change when selecting vital signs to monitor. The monitoring program is still in the process of being implemented, with 23 of 32 networks having completed plans. Data analysis, synthesis and reporting are major challenges; there are several examples of efforts to report on information developed to date including that incorporated into the program from earlier efforts (<http://science.nature.nps.gov/im/reports/outreach.cfm>), but there is no overall summary or synthesis of the available data from the program.

NPS has developed a web-based seminar series that will feature climate change experts on impacts and management strategies. The primary goal is to build service-wide capacity for communicating and coping with change.

White papers are being written to address policies related to natural resource management. Some NPS regions are taking the initiative, especially the Pacific West Region. Additionally, some individual parks have begun to think about what the effects of climate change will mean to park management. However, these projects are being developed at a slow pace and there is no funded effort to assure that all parks assess their vulnerabilities to climate change and develop and implement responses in a timely manner.

In short, there is a wide-range of efforts underway to gather and synthesize information on climate change and provide the basis for estimating impacts for planning and decision-making. Several are being undertaken by other agencies and NPS has a person designated to coordinate these efforts. Funding to fully apply the information, especially in scenario-building and development and implementation of resource plans, is lacking.

Public Information

Some regions and parks also have begun to interpret the effects of climate change to visitors. In addition, NPS is working with EPA and other agencies on a “Climate Change: Wildlife and Wildlands Toolkit, for teachers and informal educators”—due out by the end of 2008.

Areas Where Attention Is Almost Completely Lacking

Planning

Current general management plan (GMP) guidance does not explicitly require paying attention to the effect that changing climate will have on future park natural and cultural resources, infrastructure, and visitors. At least one region is requiring this, however, and the scenario-development efforts planned are intended to assist in this effort. The guidance on GMP environmental impact statement (EIS) development indicates that assumptions for the analysis should be spelled out, including, as an example, climate change. It also indicates that the area of analysis would vary by issue, but nonetheless states that “in most instances” the park boundary will be the appropriate area for inclusion in GMP compliance documents.

While there are a few sentences that mention landscape level and sustainable development, there is no admonition to analyze how climate changes will affect the ability of parks to carry out their mission or to analyze the sustainability of development in the context of climate change impacts. Moreover, no planning process explicitly addresses larger landscape issues, such as corridors for movement of wildlife in anticipation of changing home ranges or migration routes—nor do NPS planning processes require initiation or involvement in the kinds of cooperative planning processes that cross government and private sectors and that would be needed to address landscape responses to climate change.

Resource Management Plans were initiated in response to the 1980 State of the Parks Report. An NPS-wide database capturing threats and issues was developed and was in place through 1999. While NPS Management Policies continue to require such plans, development of new and updated plans has been in hiatus for nearly 10 years. The Government Performance and Results Act of 1994 (GPRA) was implemented in the National Park Service in such a way that every park was required to develop a unique GPRA “strategic” plan—which focuses on a short 5-year timeframe and measurement of key indicators negotiated with OMB (most agencies implemented GPRA on a more bureau-wide or program-wide basis).

Parks’ small resource staffs are stretched thin by the annual GPRA reporting requirements and the process was not well integrated into the broader planning process, including strategic development of funding needs to meet park goals, ultimately affecting the ability of park managers to carry out resource management planning. As a result of GPRA and other needs for change, the NPS planning process was overhauled and a new process was outlined in the 2001 National Park Service Management Policies. The development of resource management plans was halted pending guidance development for the larger planning process. The new resource planning process contained in the draft sought to fill the gap between a new more conceptual GMP and the very short-term, not very strategic (despite their name) actions required in GPRA plans. While draft guidance for new resource

plans was issued in 2004, 4 years later the guidance has still not been finalized and requirements to update resource plans are still suspended.

Only the operations plans at the park addressing facilities management focus on sustainability at all, and these look at reducing environmental impact, not the effects of a changing environment on park resources.

The 2009 round of scenario-development workshops is tied to the planning process, and it is important that planning explicitly consider the range of changes climate change will bring. However, given that GMPs are intended to last 10-15 years and many parks have plans substantially older than that, depending on the GMP process alone—unless amendments were required for all parks in the short-term—will not provide the planning underpinning needed to respond to climate changes.

Construction and Development

There have been efforts to increase the sustainability of park facilities, with particular attention to energy efficiency, and concomitant certification under the Leadership in Energy and Environmental Design (LEED) rating system. However, this attention has not been broadened to look hard at the sustainability of locations for various types of facilities and investments. While policy statements have long proclaimed that development footprints in the park should be minimized, there has been little effort on a Servicewide basis to analyze when facility development is best achieved outside the park boundary, let alone to ascertain whether investments in new structures, repairs or rebuilding, or historic structures are sustainable in the face of increasing storm frequency or intensity, sea rise, or other effects of climate change. Rebuilding of roads in Gulf Islands National Seashore is a recent example.

Land Acquisition

While climate change could have a profound effect on the efficacy of acquisition of specific parcels of land within authorized boundaries, there is no NPS-wide requirement for analysis of this factor. Any cooperative landscape level planning process that seeks to mitigate climate effects on natural resources would also need to consider land acquisition.

Public Attention To Climate Change Effects on Parks

Outside the National Park Service, attention is now being paid to how climate change will affect parks:

Government Accountability Office (GAO)

The GAO looked at the potential vulnerabilities of selected federal lands to climate change, at the request of Senators John Kerry and John McCain. In its August 2007 report, GAO found:

...BLM, FS, FWS, NOAA, and NPS have not made climate change a priority, and the agencies' strategic plans do not specifically address climate change. Resource managers focus first on near-term, required activities, leaving less time for addressing longer-term issues such as climate change....In addition, resource managers have limited guidance about whether or how to address climate change and, therefore, are uncertain about what actions, if any, they should take. In general, resource managers lack specific guidance for incorporating climate change into their management actions and planning efforts. Without such guidance, their ability to address climate change and effectively manage resources is constrained...Finally, resource managers do not have sufficient site-specific information to plan for and manage the effects of climate change on the federal resources they manage.

U.S. Climate Change Science Program (CCSP)

An EPA-sponsored workshop on Adaptations of National Parks to Climate Change was held in December 2006, as part of the CCSP's efforts leading to a larger report. Workshop objectives included identifying management goals and barriers to achieving them. Information on climate change was presented, but it was emphasized that there will be surprises. Workshop discussions and the resulting report are summarized here, since they represent the best evaluation and synthesis of climate change concerns for the National Park System and possible strategies for response.

Workshop participants concluded that while ecosystems cannot be kept intact, ecosystem function can be maintained. Nonetheless, most participants kept coming back to the need to strive for this goal, reducing impairment to the extent possible—or hold on as long as we can, focusing more on processes and less on species, so that the processes can be left unimpaired. In this context, the concept of resilience and how, or even if, the NPS should manage to increase/improve resilience was continually raised. Strategies suggested include decreasing fragmentation through land acquisition and coordination with others on the landscape level, reducing pollution, avoiding inappropriate responses to changing coastlines, and reducing overexploitation, as well as restoration of natural fire regimes. The need for managed disturbance over multiple scales, rather than waiting only for climate change to create the disturbance, was raised. Also, identifying areas of resilience should affect priorities for deployment of resources--investment decisions. Disaster response must take into account what will happen in the future, rather than just rebuilding automatically.

It was suggested that NPS also needs to look at opportunities to learn more about systems and system responses to assist in adaptive management strategies. The I&M networks are working on identifying targets for threshold shifts. New resource stewardship plans (replacing resource management plans) as conceived in draft guidance are also supposed to address thresholds and ecosystem scales. While I&M networks develop information at a scale that is useful to parks, participants suggested that USGS should be doing the roll-ups to look at what the information means at larger scales. Also important for NPS is informing the public and using the parks as a regular teaching tool, leading by example and advertising it.

Subsequent to this workshop, the completed reportⁱⁱⁱ (available at <http://www.climatescience.gov/Library/sap/sap4-4/final-report/>) stated and recommended:

1. "Addressing resilience to climate change in activities and planning will increase the ability of the National Park Service to meet the mission of the Organic Act..." The report indicated that climate change should not be treated as one of a host of pressing issues, but should be considered in all activities and plans. Short-term approaches, such as reducing habitat fragmentation and loss, were identified that may help to provide resilience over the next few decades. The possible need to prioritize resources and determine parks that should receive immediate attention was raised.
2. "Preparing for and adapting to climate change is as much a cultural and intellectual challenge as it is an ecological one." The report suggested revisiting management practices and policies, a "portfolio" of management approaches, and an environment that is supportive and allows risk-taking, learning from mistakes, and adaptation.
3. "As climate change continues, thresholds of resilience will be overcome, increasing the importance of using methods that address uncertainty in planning and management." The report recommends a small number of scenarios be used to address uncertainties associated with climate change, then adaptive management that includes iterative monitoring and interpretation to gauge management effectiveness.
4. "Protecting natural resources and processes may continue to be achieved during the coming decades using science-based principles already familiar to Park Service managers." These include identifying what is at risk, defining what constitutes "unimpaired" in a changing world, deciding appropriate scales at which to manage the processes and resources, setting measurable targets of protection, and monitoring of management results.

5. “Many management goals can only be achieved through regional interagency cooperation.” The report recognizes that the National Park Service can be a lead player in regional collaboration with other land and resource management entities that can develop and implement strategies for mitigating climate change effects on resources.
6. Climate change can best be met by engaging all levels of the National Park Service. Different levels, as well as various program areas, are targeted. Revision of the National Park Service Management Policies to incorporate climate change considerations and amending General Management Plans and resource management plans to include the understanding, goals, and plans that address climate change issues, are recommended.

Other reports or articles of note include:

- The Natural Resources Defense Council’s “Our National Parks at Risk,” focusing on western parks and ranking 12 parks as facing the greatest risks from global warming.^{iv}
- The World Wildlife Fund’s “No Place to Hide: Effects of Climate Change on Protected Areas” that focuses on worldwide threats to biodiversity posed by climate change.
- George Wright Forum articles (available at <http://www.georgewright.org/>), including “What Should Protected Area Managers Do in the Face of Climate Change?” by David Walsh^v; “Naturalness and Beyond: Protected Area Stewardship in an Era of Global Environmental Change” by David N. Cole, et al.^{vi}; and articles in Volume 25:2 concerning climate change and cultural heritage^{vii}.

RECOMMENDATIONS

Climate change will present significant challenges to parks, for protecting and managing natural and cultural resources and basic infrastructure. More information is needed, as well as consistent observation and effective priorities at many levels to address necessary strategies, all of which require significant funding and management commitment. NPS must take the initiative and the Coalition, Congress, and the public should monitor their efforts. The National Park Service should develop a specific response to the CCSP recommendations, including:

1. Evaluating and implementing appropriate policy changes, requiring GMP amendments to address climate change, and implementing new resource stewardship plans to address climate change. While not specifically raised in the CCSP recommendations, NPS needs to address GMP amendments in the short-term (with public involvement), not the normal planning cycle.
2. Developing scenarios that will be the basis of planning and adaptive management. Also not specifically addressed in the CCSP recommendations, NPS should ensure that these are developed in a timely manner for all parks that face climate-related impacts, with priorities based on risk to resources which the parks were established to protect.
3. Identifying steps that it will take to serve as a catalyst for regional/landscape level collaboration to mitigate climate change effects.
4. Identifying and implementing management approaches and processes that will allow adaptive management and science-based decisions and processes.

In addition, the National Park Service should take advantage of the spectrum of natural and managed landscapes contained in its parks to document the progression of global warming and its effects at the continental landscape level. No other agency holds this potential for understanding and widely communicating information, through interpretation and other means, about climate change in the US. By establishing a more robust capability, the NPS could be a force in shaping the response to climate change. We are not recommending a research program, but an office led by a

credible scientist and staffed with a few others with the knowledge and stature to work with researchers and others in the climate change arena to collect and synthesize data, to hold forums and develop public information, and to assist parks with scenarios planning. NPS's current climate change coordinator is capable of this effort, but has few resources at her disposal.

Finally, the National Park Service should develop specific policies or processes to ensure that infrastructure investments explicitly consider vulnerability to climate change impacts.

ⁱ Intergovernmental Panel on Climate Change, Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report; *Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability – Summary for Policy Makers*, April 6, 2007

ⁱⁱ US Climate Change Science Program, 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, 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.

ⁱⁱⁱ US Climate Change Science Program, 2008 *ibid*

^{iv} *Losing Ground: Western National Parks Endangered by Climate Disruption*. By Stephen Saunders and Tom Easley, The Rocky Mountain Climate Organization and Theo Spencer, Natural Resources Defence Council. July 2006

^v "What Should Protected Area Managers Do in the Face of Climate Change?" by David Walsh, *The George Wright Forum*, Vol 22:1 (2005)

^{vi} Naturalness and Beyond: Protected Area Stewardship in an Era of Global Environmental Change, David N. Cole, et al., *The George Wright Forum*, Vol. 25:1 (2008)

^{vii} *The George Wright Forum*, Vol. 25:2 (2008)

APPENDIX A

This Series Of Papers

The imminent arrival of the centennial of the National Park Service's birth, which will occur in 2016, has led to reflection on its past, evaluation of its successes and failures, and discussion of its future goals and priorities – both within the agency and among its many friends and supporters.

As an organization containing more professional experience and knowledge than any comparable entity anywhere in the country, we believe that we are uniquely placed to offer our professional perspectives on the array of issues that are and will be discussed over coming months and years.

This series of papers offers our professional evaluation of the key issues that the agency is now facing or will be dealing with in coming years. Current papers in the series, either completed or in development, include the following. Others may be added:

- Report 1 *America's Crown Jewels: The National Park System* – A paper on the philosophic and legislative foundation of the NPS and an evaluation of the need for more effective national engagement in protecting parks.
- Report 2 *The National Parks Centennial Commission* – An evaluation of the commission and recommendations on how it should work, what its goals should be, and what issues it should focus on.
- Report 3 *The National Park Centennial Institute* – A paper that explores the need and concept for a formalized academic institute to study a wide variety of park-related issues in order to inform and educate agency staff and political leaders and better manage our parks in a new century.
- Report 4 *Competitive Sourcing, Privatization, and Philanthropy in our National Parks* – A paper on these key issues and the bearing they have on the agency and its efforts to attain its goals.
- Report 5 *The Future of Entrance Fees and Their Connection to Visitation* – An examination of the problem of over reliance on entrance and user fees and the potential fees have to “price publics out of their parks.”
- Report 6 *Reasserting International Environmental and Park Leadership* – This paper looks at the reasons why the NPS has lost its standing as an international leader in parks and what needs to be done to become a more effective member of the international parks community.
- Report 7 *A Renaissance of Park Interpretation and Education Reaffirms the Mission of the National Park Service* – A paper that looks at the present dire straits of the NPS interpretive and education program and calls for a “renaissance” and a renewal of excellence in our on-site and off-site educational programs.
- Report 8 *Toward A Second Century Of Excellence For The National Park System* – This paper presents a ten-point vision of the attributes that the National Park Service needs to have by the time its centennial arrives on August 25, 2016. It also outlines qualities that must be sought and fostered in its leaders for it to retain its integrity, serve the public and meet its goals, and identifies core values that underlie “principled leadership.”

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- Report 9 *It Is Not A Matter Of Money – It Is A Matter of Priorities* – This paper exposes the budgetary quagmire the National Park Service finds itself in and discusses ways out of the situation. It also presents a 15 year review and analysis of NPS budgets and compares the Clinton and Bush administration’s budgets.
- Report 10 *The Renewal of the Park Ranger Profession* – A review of the present state of the park ranger profession, which is increasingly called upon to specialize in the narrow niche of law enforcement, and how it might be reformed to better serve the agency in the future.
- Report 11 *Global Climate Change Creates New Park Environments and New Organizational Challenges for Park Science Programs* – This paper looks at the coming changes to our national and global ecosystems and impacts upon society and where our national parks can serve as effective barometers of global change.
- Report 12 *Reassessing the Development Footprint in our Parks* – This paper looks at the planning, development and construction process in the parks, examining the lessons learned from the first century of park development and how they need to be reconsidered for the second century.