

## SUPPORTING BASIC ECOLOGICAL RESEARCH IN U.S. NATIONAL PARKS: CHALLENGES AND OPPORTUNITIES

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**Abstract.** The long-term preservation of national park ecosystems requires scientific knowledge about populations, communities, and the ecological processes upon which sustainable ecosystems depend. Unfortunately, national parks in the United States have a well-documented history of indifference, if not hostility, to the support of basic research. Numerous external reviews have criticized the lack of institutional support for science, blaming it in large part on the traditional emphasis of the National Park Service (NPS) on scenery and tourism management. However, recent efforts to improve the support for science in the U.S. national parks have been most encouraging. These include a long-sought Congressional mandate to support research, a major budget initiative to support scientific understanding and management of park resources as well as to improve research facilities, leadership in the establishment of a network of university-based cooperative units, and the successful partnering with private organizations to support innovative programs to fund Ph.D. students, postdocs, and sabbaticals in national parks. The long-term success of national parks in preserving natural ecosystems depends, in large part, on the NPS's ability to provide support for the science that is necessary to understand natural ecosystems as well as the effects of human activities.

**Key words:** *Cooperative Ecosystem Studies Units; ecological research; management of natural areas; national parks; National Park Service (USA); Natural Resource Challenge; parks for science; science for parks.*

### INTRODUCTION

National parks protect some of our nation's most important natural resources. The long-term preservation of those resources requires a thorough understanding of park ecosystems and the ecological processes that influence them. National parks also provide unique opportunities to learn about natural ecosystems and serve as important baselines against which to assess the influence of human activities. Yet, despite the clear importance of science for parks and parks for science (Parsons 1989, Graber 2002), there continues to be a lack of basic scientific information available on many park ecosystems. This can in part, be blamed on a historic lack of support for or interest in scientific research within the National Park Service (NPS). In a 1997 book published by Yale University Press, historian Richard W. Sellars presents a convincing history of how the Park Service, the agency charged with protection of many of the nation's most valuable natural resources, evolved a culture that neither understood nor valued the importance of science to its management decisions. As a result, the NPS never developed the interest or

infrastructure necessary to support an effective research program. Some scientists have viewed the NPS as not only unsupportive, but actually hostile to research (Eichelberger and Sattler 1994). This perception was elaborated on in an April 2000 news report in *Science* that claimed "inadequate science is hampering management decisions in the national park system" and "agency officials have tended to view science with anything from benign neglect to outright hostility" (Kaiser 2000:34). The resulting lack of basic understanding of park ecosystems has resulted in some decisions being made without the benefit of a full understanding of their consequences. In addition, despite the obvious allure of national parks as attractive places to work, some scientists have avoided working in them. Recent reviews of science in the national parks have expressed concern over the long-term implications of this situation (NRC 1992, National Park Service Advisory Board 1993).

Despite this perception of indifference, or even hostility, toward science in our national parks, recent developments indicate that the NPS recognizes this deficiency and is actively working to change this perception. In this paper I briefly review the history of ecological research and its support (or lack thereof) in the U.S. national parks, and then document a number of recent developments that indicate that a more sup-

For reprints of this Forum, see footnote 1, p. 3.

Manuscript received 14 March 2003; accepted 30 March 2003.  
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portive atmosphere toward research may be emerging in the NPS.

#### BACKGROUND

The history of support for and use of scientific research in the NPS has been inconsistent at best. In-house research programs, as well as the direct support of external research, have come and gone over time. In the early years this could largely be attributed to the perception that if parks were simply left alone their ecosystems would survive forever. The role of science was largely limited to descriptions of the flora, fauna, and geology. Probably the first significant direct support of research by the NPS occurred with the 1929 endorsement of a comprehensive survey of park wildlife (the work was actually funded through the personal fortune of NPS biologist George Wright). Shortly thereafter, the NPS had established a "wildlife division" charged with furthering the understanding of park fauna. Scientists in the wildlife division challenged the traditional management of parks by questioning the utilitarian and recreation focus that had traditionally dominated the agency. For example, they warned about the limitations of park boundaries that did not encompass complete ecosystems as well as the effects of the loss of both habitat and key species on park values (Sellars 1997). These early NPS biologists advanced some of the most important ideas later incorporated into the field of conservation biology (Shafer 2001). Following a decade marked by frequent clashes with park management, the NPS biologists were in 1940 transferred to the Biological Survey, leaving the NPS largely unchallenged in its efforts to apply the earlier "traditional" assumptions and practices of park management.

In the early 1930s the NPS, in what Sellars (1997: 109) states was "probably at the urging of the Ecological Society of America and leading biologists," established a system of research reserves to "preserve permanently" selected natural areas. This action was designed, in part, to protect areas for scientific study in "their original, unmodified condition." However, the vulnerability of the research reserves to administrative discretion became apparent when, following a severe windstorm in 1936, the Andrews Bald reserve in Great Smoky Mountains National Park was, over the objections of agency biologists, declassified in order to permit cleanup of the dead and dying trees. The research reserve program soon became ignored by the agency. Sellars (1997:111) summarizes the situation by stating that the agency's handling of the Andrews Bald research reserve "reflected the Park Service's ingrained disregard for scientific research." Into the 1990s the National Science Foundation (NSF) refused to fund Long-Term Ecological Research sites in national parks, largely as a result of NSF's lack of trust in the NPS's

commitment to the long-term protection of study areas (T. Callahan, *personal communication*).

By the mid 1940s the NPS had rehired a few biologists, but most of these worked in Washington, D.C., and the few working in the parks were supervised by, first, park naturalists and, later, park rangers. There was little internal support for increased funding of science within the agency. This situation continued into the early 1960s, when two widely publicized reports called attention to the need for greater emphasis on science in the NPS. In 1963, the Robbins Report on research needs (NRC 1963) and the Leopold Report on wildlife management (Leopold et al. 1963) focused attention on the need for a stronger scientific basis for management decisions in the national parks. Both reports concluded that the NPS was uninformed about its biological resources and criticized the agency's failure to support scientific research. The scientific value of national parks and the need for scientific research to "form the basis for all management programs" (Sellars 1997:215) was a focus of both reports as they called upon the NPS to support a strong, independent, research organization.

Although the 1963 reports generated significant resistance within the agency, it was difficult to argue with the validity of their conclusions. The rationale and recommendations they presented, particularly those of the Leopold Report, were largely incorporated into NPS policy in 1969. Nevertheless, organizational change and funding support were slow to follow. Although the few new scientists that were hired reported initially to a Chief Scientist in the Washington Office, supervision was soon transferred to regional directors and park superintendents. Despite the reluctance of the NPS to incorporate science into its operations (see Sellars [1997] for a full accounting of this story), a number of significant changes soon occurred, forming the basis for an expanded NPS research program.

#### BUILDING OF A NATIONAL PARK SERVICE RESEARCH PROGRAM

In 1970 the first NPS Cooperative Park Studies Unit (CPSU) was established at the University of Washington. These units were designed to bring university scientists and students into contact with the applied-research needs of the national parks. By 1980 there were 35 CPSUs across the country, many of which provided supervision and coordination for a new cadre of park-based scientists (including the author) that had been hired during the 1970s. At about the same time, several of the larger parks—including Everglades, Great Smoky Mountains, and Yellowstone—developed substantial in-park research centers that were staffed by NPS research scientists. These centers also provided facilities and logistical support for non-government scientists working in the parks. For the most part, development of these centers and the focus and quality

of the research conducted was driven by individual personalities and circumstances rather than by a unified, national agenda. For example, Superintendent Boyd Evison converted the traditional superintendent's houses in Great Smoky Mountains and Sequoia and Kings Canyon National Parks into park research centers that are still used by both NPS and non-government scientists. Most park research programs consisted of individual researchers who were expected to oversee the entire research operations of a large, complex park (e.g., Channel Islands, Haleakala, Yosemite). Some parks focused attention on providing logistical support for outside scientists to work in the park (e.g., Isle Royale). When I first arrived as the sole researcher at Sequoia and Kings Canyon National Parks in the early 1970s it was clear that the most efficient way for the parks to obtain the scientific help they needed was to provide logistical support that would attract qualified researchers to work in the parks. At Sequoia and Kings Canyon, support included help with data acquisition and field sampling as well as laboratory and dormitory facilities. Since limited funds were available to support research on park management priorities, we attempted to leverage what funds were available to attract additional support from other sources. For example, the leveraging of park funding with additional financial support from the California Air Resources Board for studies related to acidic deposition and global change (Tonnessen 1992) helped attract a number of respected university scientists to work on basic ecological questions of importance to both science and park management (e.g., Graumlich 1993, Swetnam 1993, Leydecker et al. 1999, Miller and Urban 1999). Other parks had similar success in the 1980s and early 1990s, although the efforts and results were clearly uneven across the agency. Again, these efforts were largely driven by individual personalities (of both the scientists and park management) more than by a concerted central effort or model promoted by the agency. By 1987 the NPS employed 73 park-based researchers (NRC 1992) in addition to providing support for hundreds of cooperating academic scientists.

In 1980 the Pacific Northwest and Western regions of the NPS coordinated production of a new publication, *Pacific Park Science*, which focused on issues related to park science and management. This became a national publication the following year under the title of *Park Science*. It continues to be distributed free of charge to park management and natural-resources staff as well as others interested in science and the national parks. *Park Science* underwent a major facelift in 2000 and now advertises itself as a biannual resource management bulletin that "reports recent and ongoing natural and social science research, its implications for park planning and management, and its application in resource management" (*Park Science* 21(2):48). It continues to serve as an important communication forum

for informing NPS managers about the value of science for the national parks and is a source of information for scientists about current science-related issues in the national parks (for additional details see the NPS web site).<sup>2</sup>

Discussions in the late 1970s at NPS-sponsored conferences on scientific research in the National Parks led to the 1980 creation of the George Wright Society as a professional association for people who work in protected areas and on public lands. The society was named for George Wright, the early NPS biologist who had attempted to build an in-house research program with personal funds (Emory and Lloyd 2000, Sellars 2000). With its membership dominated by those interested in park-related issues, the Society adopted the motto: "Dedicated to the protection, preservation and management of cultural and natural parks and reserves through research and education." In 1981 the Society began publication of *The George Wright Forum*. The *Forum* publishes scholarly articles relative to the "application of knowledge, understanding, and wisdom to policy-making, planning, management, and interpretation of the resources of protected areas around the world" (*The George Wright Forum* 20:65). Although the focus is largely on U.S. national parks, the *Forum* addresses issues relevant to all protected areas. The George Wright Society also sponsors biennial conferences on science and its application to parks and other protected areas. These conferences, which are well attended by NPS scientists and managers, have proven to be valuable forums for students, university faculty, and others interested in the application of science to park management issues. They have effectively replaced the 1976 and 1979 research conferences that had been sponsored by the NPS in conjunction with the American Institute of Biological Sciences (e.g., Linn 1979). Additional information about the George Wright Society, the *Forum*, or future conferences can be found at their web address.<sup>3</sup>

Although much excellent science was conducted in national parks between the 1970s and early 1990s (see, for example, Hermann and Bostedt-Craig 1987, Agee and Johnson 1988, Baron 1992, Swetnam 1993, Halvorson and Davis 1996), continued concern over inadequate funding, disagreement about how research should be organized within the agency, and a reluctance to fully incorporate science into management decisions led to additional external reviews of NPS science (National Parks and Conservation Association 1989, NRC 1992). The most comprehensive review was carried out at the request of the NPS by the National Academy of Sciences (NRC 1992). The National Research Council (NRC) report, prepared by a committee chaired by Ecological Society of America past-president Paul Risser,

<sup>2</sup> URL: <[www.nature.nps.gov/parksci](http://www.nature.nps.gov/parksci)>

<sup>3</sup> URL: <[www.georgewright.org](http://www.georgewright.org)>

reinforced the message of earlier reviews and again stressed the need for a stronger science program, both to support ecologically based management, but also because of the scientific value of parks as benchmarks against which to measure the impact of human activities so prevalent elsewhere. The report emphasized the value of "science for parks" as well as the value of "parks for science" (NRC 1992:91,96). Among the many recommendations in the NRC (1992) report was a call for organizational and budgetary autonomy for the NPS science program. Concern over situations where individual park superintendents could control scientific agendas led to the recommendation that scientists in the parks "report to a chief scientist at the regional level" (NRC 1992:101).

Spurred, in part, by a desire to be responsive to the increasing criticism of the NPS research program, the Park Service coordinated with the Ecological Society of America (ESA) to identify the ecological-research needs of the agency as well as articulate the unique role the NPS could play in a national ecological-research agenda. A workshop held in February 1992 brought together NPS management, research, and resources staff with ESA scientists interested in applied ecological research. This group identified key elements needed for an effective NPS ecological-research program that included both short-term mission-oriented research and fundamental anticipatory and predictive research useful for addressing long-term questions of value to both science and management (Risser and Lubchenco 1992). This workshop provided a valuable opportunity for NPS managers and scientists to exchange ideas and experiences with some of the nation's leading ecologists. Participants agreed that continued dialogue and mutual involvement in defining the scope of future research would be of value to all.

#### CREATION OF AN INDEPENDENT RESEARCH ORGANIZATION

In an effort to build on the exciting ideas presented in the National Research Council (NRC 1992) and ESA (Risser and Lubchenco 1992) reports, the NPS organized a meeting in San Diego (California, USA) in January 1993 that was attended by Washington and regional-office science managers as well as selected park superintendents and researchers. This meeting, intended largely to be responsive to recommendations in the 1992 NRC report, resulted in the decision to place all park scientists under the supervision of other scientists (usually at Cooperative Park Studies Unit [CPSUs] or in regional offices) rather than park superintendents (as occurred in several large parks, e.g., Yellowstone and Glacier). They proposed an organization modeled after the one used in the Western Region of the NPS that provided for the autonomy of park scientists called for by the NRC report (NRC 1992). However, before this plan could be implemented, Sec-

retary of the Interior Bruce Babbitt announced his intention to reorganize the biological-research capabilities within the Department of Interior. This reorganization would include the transfer of the NPS biological-research staff and their funding into a new agency that was to be modeled after the U.S. Geological Survey. Secretary Babbitt justified this change as necessary to both provide independent research capabilities to Interior's land-management agencies and to pool limited resources. The new organization was also expected to play a lead role in developing a survey of the nation's biological resources (NRC 1993).

After much publicity (and debate) the Clinton administration created the National Biological Survey (NBS) in October 1993. This resulted in the transfer of all NPS researchers to the NBS, and once again the Park Service was without an in-house biological-research capability. The support for NPS science needs that was to be provided by the Survey soon became threatened by efforts to reduce the funding and staffing to the NBS. The administration and Congress argued over issues such as the infringement of private-property rights while conducting surveys. In June 1994 Ron Pulliam, a University of Georgia ecologist and past ESA president, was appointed the first Director of NBS. This appointment gave the NBS immediate credibility in scientific circles. However, Pulliam soon found himself in the midst of a continuing political struggle between Congress and the administration regarding the role of science in land management. He resigned in 1997, frustrated over political meddling that he felt limited the accomplishment of quality science (Pulliam 1998*a, b*). During this period the Department of the Interior land-management agencies, including the NPS, were prohibited from hiring their own researchers or spending appropriated dollars on research. As a consequence of the creation of the NBS, the NPS lost much of the scientific expertise it needed to make scientifically informed decisions about increasingly contentious issues related to the management of natural ecosystems. The decision of parks such as Yellowstone to discontinue providing office and laboratory space to NBS scientists further constrained efforts to provide relevant science to park management. Some critics speculated that moving scientists out of the parks made it easier for NPS managers to ignore science. Meanwhile, the NBS, which was incorporated into the U.S. Geological Survey (USGS) as its newly created Biological Resources Division (BRD) in 1996, continued its struggle to be responsive to the science needs of its parent agencies (Wagner 1999).

As of March 2003 some of the most productive ex-NPS scientists who had been originally transferred to the NBS, including scientists stationed at parks such as Channel Islands, Sequoia, and Kings Canyon, and the University of Washington CPSU, have either returned to the NPS in research administration positions

or found employment with other agencies. The loss of these scientists in many cases reflected a frustration with the separation of science from the NPS. The loss of experience and expertise in park science issues created by these transfers has made it increasingly difficult for the USGS to be responsive to NPS research needs. On the other hand, some ex-NPS researchers have found the increased independence they enjoy within the new agency frees them to “do real science” (Kaiser 2000:36). The relationship between the NPS and USGS is continuing to evolve. The final outcome of this experiment in separating the science from management will not be known for some time (Wagner 1999, Kaiser 2000).

Shortly after Secretary Babbitt announced the creation of the NBS, the National Park Service Advisory Board established a Science Program Committee to advise the NPS Director and the Secretary as to how the science needs of the agency could be best met in light of changes occurring since the 1992 NRC report, particularly after the transfer of the NPS research function to the NBS. The committee, which included five park superintendents and five scientists (including ESA members Paul Risser, Norm Christensen, Jane Lubchenco, and David Policansky), reiterated many of the basic recommendations of the NRC (1992) report. These included the need for a focus on ecosystem-based management, professionalization of staff, improved partnerships and linkages—including the recommendation to develop a Memorandum of Understanding with ESA, and the need for a legislative mandate for science in the NPS. Particular attention was given to actions needed to “ensure that communication and collaboration between the NPS and NBS are as effective and mutually beneficial as possible” (National Park Service Advisory Board 1993:7). The specific recommendations from this committee regarding the importance of the NPS maintaining an effective relationship with the NBS clearly indicated that the committee recognized the potential for a gradual dilution of support for NPS science needs under the new arrangement.

#### REBUILDING NPS SCIENCE CAPACITY

Following several years of working primarily with the National Biological Survey (NBS) to meet its research needs, the National Park Service (NPS) has recently begun to explore ways to rebuild scientific expertise within the agency. An early example of this interest in reaching out to other sources to address its science needs included a session organized by the NPS at the 1996 Annual Meeting of the Ecological Society of America that highlighted pressing wildlife-management issues faced by the parks (Britten 1996). This session, which was aimed at drawing attention to research needed to assist park-management decision making, resulted in a series of four papers published

in *Ecological Applications* (Huff and Varley 1999, Peterson 1999, Porter and Underwood 1999, Wright 1999). Throughout the latter 1990s both the NPS and NBS organized sessions at a variety of professional meetings to facilitate discussion of research needs and opportunities in the parks. Although this type of exposure is extremely important for the NPS, active outreach from professional societies and academia may be required to assure continued involvement of NPS staff in such activities. For example, the symposium at the 2001 ESA meeting on research in national parks, at which this paper was initially presented, did not include any NPS or USGS employees as speakers.

#### *A legislative mandate*

Congress made a definitive statement regarding the importance of research to national parks when it passed the 1998 National Parks Omnibus Management Act<sup>4</sup> (Harmon 1999). This legislation provided “clear authority and direction for the conduct of scientific study in the National Park System” (Harmon 1999:12). A further intent was stated as “to encourage others to use the National Park System for study to the benefit of park management as well as broader scientific value” (Harmon 1999:13). The Act also validated efforts to establish new cooperative arrangements with universities by authorizing and directing the NPS to work with other Federal and State agencies “to establish cooperative study units” with universities “to conduct multi-disciplinary research” (Harmon 1999:14). The Act provided the NPS with its first clear mandate to support and conduct research, a deficiency that had been noted by several previous reviews of NPS science (e.g., NRC 1993). It also marked a clear relaxation of the exclusivity of the USGS as the provider of NPS research.

#### *The Natural-Resources Challenge*

In 1999 NPS Director Robert Stanton announced a major new initiative designed to address the natural-resource management challenges facing the agency. The Natural Resources Challenge (NR Challenge) was in large part a response to Sellars’s 1997 book criticizing the NPS’s lack of commitment to science. The NR Challenge was proposed as a five-year initiative to address such issues as the need for expanded inventory and monitoring programs, the need for improved collaboration with other professionals, the expansion of education and research programs, as well as targeted management actions to address such issues as non-native species, endangered species, and air- and water-quality concerns. In 2000, Congress funded \$14.3 million of the requested \$19.7 million for the first year of the envisioned five-year initiative. An additional \$44 million of base funding was added in the following two

<sup>4</sup> Public Law 105–391, Title II, Sections 201–207.

years. Among the many initiatives supported by the NR Challenge is the establishment of Learning Centers. Learning Centers are designed as physical locations within or adjacent to parks where science and education will be supported in ways that facilitate research and help educate the nation about park resources. Conceived as public-private partnerships, Learning Centers primarily provide facilities and support for both science and education. Five Learning Centers (adjacent to Cape Cod, Kenai Fjords, Rocky Mountain, Point Reyes, and Great Smoky Mountains National Parks) were initially established based on a competitive process among parks. An additional eight centers were funded during 2002. A total of 32 Learning Centers are proposed for eventual establishment. Other efforts to make parks more accessible to scientists included increased funding for research as well as the initiation of a number of new programs designed to attract university and other external scientists.

Other consequences of the NR Challenge have included recent increases in the science staff of NPS natural-resource offices. For example, the Biological Resources Management Division in Fort Collins, Colorado, has hired several additional scientists, including a research veterinarian and a wildlife geneticist. Such new positions have the potential to have a significant impact in the way parks do science (K. Tonnessen, *personal communication*). Thirty-two Inventory and Monitoring Networks, made up of clusters of parks across the nation, have been established as of March 2003. Many of these networks are hiring Ph.D. scientists as program coordinators and much of the actual inventory and "vital signs" monitoring work are being conducted by university cooperators. Some of the networks are establishing scientific advisory committees that include academic ecologists to guide the long-term direction of the vital-signs monitoring program.

The Natural Resource Challenge's promise to make science a more integral part of park management has received extensive coverage in the national scientific press, including articles in both *BioScience* (Paul 1999) and *Science* (Kaiser 2000). Efforts to engage outside parties in a discussion of opportunities and challenges presented by the NR Challenges were to include a series of "dialogues" with a wide cross section of partners and other interested and influential individuals. The first dialogue was held in Chicago (Illinois) in June 2001. Participants included representatives from academia, other government agencies, and organizations such as the Wilderness Society (Enquist 2001). Despite considerable political support, the future of the NR Challenge is unclear, given an increasingly uncertain federal budget environment.

#### CURRENT OPPORTUNITIES THAT PROMOTE THE USE OF PARKS FOR SCIENCE

##### *Cooperative ecosystem studies units*

In 1997 the National Park Service (NPS) proposed a network of cooperative research units that would

bring together natural-resource professionals on university campuses. The units were to include both ecological and social sciences as well as other federal land-management and science agencies. A Request for Proposals was issued and universities were invited to apply, preferably in partnerships, to host regional Cooperative Ecosystem Studies Units (CESUs). The CESUs were designed to provide research, technical assistance, and education to federal resource managers in their region. The first four CESUs, were competitively selected in 1999. Distributed across the country, they included a total of 26 partner universities, including at least one predominately minority institution in each unit. As of October 2002 12 CESUs had been established (Table 1), with selections of several others pending. Each CESU has a NPS science coordinator whose duty it is to facilitate the communication of information needs and the acquisition of research, education, and technical-development products that will benefit NPS units in the region. A particularly useful benefit is that the entire CESU network, including all of the member institutions, is integrated in a way that greatly facilitates the exchange of funding (at a standard overhead rate) as required to accomplish needs and objectives. Although the NPS is still the only agency to locate new staff at the CESUs, there are indications that other agencies, particularly the U.S. Department of the Interior's Bureau of Land Management (BLM), may soon follow that model. As the CESU concept matures, increased opportunities to leverage limited funds to address common objectives among the partner agencies can be expected. The opportunity for interdisciplinary, interagency exchange of ideas and collaboration among a diverse array of scientists has been likened to a "watercooler culture" (Deweerd 2002:128).

##### *Canon national parks science scholars program*

In 1997 the NPS negotiated an agreement with Canon USA, Inc., to provide up to \$2.5 million dollars to support graduate students to conduct Ph.D. research important to the future of national parks. The Canon National Parks Science Scholars Program, which provides stipends and research support for graduate students in the biological, physical, social, and cultural sciences, is designed to assist in the development of the next generation of scientists working in the fields of environmental science, conservation, and park management. It also encourages the use of national parks as laboratories for science. The National Park Foundation coordinates the program, and the American Association for the Advancement of Science convenes peer-review panels to evaluate applications. The competitive selection of the applicants for these awards is based on research proposals addressing broad research questions selected by the NPS. Each Canon Scholar is awarded \$25 000 per year to complete his or her re-

TABLE 1. Cooperative Ecosystem Studies Units (CESUs) and host universities established, 1999–2002.

CESU	Host university
Chesapeake Watershed	University of Maryland, Frostburg
Colorado Plateau	Northern Arizona University
Desert Southwest	University of Arizona
Great Basin	University of Nevada, Reno
Great Lakes-Northern Forest	University of Minnesota
Great Plains	University of Nebraska
Gulf Coast	Texas A&M University
North Atlantic Coast	University of Rhode Island
Pacific Northwest	University of Washington
Rocky Mountains	University of Montana
South Florida/Caribbean	University of Miami
Southern Appalachians	University of Tennessee

*Note:* Federal partners in the CESUs include the U.S. Department of the Interior's National Park Service, Bureau of Land Management, Bureau of Reclamation, Fish and Wildlife Service, and U.S. Geological Survey; the U.S. Department of Agriculture's Forest Service; the Department of Defense; the Environmental Protection Agency (EPA); the National Aeronautics and Space Administration (NASA); and the Department of Energy. Not all Federal agencies are members of all CESUs.

search, for a maximum of three years and \$75 000. A Canon National Parks Science Symposium is held annually in Washington, D.C., both to recognize the scholars and to advance public understanding of the role of national parks in science. As of October 2002 a total of 38 students from 29 universities in four countries had received Canon scholarships to conduct research in national parks. In 2002, Canon USA. agreed to contribute an additional \$3 million over four years to this program. These funds will allow geographic expansion of the program to include students working in parks throughout the Americas. Additional information on the Canon Scholars Program can be found on the Internet.<sup>5</sup>

#### *Ecological research fellowship program*

One of the most recent efforts to take advantage of the value of parks as laboratories for basic ecological research as well as to attract quality researchers to the national parks is the National Parks Ecological Research Fellowship Program. Funded by the Andrew W. Mellon Foundation, this program is operated as a partnership with the National Park Foundation (who administers the program), and the Ecological Society of America (which provides the peer review of proposals). It provides fellowships for postdoctoral research in basic ecological sciences related to the flora of national parks. Fellowships are funded for up to three years (\$50 000 per year) for salary, research expenses, equipment, and travel to field sites or to attend scientific meetings. Three fellowships were funded beginning in 2000, two more in 2001, and three in 2002. An annual symposium will be held at a park, beginning in 2002, at which the recipients will present their research. The fellows and the research supported by this program

were highlighted at the 2002 ESA meeting in Tucson (Arizona). Similar sessions are planned for future meetings. Additional information on the Ecological Research Fellowship Program can be obtained from ESA at its web site.<sup>6</sup>

#### *Sabbatical-in-the-Parks Program*

Initiated by the NPS in 2001, the Sabbatical-in-the-Parks Program matches university scientists interested in working in parks with the needs and opportunities of individual parks. The program maintains a clearinghouse to facilitate matches between scientists and parks. The program is open to tenure-track faculty from four-year institutions that are interested in working in the biological, physical, social, or cultural sciences. The first sabbaticals began in the 2001–2002 academic year. Information on the program as well as application details are available online.<sup>7</sup>

#### *Facilitating scientific use of parks: research and collecting permits*

There has been an historic difficulty in obtaining research and collecting permits for work in national parks (Bayless 1999, Kaiser 1999). The lack of a consistent policy or review process for research approval has contributed to the overall perception that the NPS was not interested in science. These concerns are addressed by a new standardized system for research and collecting permits that is part of the "warm welcome" promised researchers as part of the Natural Resources Challenge. This system, which is now available through the Internet,<sup>8</sup> allows researchers to apply for permits, submit progress reports, and learn about what

<sup>5</sup> URL: <[www.nature.nps.gov/canonscholarships](http://www.nature.nps.gov/canonscholarships)>

<sup>6</sup> URL: <[www.esa.org/nper](http://www.esa.org/nper)>

<sup>7</sup> URL: <[www.nature.nps.gov/sabbaticals](http://www.nature.nps.gov/sabbaticals)>

<sup>8</sup> URL: <<http://science.nature.nps.gov/research>>

TABLE 2. Programs and web sites for recent National Park Service (NPS) science-friendly institutions.

Program	Web site
<i>Park Science</i>	www.nature.nps.gov/parksci
George Wright Society and <i>Forum</i>	www.georgewright.org
NPS Science Program (includes Natural Resource Challenge)	www.nature.nps.gov
Canon scholarship program	www.nature.nps.gov/canonscholarships
Ecological Research Fellowships	www.esa.org/nper
Sabbatical-in-the-Parks Program	www.nature.nps.gov/sabbaticals
NPS research and collecting permits	http://science.nature.nps.gov/research

*Note:* Each program listed is also described in the text (see *Building of a National Park Service research program; Rebuilding NPS science capacity: The natural-resource challenge; Current opportunities...: Canon... scholars..., Ecological research fellowship..., Sabbatical-in-the-Parks..., and Facilitating scientific use...*).

others are doing in the parks (Bayless and Henderson 2001). The system also catalogs research needs and ongoing projects, and reports on recently completed studies in individual parks. It promises to make it much easier for all interested parties to communicate regarding science needs and the availability of information.

#### CONCLUSIONS

The NPS is working hard to overcome the better part of a century of criticism for being uninterested in and unsupportive of research. The agency charged with preserving many of the nation's most unique and valuable natural resources is coming to recognize that an understanding of those resources is essential to their long-term preservation. Such understanding, of course, must come largely from science. The 1992 NRC report "Science and the National Parks" recognized both the importance of science to the parks as well as the importance of parks to science. It urged the NPS to work with academic and other agency partners to expand its science program, including both the support of quality independent research and the increased use of science in management decisions. Sellars' 1997 book on the history of science and its use, or lack thereof, in the national parks explored not only the history of indifference to science shown by an agency focused primarily on scenery and tourism, but the difficulties inherent in changing an entrenched bureaucratic culture that is comfortable with making management decisions based more on subjective judgment than science. The 1993 transfer of what research capabilities the NPS possessed to the newly created National Biological Survey (later incorporated into the Biological Resources Division of the U.S. Geological Survey) has raised the yet-unanswered question of what the impacts of separating researchers from the NPS will be on the use of science by managers (Wagner 1999, Kaiser 2000).

The NPS has recently undertaken a number of proactive initiatives to make parks more attractive places for scientists to work (see Table 2). Recognizing, as stated in the brochure advertising the 2001–2002 Sabbatical-in-the-Parks Program, that the NPS "has a two-fold scientific responsibility—to use the best available science in park management and to encourage research

in parks that benefits society as a whole," there are many encouraging signs that the NPS is serious about its efforts to set out a "welcome mat for science" (Paul 1999:958). These include efforts to develop collaborative arrangements with professional societies such as ESA and the AAAS, initiatives to partner with the private sector (Canon USA, Inc., and the Andrew W. Mellon Foundation) to offer fellowships for pre- and post-doctoral researchers, and support for sabbatical programs for tenured faculty. In addition, collaboration with universities and other agencies to develop university-based cooperative ecosystem studies units (CE-SUs), and largely in-house initiatives such as Learning Centers are important ways to demonstrate to Congress the value of supporting major increases in science and natural-resources management funds for national parks. A long history of indifference toward science will be difficult to overcome and some remain skeptical as to whether the NPS can be successful in these efforts (see Kaiser 2000). The fact that important steps are being taken to overcome this skepticism is encouraging. And although these efforts appear sincere, the final verdict regarding the success of such initiatives may well depend in large part on how the research community responds to the NPS's overtures. It will take a concerted effort by the NPS, the USGS, university scientists, and other supportive organizations and individuals to assure this new science-friendly atmosphere becomes ingrained in the culture of the National Park Service. It is the best hope for the long-term survival of the our national parks as we know them.

#### ACKNOWLEDGMENTS

This paper is based on an invited paper presented at the symposium Science in National Parks: Basic Research and Application, which was organized by Stewart Pickett and William Robertson IV and held 8 August 2001 in Madison, Wisconsin, USA.

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