

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and
Science



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Funding the Natural Resource Challenge

Report to Congress, Fiscal Year 2006

Clemson University



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Cover: A mature Cascade frog (*Rana cascadae*) at an ephemeral pond just south of Sphagnum Bog in Crater Lake National Park during the wetlands inventory.

Geologic Resource Program staff assessed a rock fall near a popular hiking trail and advised park management on potential future occurrences and safety issues at El Morro National Monument.
Photo: Deanna Greco, NPS

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Washington, DC

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Executive Summary

National Park Service (NPS) Natural Resource Program funding increases over the past seven years have led to significant gains in core mission capability through careful design, and efficiencies through cross-program interactions, partnerships, and accountability. Natural Resource Challenge increases (2000–2006) are a key component of those increases, are making a difference now, and providing the framework to do even more in the future. These increases have allowed the NPS to improve a variety of programs (see table below).

To date funding increases have included a greatly expanded and accelerated Inventory and Monitoring (I&M) Program with 30 of 32 Networks

fully funded; 17 Cooperative Ecosystem Studies Units (CESU), including 12 with NPS research brokers/coordinators; increased expertise in parks and Servicewide programs, the Biological Resources Management Program, which includes programs for coordinating both native and non-native species management and control; 17 Research Learning Centers, encouraging research and providing educational support through a network of parks; 16 Exotic Plant Management Teams; and increases to the Natural Resource Preservation Program (NRPP). These funding increases allow the National Park Service to develop high quality scientific data, more sophisticated information and tools for improved management, and in many cases, more cost-

NPS Natural Resource Stewardship Programs¹

All numbers shown in thousands of dollars

Program Components	Change in Program 1999–2006
Servicewide Natural Resource Programs	
Natural Resource Challenge-Affected Programs	
Air Quality Program	2,407
Biological Resource Management Program	8,776
Cooperative Ecosystem Studies Units ¹	127
Geologic Resources Program	754
Inventory and Monitoring Program ¹	37,337
Natural Resource Data and Information Program	1,510
Natural Resource Preservation Program	2,797
Research Learning Centers (15 Centers established) ¹	0
Resource Damage Assessment & Restoration Program (incl. Oil Spill Pollution Act)	471
Resource Protection Fund	286
Water Resources Program	7,571
Natural Resource Challenge Programs Subtotal	62,036
Non Natural Resource Challenge Programs	
Cave and Karst Research Institute	328
Everglades—Comprehensive Restoration Plan (CERP)	4,620
Everglades—Critical Ecosystem Studies Initiative	2,640
Everglades Task Force Support	486
Geographic Information System (GIS) Program	[81]
Glen Canyon Adaptive Management Program ¹	95
Natural Sounds Program (formerly Overflight Program)	1,199
Subtotal Non natural Resource Challenge Programs	9,287
Subtotal—Servicewide Natural Resource Programs	71,323
National Park System Units, Other Field Units, and Central Office Natural Resource Stewardship Programs	43,143
Total Natural Resource Stewardship	114,466

¹ Reflects program funding after transfers to parks or regions

Teachers working with the Great Lakes Research and Education Center learn *E.coli* sampling protocol during an educator workshop near Pictured Rocks National Lakeshore. The Research Learning Centers encourage research and provide educational support to parks.

effective approaches for the future. A few specific examples of how funding increases are benefiting parks include:

Inventory Program

Numerous species newly discovered to be present in parks and numerous range extensions have been documented, as well as discoveries of several species new to science. Information developed through the monitoring design process, from inventories and ongoing park monitoring efforts being integrated into vital signs programs is providing important planning and compliance information into park resource conditions and trends.

- A new fish species, Leslie's cardinalfish, in the genus of *Ostorhinchus* was discovered by a Department of Marine and Wildlife Resources biologist in American Samoa. The Senior Ichthyologist at the Bishop Museum wrote the description and named this newly discovered species. The fish has subsequently been observed in waters in the Tutuila unit of the National Park of American Samoa during a routine dive by park marine ecologists. This fish lives in deep areas of the reef usually below depths of 90 feet.
- The field work for vascular plant inventories has been completed for all five Appalachian Highland Network parks. To date, 453 species of previously-undocumented vascular plants have been added to park species lists for Blue Ridge Parkway, Big South Fork National River & Recreation Area, and Obed Wild & Scenic River. This represents a significant accomplishment in parks that have each had extensive botanical surveys done in the past. The most significant find for FY 2006 was a white fringeless orchid (*Platanthera integrilabia*), a candidate for federal listing; found for the first time at Big South Fork during network inventories. Further searches in 2006, refined with predictive GIS habitat models developed from characteristics of the originally discovered populations, resulted in the discovery of what is either the largest or the second largest population of white fringeless orchid known to exist.
- The resurvey of vertebrate transects in Yosemite National Park, initially surveyed in 1911–1920 by Joseph Grinnell of the University of California Museum of Vertebrate Zoology, continues to provide detailed information about changes in animal presence and elevational distribution. The resurvey has documented a shift upward in elevation for ranges of four boreal small mammals. Several low-elevation species have also expanded their ranges upward. Further, some species that

were previously abundant were rarely found in the recent resurveys. Future additional fieldwork will focus on habitats above 9,000 feet in elevation, where investigators have observed the most significant changes in species distributions.

The Service completed an additional 178 datasets in FY 2006, bringing the total to 1,939 (70.1 percent) of the outstanding datasets. Some parks will require additional time to certify the accuracy of their biological (vertebrates and vascular plants) field inventories, even though most of those field inventories were completed and datasets were available by the end of FY 2005.

Vital Signs Monitoring

Six additional networks were funded for park vital signs monitoring in FY 2006, bringing the total funded to 30 networks encompassing 251 parks. This represents 93 percent of parks with significant natural resources having funding to initiate long-term park vital signs for monitoring. By the end of FY 2006:

- 26 networks (255) parks had identified their vital signs—the key to a low cost, management-oriented monitoring program.
- 17 networks (157 parks) had implemented vital signs monitoring.
- Black bear and hard mast monitoring results at Great Smoky Mountains National Park resulted in improved visitor safety. Monitoring data in the annual bait station surveys for bears indicated 80 percent visitation, the highest value for this index since data were first collected in 1981. Additionally, the annual hard mast surveys indicated reduced acorn crops, especially at mid and high elevations. As a result of high populations and low food abundance, park managers issued a warning in a press release on 7 September 2006, stating that bears may display bold behavior in contacts with visitors.
- At Wilson's Creek National Battlefield an increase in the population size of the federally threatened Missouri bladderpod in 2005 and its stability in 2006 has been attributed to the restoration of the cultural landscape on Bloody Hill. The resulting open savanna provides habitat for the Missouri bladderpod, where it can increase in abundance and distribution. Monitoring by the network will continue to provide trend information to help guide management decisions.
- During 2004–2006, scenes from a total of 214 historic photographs were re-taken in three Southwest Alaska network parks and organized into a database. The primary subjects of the photographs are glaciers, ocean shorelines, floodplains, volcanic features, landslides,

During 2004–2006, scenes from a total of 214 historic photographs were re-taken in three Southwest Alaska network parks and organized into a database. Comparison of the old and recent photographs reveal that a variety of changes associated with vegetation succession and geomorphic processes have occurred within the parks. The two photographs above show the recession of Spotted Glacier in Katmai National Park and Preserve.

Top Photo: Spotted Glacier in Katmai National Park and Preserve in a historic photograph from 1895.

Bottom photo: Recession of the Spotted Glacier in Katmai National Park and Preserve as revealed by repeat historic photography in 2005.

avalanche chutes, plant succession including shrub and tree expansion, and human disturbance. In comparing the old and recent photographs, it is evident that a variety of changes associated with vegetation succession and geomorphic processes have occurred within the parks. Volcanism in Katmai National Park and Preserve and Aniakchak National Monument and Preserve has created extensive barren landscapes that for the most part have been slowly colonized except in favorable microsites. Most glaciers have shown dramatic retreat since the early 1900s, with newly exposed surfaces becoming rapidly vegetated by tall shrubs and trees at low elevations but remaining sparsely vegetated at higher elevations. Expansion of trees and shrubs was observed in western Katmai, and altitudinal increase in treeline was observed at many locations in Katmai and Lake Clark National Park and Preserve.

As a result of the strategy of building on existing monitoring efforts by parks, other programs, and other agencies, and by involving the superintendents and park staff in the planning and design of long-term monitoring efforts, the I&M networks have played a key strategic role in the National Park System as a unifying program that has catalyzed collaboration among parks and programs, and developed new cost-sharing opportunities with other programs and agencies.

Partnerships

The combination of expanded expertise and activities has assisted in a number of fruitful partnerships, across program areas within the Park Service and with outside partners:

- Storm Hazards and Assistance to Incident Management Team. The Gulf Coast Cooperative Ecosystem Study Unit, Texas A&M University, and the Intermountain Fire program worked together to provide data to parks impacted by hurricanes Katrina and Rita. Researchers worked with the Incident Management Team to provide critical data on employee locations immediately following the evacuation and flooding of the greater New Orleans area as well as other communities along the Gulf Coast. Data included estimates of inundation and damage for each community and a database of imagery for the region. These data are now being incorporated into the longer term Storm Hazard project where storm response plans are being developed for coast parks using the spatial databases including park data, census data, and past storm history data compiled by the Environmental Hazard Center at Texas A&M University.
- Chytrid Fungus Inventories. The Southeast Coast Inventory and Monitoring Network (SECN) has partnered with the USFWS, The Atlanta Zoo, Georgia Department of Natural Resources, and others to further understand the distribution of a chytrid fungus, an amphibian pathogen related to large-scale amphibian population declines. The SECN

Leslie's cardinalfish (*Ostorhinchus* sp.) swimming in depth of 98 feet under a reef located in the Tutuila unit of the National Park of American Samoa. The fish is two inches in length and lives in deep areas of the reef, usually below 90 feet. This is a new species discovered in 2005 and named in 2006, it is not known to occur anywhere else in the world.



staff sampled and tested several frog and salamander species at five parks in the Southeast Region (Cumberland Island National Seashore, Horseshoe Bend National Military Park, Timucuan Ecological and Historic Preserve, Ocmulgee National Monument, and Kennesaw Mountain National Military Park) in spring and fall 2006 as part of an ongoing Cooperative Agreement with researchers at the University of Georgia. Preliminary results have shown that the fungus is present in frog and salamander species at Horseshoe Bend. Sampling efforts will be expanded this fall at Horseshoe Bend, Kennesaw Mountain, and Ocmulgee to more adequately address the presence of this disease in SECN parks.

- In FY 2006, the 16 Exotic Plant Management Teams treated 14,700 acres, targeting 343 invasive plant species in over 157 NPS units. Student teams sponsored by the Student Conservation Association added 18,000 hours treating invasive plants in parks. This innovative program won the Take Pride in America Volunteer 2006 award with a presentation by the Secretary of the Interior.
- The Appalachian Highlands Science Learning Center collaborated with numerous partners to offer nine bioblitzes in 2006. These were focused citizen science volunteer efforts to help researchers conduct field inventories of specific taxa or habitats such as water mites, ferns, moths and butterflies, beetles, slime molds and species found in the unique habitats of tree canopies and karst areas. The thrill of discovery, the newspaper articles that accompany the

bioblitz and direct public involvement, all lead to greater stewardship and an increased sense of place that is changing the way the public values national parks.

- With state and federal partners, the Park Service began adaptive management of marine reserves in four ocean parks in 2006. Fishing is a traditional use enjoyed by visitors in many park units; however, unsustainable fishing practices beyond park borders have diminished fishing opportunities within many parks. Fish populations in some parks became indistinguishable from those around them. Efforts to restore the integrity, stability and beauty of depleted ocean park resources and safeguard future recreational fishing activities led to changes in fishing regulations in Buck Island Reef National Monument, Channel Islands National Park, Dry Tortugas National Park, and Virgin Islands Coral Reef National Monument. After years of civic engagement, fishing was curtailed in portions of those parks to allow fish and other sea life to increase in size and reproductive capacity, and to restore food webs altered by over fishing. The park's vital signs monitoring programs, coupled with research by USGS, NOAA, and universities, are evaluating the performance of the reserves and to learn how fishing affects ocean ecosystems.

Innovative Approaches

New tools that address ways to disseminate valuable monitoring information to park managers and their constituency include:



The Southeast Coast Exotic Plant Management Team at Congaree National Park ready for outreach and education at the 2006 Naturefest event. Student teams sponsored by the Student Conservation Association added 18,000 hours treating invasive plants in parks. Photo: Theresa Thom

- A cyber infrastructure, remote sensor arrays, and a dynamic website are being used to provide access to real-time and historic information on southern California coastal ecosystems. The California Mediterranean Research Learning Center has developed multiple partnerships to serve real-time or close to real-time visual, climatic, and acoustical components of the environment on the internet, along with links to raw climate and ecological data, long term data series (including Vital Signs monitoring), and digitized photographs. The effort will expand public and student awareness of the Mediterranean ecosystem in this urban area.
- e-Authentication pilot project—In collaboration with the Office of Management and Budget and General Services Administration, modifications to the NPS Research Permit and Reporting System software were implemented to accommodate e-Authentication pilot project requirements. The Department of The Interior uses this e-Authentication pilot project to help the federal government progressively respond to the President's E-Government Initiative. The Internet-based NPS Research Permit and Reporting System receives more than 10,000 new electronic records from the public annually (comprised of permit applications, issued permits, and annual accomplishment reports).
- The IPM Program developed a "Pest Alert" system and collaborated with the NPS Reservation System to install it on the new Recreation.gov system which serves DOI, USDA Forest Service, Army Corps, and the US Fish and Wildlife Service. The Alert, which can be update at anytime, informs registering campers of pest quarantines or related issues in specific states and how their actions can assist in preventing the spread of invasive species.
- The Biological Resources Management Program assisted natural resource management staff at Acadia National Park in applying human dimensions concepts to management of white-tailed deer issues; helped establish a "visiting scientist program" associated with the Schoodic Education and Research Center (science and learning center); and developed a research needs assessment (research agenda) for the human dimensions of wildlife management.

These are a few of the exciting results of the application of new expertise, information, and partnerships for improving the management of natural resources in units of the national park system. In FY 2000, Congress demonstrated its commitment to natural resource management in national parks through the implementation of the Natural Resource Challenge. Since its inception, the Challenge has provided tangible benefits through information based management, increased expertise, partnerships, and resource leveraging. The Natural Resource Challenge and other funding increases continue to provide significant and relevant contributions as the Park Service works to meet the expectations of the American public and Congress that their national parks will remain "unimpaired for future generations."



Chapter One: Funding

This report responds to directions in the House Report 106-22 for the FY 2000 appropriations for the National Park Service and other Department of Interior and related agencies. In the House report, the National Park Service was requested to provide information concerning the expenditures and related accomplishments resulting from a series of increases to Natural Resource Stewardship Programs beginning in FY 2000, known as the Natural Resource Challenge. This report addresses FY 2006 expenditures and accomplishments for all Natural Resource Stewardship Programs, exclusive of Everglades Restoration and Glen Canyon Adaptive Management Program, as well as communicates the successful implementation of the Challenge to date. A detailed history of the Challenge is in-

cluded as Appendix A.

The Challenge included a series of requests for new funding that were designed by field superintendents and subject matter experts to meet future natural resource management needs. Many of the increases resulted in accelerating or expanding earlier programs, while a few resulted in entirely new activities. The table below shows the funding for Servicewide Natural Resource Stewardship Programs, distinguishing those affected by Natural Resource Challenge funding, and identifies the funding level for FY 1999, the year before the first Challenge increases, and FY 2006. Most of the differences where increases are shown were as a result of the Challenge.

NPS Natural Resource Stewardship Programs

All numbers shown in thousands of dollars/Fiscal Year¹

Program Components	1999	2006	Change
Servicewide Natural Resource Programs			
Natural Resource Challenge-Affected Programs			
Air Quality Program	6,285	8,692	2,407
Biological Resource Management Program	-	8,776	8,776
Cooperative Ecosystem Studies Units ¹	-	127	127
Geologic Resources Program	1,918	2,672	754
Inventory and Monitoring Program ¹	5,787	43,124	37,337
Natural Resource Data and Information Program	-	1,510	1,510
Natural Resource Preservation Program	5,432	8,229	2,797
Research Learning Centers (15 Centers established) ¹	-	-	0
Resource Damage Assessment & Restoration Program (incl. Oil Spill Pollution Act)	873	1,344	471
Resource Protection Fund	-	286	286
Water Resources Program	4,754	12,325	7,571
Natural Resource Challenge Programs Subtotal	25,049	87,085	62,036
Non Natural Resource Challenge Programs			
Cave and Karst Research Institute	-	328	328
Everglades—Comprehensive Restoration Plan (CERP)	-	4,620	4,620
Everglades—Critical Ecosystem Studies Initiative	1,270	3,840	2,640
Everglades Task Force Support	910	1,286	486
Geographic Information System (GIS) Program	1,100	1,255	155
Glen Canyon Adaptive Management Program ¹	-	95	95
Natural Sounds Program (formerly Overflight Program)	370	1,399	1,199
Subtotal Non natural Resource Challenge Programs	3,536	12,823	9,287
Subtotal—Servicewide Natural Resource Programs	28,585	99,908	71,323
National Park System Units, Other Field Units, and Central Office Natural Resource Stewardship Programs	65,832	108,975	43,143
Total Natural Resource Stewardship	94,417	208,883	114,466

¹ Reflects program funding after transfers to parks or projects

SCA Interns Jade McGill and Cara Stafford, and Biological Technician Amy Whitcomb (from left to right) stand next to a pile of bull thistle plants they have removed from a recent burned area in the wilderness of Bubbs Creek, Kings Canyon National Park. Photo: Richard Thiel

The following table shows FY 2005 funding and changes resulting from FY 2006 increases and other actions for all of the programs affected by the Natural Resource Challenge.

The next three chapters focus on describing the accomplishments achieved in FY 2006 through

the natural resource programs and parks affected by the Natural Resource Challenge. Additional detail about previous years and allocation of the funding within programs are found in Chapter 5 and several of the appendices.

FY 2006 Changes to Natural Resource Stewardship Programs ¹
With Natural Resource Challenge Contributions Highlighted
All numbers in thousands of dollars

Program Components Servicewide Natural Resource Programs	FY 2005	FY 2006 Program Increases	FY 2006
Air Quality Program	8,773		8,692
Challenge contribution	2,800		2,800
Biological Resource Management Program	8,475		8,776
Challenge contribution	7,985		7,985
Cooperative Ecosystem Studies Units ²	129		127
Challenge contribution	1,993		1,993
Geologic Resources Program	2,647		2,672
Challenge contribution	696		696
Inventory and Monitoring Program	39,527		43,124
Challenge contribution	36,530	3,892	40,403
Natural Resource Data and Information Program	1,505		1,510
Challenge contribution	1,098		1,098
Natural Resource Preservation Program	12,295		8,229
Challenge contribution ³	7,372		3,499
Research Learning Centers ²	–		–
Challenge contribution	2,698		2,698
Resource Damage Assessment & Restoration Program (incl. Oil Spill Pollution Act)	1,341		1,344
Challenge contribution	500		500
Resource Protection Fund	290		286
Challenge contribution	300		300
Water Resources Program	12,436		12,325
Challenge contribution	7,985		7,985
Cave and Karst Research Institute ⁴	333		328
Everglades Research and Restoration ⁴	9,829		9,746
GIS ⁴	1,273		1,255
Glen Canyon Adaptive Management ⁴	95		95
Natural Sounds Programs ⁴	909	499	1,399
National Park System Units, Other Field Units, and Central Office Natural Resource Stewardship Programs	106,275		108,975
Challenge contribution	6,595		6,595
Natural Resource Stewardship Programs	206,127		208,883
Challenge contribution	76,522		76,552

¹ Includes across-the-board reductions and other changes to base, so FY 2006 changes added to FY 2005 will not equal the FY 2006 final funding

² Reflects program funding after transfers to parks or regions

³ Reduced by \$3,873 in order to fund I&M networks in FY 2006

⁴ Programs not affected by Natural Resource Challenge



Chapter Two: Measuring Progress

The National Park Service, like most governmental organizations, is increasingly being charged with reporting performance in a measurable way. The Government Performance and Results Act formalizes reporting requirements and stresses measuring performance by tracking outcomes. For the natural resources of the National Park System, the desired outcome is resources in good condition, as defined by the desired condition identified in a planning document.

During fiscal year 2005 the National Park Service completed its transition to performance goals in the 2003–2008 Department of the Interior strategic plan. These 14 natural resource-related goals focus largely on the end outcome and intermediate outcome results linked to desired conditions. Although this transition included the adoption and reporting to the majority of these goals, work continued towards developing baselines and desired conditions for the four land health goals applicable to the NPS. During 2005 only those parks with desired conditions identified in their general management plans, objective acreage data for each land type baseline, and sufficient information to document the current condition of their lands were able to address the land health goals. In some instances these desired conditions were so qualitative as preclude translation into readily measurable conditions for performance management purposes. Work continued at the close of the fiscal year to assist the majority of parks in meeting these three elements required to adopt and report to the land health goals by 2007.

Development of strategic monitoring programs began in FY 2001. When fully funded and implemented, a means to measure resource condition and performance in connection with resource stewardship will be in place for 270 parks organized into 32 geographic networks, although it will

still require several years to develop statistically valid condition trend data. Through FY 2006, 30 networks (of a total of 32) involving 251 of 270 parks with significant natural resources have been fully funded. The two remaining networks have received initial planning funds. All of the fully funded networks have completed the vital signs identification phase. At the end of FY 2006, 17 networks (involving 153 parks) had implemented vital signs monitoring. An interim strategy is being developed to use information developed through inventories, planning for monitoring, and other efforts for to allow reporting on resource conditions over the next several years while significant status and trend data are being collected.

Of the 10 goals with FY 2006 targets reported on in the table below, all were technically met or exceeded (the Department considers actual accomplishments within 5 percent of the target to have been met)—some were exceeded to significant degrees.

The following table shows the relationship of natural resource programs to selected Department of the Interior strategic plan goals, i.e., goals from the National Park Service FY 2001–2005 plan that carried over to the 2003–2008 Department of the Interior plan. All programs respond to some elements of the new plan, and had specific targets for FY 2006.

Natural Resource Challenge Support for Stewardship of Natural Resources in Parks—Relationships to FY 2006 Strategic Plan Goal Targets

Katie Christenson with eaglet captured for bioaccumulative analysis in Saint Croix National Scenic River. Preliminary results from the bioaccumulative contaminants monitoring show spatial patterns of mercury and lead concentrations in feathers of bald eagle nestlings. Bioaccumulative contaminants is one of the 11 Vital Signs selected by parks in the Great Lakes Inventory and Monitoring Network.

**Natural Resource Challenge Support for Stewardship of Natural Resources in Parks—
Relationships to FY 2006 Strategic Plan Goal Targets**

**NPS Goal Targets for FY 2006
(NPS number/DOI number)**

**SERVICEWIDE NATURAL
RESOURCE PROGRAM
Supporting Park Performance**

***Goals relating to strategies to restore, maintain, sustain and protect
resources:***

1a3B/PEM 1.010 78% (28 of 36) of reporting Class I NPS (DOI) lands meet ambient air quality standards (NAAQS). (exceeded)

Air Resources

1a3C/PEM 1.011 88% (23 of 26) reporting Class I NPS (DOI) land meet visibility objectives. (met)

1a1B/PEM 2.004 Invasive Species: 2.29% of park lands (59,464 cumulative canopy acres of 2.6 million acres) have had plant invasions effectively controlled. (met)

Biological Resources
Management

1a2A./PEM 2.001 Threatened and Endangered Species: 42% of federally listed species that occur or have occurred in parks are making progress toward recovery [numbers not identified due to changing baselines]. (met)

1a9/PEM 3.004 38% (1,235) of paleontological localities in NPS inventory (3,250) are in good condition (met)

Geologic Resources

1a4A/PEM 1.008 98.8% (136,400 of 138,000 miles) of streams and rivers managed by the NPS that meet State and Federal water quality standards as defined by the Clean Water Act (met)

Water Resources

1a4B/PEM 1.008 77.2% (3,678,580 of 4,765,000 acres) of estuaries and marine areas managed by the NPS that meet State and Federal water quality standards as defined by the Clean Water Act (met)

***Goals related to strategy to improve information base, resource
management and technical assistance***

1b1 Acquire or develop 70.2% (1,942) of outstanding data sets identified in 2002 (2,767) of basic natural resource inventories for all parks. (met)

Inventory and Monitoring

1b3A Vital Signs: 88.8% of 270 parks with significant natural resources have identified their vital signs for natural resource monitoring. (exceeded)

1b3B 56.6% (153 of 270) parks with significant natural resources have implemented natural resource monitoring of key vital signs (met)



Chapter Three: Progress in Protecting Park Natural Resources

This chapter focuses on Natural Resource Stewardship programs that emphasize the scientific investigation, preservation, restoration, and long-term maintenance of park resources. This chapter is organized into ten central program areas that include:

- Park and Regional Natural Resource Programs
- Air Resources Program
- Biological Resource Management Program
- Geologic Resources Program
- National Natural Landmarks
- Natural Resource Preservation Program
- Natural Sounds Program
- Resource Damage Assessment and Restoration Program
- Resource Protection Program
- Water Resources Program

PARK AND REGIONAL NATURAL RESOURCE PROGRAMS

The Natural Resource Stewardship portion of the Operation of the National Park Service (ONPS) appropriation, which includes Natural Resource Management and Natural Resource Research Support, was \$208.9 million in FY 2006. Many, but not all, of the programs involved were affected by Natural Resource Challenge funding increases since FY 2000.

Of the total \$109 million designated for park and regional programs, most of the funding directly benefited parks. The Challenge contributed approximately \$6.6 million in park base increases in FY 2001 and FY 2002, which parks continue to receive. This report covers all natural resource management funding. Since park and regional programs represent the largest portion of the Natural Resource Stewardship budget, regions are asked to provide an annual overview of park and regional programs and to identify trends and appropriate actions taken.

Natural Resource Program Status

Natural Resource Challenge initiatives continue to provide major improvements in how parks manage and preserve their natural resources. Critically needed basic inventories and monitoring programs have enabled parks to focus their natural resource programs on the most vulnerable resources. Specialists in air and water resources, threatened and endangered species, and invasive plants and animals, park scientists, increased technical support and planning, and increasing the Natural Resource Preservation Program, have all contributed to improved

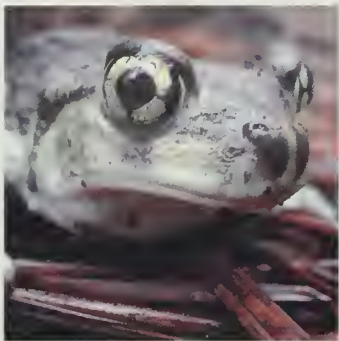
science-based decision making. Research Learning Centers and Cooperative Ecosystem Study Units, interacting and providing a direct link among parks, academia and the private scientific community, are attracting more and more key scientists to conduct research in many of the nation's parks. Natural Resource Challenge funding continues to be directly responsible for fostering partnerships and cost-share relationships that otherwise would not be possible. In absence of this funding, parks would not be able to respond to critical resource issues inclusive of preservation, restoration and recovery which could result in loss of species or degradation of habitat.

Regions reported significant accomplishments by parks and some of those accomplishments are highlighted below. Regions and parks also note increased constraints on park natural resource programs due to across the board rescissions and inflationary pressures on fixed costs. Competition for funds, both government and non-governmental, increases as resource managers adapt to meet the challenge of protecting resources.

Examples of the progress that park and regional personnel have made through the use of Challenge funding in natural resource management include:

Inventories:

- New Fish Species Discovered in American Samoa. A new fish species in the genus *Ostorhinchus* was discovered by Department of Marine and Wildlife Resources biologist, Leslie Whaylen, in American Samoa. The fish has subsequently been observed in waters in the Tutuila unit of the National Park of American Samoa during a routine dive by park marine ecologists. This fish lives in deep areas of the reef usually below depths of 90 feet.
- Vascular Plant Inventories Document Rare Orchid Species. The field work for vascular plant inventories has been completed for all Appalachian Highlands Network parks. To date, 455 species of previously undocumented vascular plants have been added to park specimen lists for Blue Ridge Parkway, Big South Fork National Forest and Recreation Area and Observed Wild and Scenic Rivers. This represents a significant accomplishment for parks that have each had previously unaided surveys of their parks. The inventory was completed in 2000. While the inventory was completed, *Heptanthera* was reported for the first time, found for the first time, and for the first



White fringeless orchid (*Platanthera integrilabia*), a candidate for federal listing, was found for the first time at Big South Fork National River during Appalachian Highland Inventory and Monitoring Network inventories. Further searches in 2006, refined with predictive GIS habitat models, resulted in the discovery of either the largest or the second largest known population. Photo: Tom Barnes, University of Kentucky

Data collected during development of the amphibian monitoring protocol indicated that Cape Cod National Seashore's Province Lands support perhaps the largest concentration of Eastern spadefoot toads in the northeastern United States. Monitoring revealed a high mortality rate of spadefoot toads on park roads during rainy nights. Based on monitoring results, park managers implemented a program of targeted road closures on rainy nights to protect spadefoots. Photo: Brad Timm

time at Big South Fork NR during network inventories. Further searches in 2006, refined with predictive GIS habitat models developed from characteristics of the originally discovered populations, resulted in the discovery of what is either the largest or the second largest population known to remain in existence for this species anywhere within its range.

- **Chytrid Fungus Inventories.** The Southeast Coast Inventory and Monitoring Network (SECN) has partnered with the U.S. Fish and Wildlife Service, The Atlanta Zoo, Georgia Department of Natural Resources, and others to further understand the distribution of a chytrid fungus, an amphibian pathogen related to large-scale amphibian population declines. The Network sampled and tested several frog and salamander species at five parks in the Southeast Region (Cumberland Island National Seashore, Horseshoe Bend National Military Park, Timucuan Ecological and Historic Preserve, Ocmulgee National Monument, and Kennesaw Mountain National Military Park) in spring and fall 2006 as part of an ongoing Cooperative Agreement with researchers at the University of Georgia. Preliminary results have shown that the fungus is present in frog and salamander species at Horseshoe Bend National Military Park. Sampling efforts will be expanded fall 2007 to more adequately address the presence of this disease in SECN parks.

Monitoring:

- **Ocean Monitoring and Preservation.** With state and federal partners, the Park Service began adaptive management of marine reserves in four ocean parks in 2006. Fishing is a traditional use enjoyed by visitors in many park units; however, unsustainable fishing practices beyond park borders have diminished fishing opportunities within many parks. Fish populations in some parks became indistinguishable from those around them. Efforts to restore the integrity, stability and beauty of depleted ocean park resources and safeguard future recreational fishing activities led to changes in fishing regulations in Buck Island Reef National Monument, Channel Islands National Park, Dry Tortugas National Park, and Virgin Islands Coral Reef National Monument. After years of civic engagement, fishing was curtailed in portions of those parks to allow fish and other sea life to increase in size and reproductive capacity, and to restore food webs altered by over fishing. The park's vital signs monitoring programs, coupled with research by USGS, NOAA, and universities, are evaluating the performance of the reserves and to learn how fishing affects ocean ecosystems.

- **Black bear and hard mast monitoring results at Great Smoky Mountains National Park** results in visitor safety warning. Monitoring data in the annual bait station surveys for bears indicated 80 percent visitation, the highest value for this index since data were first collected in 1981. Additionally, the annual hard mast surveys indicated reduced acorn crops, especially at mid and high elevations. As a result of high populations and low food abundance, park managers issued a warning in a press release on 7 September 2006, stating that bears may display bold behavior in contacts with visitors.
- **Spadefoot toad monitoring at Cape Cod National Seashore** leads to enhanced resource protection. Data collected during development of the amphibian monitoring protocol indicated that Cape Cod National Seashore's Province Lands support perhaps the largest concentration of Eastern spadefoot toads in the northeastern United States. Monitoring revealed a high mortality rate of spadefoot toads on park roads during rainy nights. The study demonstrated that Province Lands Road, which bisects an area of temporary wetlands used by spadefoots, had a particularly high number of incidents. Based on the monitoring results, park managers have implemented a program of targeted road closures on rainy nights to protect spadefoots. The park is conducting ongoing monitoring to refine and determine the effectiveness of this management action.

Protection and Restoration:

- **Stream Corridor Restoration within Newly Acquired Properties at Buffalo National River.** This project addresses accelerated rates of stream bank erosion and lateral channel migration that have adversely impacted natural river processes. This is being accomplished through the re-establishment of natural processes and erosion rates. Severely eroding banks were selected for revetment treatments using a scorecard developed by the park staff based on past revetment success. Corridor restoration was accomplished through the planting of 10,000 native hardwood seedlings, including Green Ash, White Oak, and Red Oak. The project exceeded its objectives for length of bank stabilized. A 75-80 percent success rate is expected.
- **Redwood National and State Parks** partnered with a local non-profit restoration organization and adjacent industrial timberland owner to reduce sediment threats from roads in the Coyote Creek watershed. Reducing sediment threats in the watershed helps protect park resources including downstream alluvial old growth redwood groves and habitat for

three species of salmonids listed as threatened under the Endangered Species Act. The project entailed the removal of about six miles of roads on Green Diamond Resource Company lands that were abandoned, located on unstable slopes and posed a high threat of eroding and delivering sediment to the creek. An additional one mile of road on park lands was decommissioned and one and a half miles of park roads were upgraded. The upgraded roads are part of an historic ranching district and erosion control treatments included replacing undersized and failing culverts and improving road surface drainage. The project was completed in September, 2006. Redwood National and State Parks will continue to implement similar projects throughout the Redwood Creek watershed as part of a cooperative erosion control and water quality protection program.

Challenge-funded Parks

The Natural Resource Challenge supported base funding increases for 36 national parks in FY 2001 and FY 2002. The increases were primarily directed at invasive species control and threatened and endangered species restoration and recovery, but also focused on other native species efforts and basic natural resource capability for small parks. The funding became a permanent part of the parks' base funding.

Total Natural Resource Management base funds available in FY 2006 to these 36 parks was approximately \$16.8 million. More than 39 percent of that funding came from the Natural Resource

Challenge program. Funding levels for 24 of the parks ranged from \$58,000 to \$500,000.

Sixteen of the 36 parks reported net decreases to their programs, from FY 2005 to FY 2006, ranging from less-than-one to 159 percent. Of the parks reporting decreases, 11 experienced significant decreases of 5 percent or more with 4 experiencing decreases of greater than 50 percent. Fourteen parks reported increases ranging from less-than-one to 37 percent. Six parks reported exactly the same funding as the previous year. The overall program experienced an increase in funding from FY 2005 to FY 2006 of \$1,754,362 or 10 percent.

Natural Resource Challenge funding greatly strengthens the ability of parks to address the most critical problems in natural resources management. However, many parks continue to report they are experiencing difficulties retaining funds for natural resource programs due to the absorption of fixed costs and other higher priority needs. In all cases it is clear that the results of the Challenge are positive, clearly demonstrated by the accomplishments reported. Accomplishment highlights include:

- Padre Island National Seashore received a Natural Resource Challenge (NRC) Park Base Increase for Endangered Species to establish a Kemp's Ridley Sea Turtle Monitoring Program in 2002. As a result of the NRC base increase, the park was able to partially fund the hiring of 12 seasonal GS-04 Biological Technicians



Kemp's ridley sea turtle hatchlings are released on the beach at Padre Island National Seashore during filming for ABC World News Tonight in 2005. The number of Kemp's ridley nests found during FY 2006 was the highest ever recorded at the park (64) and nesting is increasing.



Top: Great Smoky Mountain National Park on a clear day.

Middle: Great Smoky Mountain National Park on a day with moderate air quality.

Bottom: Great Smoky Mountain National Park on a day with extremely poor air quality. All three images are from the IMPROVE website: <http://vista.cira.colostate.edu/improve/>

The Air Resources Program collaborated with several parks, including Great Smoky Mountains, on their ozone health advisory programs. Parks issue ozone advisories to visitors and staff when ozone reaches unhealthy levels in the parks.

and other staff that worked with the Kemp's ridley program in 2006. Sea turtle monitoring and science efforts were enhanced, and community and partner participation in this work expanded. The number of Kemp's ridley nests found during FY 2006 was the highest ever recorded at the park (64) and nesting is increasing. This record more than doubles the previous park record of 28 and constitutes 62.7 percent of the 102 Kemp's ridley nests found in Texas and 59.3 percent of the 108 Kemp's ridley nests documented in the U.S. Numbers recorded during FY 2006 and recent years indicate that a nesting colony of this endangered species is becoming re-established at PAIS and PAIS is the most important Kemp's ridley nesting beach in the U.S.

At 62,000 acres, Santa Cruz Island is the largest of the five islands comprising **Channel Islands National Park**. Island-wide projects have included the reintroduction of bald eagles, relocation of golden eagles, restoration of the federally endangered island fox, and the eradication of feral pigs—the last of the large, introduced non-native animals in the park. Feral pigs posed the biggest threat to the Santa Cruz Island ecosystem. They aggressively rooted in the soil for food which destroyed native vegetation (including 9 listed plant species), facilitated the spread of invasive weeds, destroyed ancient Chumash archeological sites, caused widespread erosion, and attracted Golden Eagles which then fed on the endangered island fox. The Natural Resource Challenge funded park-base increase for the Santa Cruz Island Primary Restoration Plan—Feral Pig Eradication was \$490,400 and was first allocated to the park in FY2002. The base increase has become the primary funding source for the park's Santa Cruz Island Restoration program, and has allowed the park to achieve significant milestones in feral pig eradication. As of July 2006, pigs were functionally removed from all 5 zones on the island. A total of 4,963 pigs were removed. In all zones the eradication advanced from the "Hunting Phase" to the "Monitoring Phase" meaning that the only pigs expected to remain on the island were regularly monitored radio-telemetered individuals. As of the end of FY 2006, there were 69 radio-monitored "Sentinel Pigs." Twelve of these are wearing GPS collars.

AIR RESOURCES PROGRAM

FY 2006 Allocation: \$8,692,000

The National Park Service Air Resources Program is responsible for preserving, protecting, and enhancing air quality and air quality-related values in the National Park System by ensuring compliance with the requirements of the Clean

Air Act and the National Park Service (NPS) Organic Act. The Air Resources Program places a heavy emphasis on the collection of credible air quality information for parks to support scientifically sound resource management decisions. Program activities supplemented by funding from the Natural Resource Challenge represent a substantial effort to gather information on the condition of natural resources, enhance park managers' ability to make informed decisions on natural resource protection and management, and pursue collaborative efforts with regulators, the scientific community, and other stakeholders to improve air quality in parks. Air Resources Program highlights for FY 2006 include:

- Each of the Department of the Interior air quality goals were exceeded: 80 percent of reporting Class I areas are in compliance with air quality standards (goal was 78 percent), and 100 percent are meeting visibility objectives (goal was 88 percent).
- Several ecological effects studies funded through the NPS Servicewide Comprehensive Call have been completed in the last two years; scientists conducting projects in **Joshua Tree**, **Rocky Mountain**, **Acadia**, and **Great Smoky Mountains National Parks** have published findings from these studies in peer-reviewed literature or in book chapters.
- The Air Resources Program collaborated with several park areas (**Acadia**, **Great Smoky Mountains**, **Sequoia** and **Kings Canyon National Parks**) regarding their respective ozone health advisory program. Parks issue ozone advisories when ozone levels reach unhealthy levels to alert park visitors and employees of potentially unhealthy conditions. The Air Resources Program also provided assistance for the design and development of an air quality interactive kiosk information system at Sequoia and Kings Canyon National Parks. This program educates park visitors about air quality issues in these parks. Visitors are encouraged to explore various resource impacts on touch screen displays. The interactive kiosk is very popular with visitors and is located in the Grants Grove Visitor Center.

Representative air quality monitoring was conducted in or near 80 park units. Eight of these parks had short-term monitoring conducted with portable units. Data relevant to resources sensitive to air pollution are also collected at various parks. Commensurate analyses are either conducted or facilitated by the Air Resource Program on the causes and effects of pollution on these resources. Because the National Park Service is not an air regulatory agency, the Air Resource Program relies mainly on non-regula-



Sediment sampling at Rocky Mountain National Park for the Western Airborne Contaminants Assessment Project (WACAP).

tory approaches to achieve air quality goals.

Air Quality Monitoring and Data Analysis

The Air Resources Program operates a network of ambient air quality monitoring sites in units of the national park system. The parameters that are currently measured include ozone and/or dry deposition as part of the Clean Air Status and Trends Network (CASTNet), wet deposition as part of the National Atmospheric Deposition Program/National Trends Network (NADP/NTN), mercury under the Mercury Deposition Network (MDN), and visibility and particulate matter as part of the Interagency Monitoring of Protected Visual Environments (IMPROVE).

Funding for monitoring equipment, installation and data analysis is covered and obligated under Servicewide contracts or cooperative agreements and managed by the Air Resources Program. Also, partners—in particular, EPA—contribute substantially to monitoring costs (\$2 million per year). Budget adjustments over past years, combined with increasing operational costs, resulted in a need to reduce the amount of monitoring in a few parks, to employ less expensive monitoring equipment in some areas (e.g., portable ozone samplers), and to pursue opportunities to leverage resources with state and local agencies.

Special Monitoring Themes

While mercury occurs naturally, human activity can release additional mercury into the environment. The ambient concentrations of mercury

are usually low, but deposition of mercury into lakes and streams can trigger biological processes that cause it to bioaccumulate in fish and animals. This accumulation can be harmful to both the host and any organism that may consume it. The Natural Resource Challenge has provided the opportunity for the Park Service to conduct mercury monitoring at select locations. This monitoring is being conducted in cooperation with the National Atmospheric Deposition Program, Mercury Deposition Network (MDN).

Natural Resource Challenge funds are also used for partial support of the “Western Airborne Contaminants Assessment Project” (WACAP), a six year project initiated by Air Resources Program in FY 2002. The objective of the WACAP is to inventory airborne contaminants in national park ecosystems using a network of eight “primary” parks (Sequoia, Rocky Mountain, Denali, Noatak, Gates of the Arctic, Olympic, Mount Rainier, and Glacier National Parks) in the western U.S. to provide spatially-extensive, site-specific, and temporally-resolved information regarding the exposure, accumulation, and impacts of airborne toxic compounds.

Night Sky Monitoring Program

The Night Sky Monitoring Program conducted by the NPS Night Sky Team seeks to protect, restore and inventory night sky quality in parks. Protection and restoration of night sky conditions are accomplished primarily through educational outreach and technical assistance to parks and communities surrounding parks. In

FY 2006, inventories were completed in 11 parks bringing the total completed to 27.

Additionally, nine inventories were initiated, bringing the total in progress to 17. Automated data collection and processing software was written in 2006, enabling the program to provide reports to parks with shorter turnarounds and less staff effort. FY 2006 brought the development of a Night Sky website on the NPS Air Resources Program system (<http://www2.nature.nps.gov/air/lightscapes/index.cfm>). Scientific and management goals were accomplished through several partnerships, including a pilot data collection program for the USDA Forest Service, a collaborative agreement with New Mexico State Parks, park lighting standards development with the International Dark-Sky Association, and scientific research with the U.S. Naval Observatory.

Ecological Effects Projects

The Air Resources Program continued to support ongoing and new projects to assess air pollution impacts on national park ecosystems in FY2006. Accomplishments include:

- **Big Bend National Park:** “Study Effects of Atmospheric Nitrogen and Climate Change on Desert Ecosystems.” This project seeks to understand the impacts of nitrogen deposition on microbial and soil nitrogen dynamics within the sotol-grasslands and high elevation oak-pine forests, and the impacts of changes in precipitation timing and amounts on plant growth, soil nutrient and microbial dynamics. This research, conducted in cooperation with Texas Tech University, is part of a larger ten-year effort to examine anthropogenic impacts and climate change. During FY 2006 project assessment of microbial and plant physiological responses at project sites were conducted.
- **Indiana Dunes National Lakeshore:** “Study the Effects of Atmospheric Pollutants on Invasibility of Pannet Vegetation.” This project assesses the concentration and spatial distribution of heavy metals and nitrogen deposition in dune wetlands (pannetes). Through controlled field experiments, the threshold levels of atmospheric nitrogen deposition that result in plant community shifts are being investigated. This study is being conducted in cooperation with Purdue University.
- **Mount Rainier and North Cascades National Parks:** “Characterize Aquatic Air Quality Related Values (ARQV) Potentially Affected by Atmospheric Deposition and Develop long-Term Protocols to Track and Refine AQRVs at Mount Rainier and North Cascades National Parks.” Stream chemistry, aquatic biota, and sediment data were collected and assessed to

determine the state of science for pollution loading impacts for these two parks.

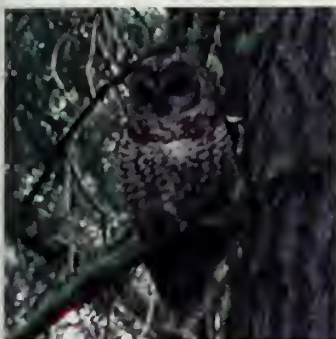
- **Rocky Mountain and Glacier National Parks:** “Evaluation of Long-Term Species Changes and Response to Nitrogen Fertilization in Alpine Plant Communities.” The purpose of this research is to perform on-site experiments to establish critical nitrogen loads for alpine vegetation response (changes in species abundance, diversity).
- **Congaree National Park:** “Influence of Sediment Microbial Community Structure on Mercury Methylation at Congaree National Park.” The purpose of this project is to develop an understanding of the microbial controls that link atmospheric-derived mercury deposited in the park to the formation of toxic methylmercury that poses a threat to ecosystem and human health. The project was completed in FY 2006 and an article on the results will be submitted for publication to the journal *Wetlands*. The results of the study suggest that the park has several mechanisms that inherently limit the availability of methyl mercury to fish populations. This project was conducted by the U.S. Geological Survey.
- **Grand Teton National Park:** “Assess the effects of nitrogen deposition on alpine vegetation.” The objective of this project is to evaluate the effects of atmospheric nitrogen deposition on the structure and function of alpine ecosystems through a combination of field measurements and experimental manipulation of nitrogen loadings in alpine sites receiving a range of ambient nitrogen deposition loadings. In FY 2006, field plots were established and snow, soil, and vegetation sampling was conducted. The samples will be processed at Utah State University for chemical analysis.

Park Air Emissions and Technical Guidance

The only air pollution sources the National Park Service has direct control over are those originating from within parks. Few parks had inventoried emission sources prior to 2000. Since 2001, criteria air pollutants (CAPs) have been inventoried in 48 NPS units. Since 2003, greenhouse gas emissions have also been inventoried in seven parks.

There is a wide variety of air emission sources across the parks—from generators and fuel tanks, to mobile sources, to woodstoves and prescribed or wildfires. Parks may have marine vessels, snowmobiles and aircraft. Campfires also emit air pollutants in amounts capable of being estimated. Some parks have specific recommendations to reduce park emissions, including:

- Replace two-stroke engine-powered snowmo-



At Lassen Volcanic National Park a female California spotted owl roosts in a tree. In FY 2006 researchers completed a two-year study to determine the abundance and reproductive status of California spotted owls. In total, five pairs of California spotted owls were located, but no successful nesting was documented.

At Hawaii Volcanoes National Park 201 *Myrsine lanaiensis* were planted in 4 dry ohia woodland sites. Prior to the project, only 1 individual was documented in the park. Plants established in the seed orchards will provide source material for future large-scale restoration projects.

Both projects were funded through Biological Resource Projects—National Level Support competitive funds.

- biles owned and operated by the Park Service in Yellowstone, Grand Teton, Crater Lake National Parks and Denali National Park and Preserve with more efficient and less polluting four-stroke engine-powered snowmobiles;
- Use of biodiesel fuels in NPS vehicles and non-road equipment where biodiesel is available and cost-effective, such as Great Smoky Mountains National Park; and
- Expand application of stabilizing dust palliative on the remainder of the unpaved park road in Denali National Park and Preserve.

BIOLOGICAL RESOURCES MANAGEMENT PROGRAM

FY 2006 Allocation: \$8,776,000

Created in FY 2000 as part of the Natural Resource Challenge, the Biological Resource Management Program provides professional, science-based support and programs with expertise which cannot be effectively or efficiently provided at the park or regional level. Some of the support provided by the program includes:

- Biological Inventories
- Biological Resource Projects—National Level Support
- Ecosystem Management and Restoration Program
- Endangered Species Program
- Integrated Pest Management
- Invasive Species Branch—Animal and Plant Programs
- Migratory Bird Program
- Vegetation Mapping
- Wildlife Health and Management

Biological Inventories Program

The Biological Inventories Program provides leadership and technical support to document the presence, absence, distribution and abundance of all species and sub-specific organisms in all NPS units. To accomplish this, the Biological Inventories Program 1) develops and maintains national information and analysis tools related to biological inventories; 2) facilitates field studies on the presence, absence, distribution and abundance of organisms in parks; 3) provides technical expertise in designing studies and analyzing biological inventory data; and 4) develops and facilitates partnerships that contribute to biological inventories in parks.

Highlights from FY 2006 include:

- Provided technical assistance to the inventory and monitoring program networks to 1) upload data collected from biological inventories in parks to NPSpecies, NatureBib and a digital bi-

- ological archive, and 2) certify park lists of vertebrate and vascular plants that contributed in part to reporting under performance goal 1a01.
- Provided technical assistance to Capitol Reef National Park and six other national park units on the Colorado Plateau improving the design and methods of a study to determine mountain lion distribution ensuring efficient and effective collection of data. The revised project protocols in partnership with the U.S. Geological Survey were shared with other mountain lion studies on the Colorado Plateau.
- Met with Olympic National Park staff and potential partners during the annual Elwha River Research Consortium Meeting to begin developing a full-scale All Taxa Biotic Inventory (ATBI) at Olympic. This ATBI would be equivalent to the highly successful ATBI at Great Smoky Mountains. The Olympic inventory would serve as a prototype ATBI for western NPS units.

Biological Resource Projects—National Level Support

Biological Resource Management Program competitive funds are used for biological resource projects that address issues facing various park units and benefit multiple partners. These projects address a myriad of resource management needs for aquatic or terrestrial plants and animals throughout NPS units. A complete list of all projects is in Appendix C.

Ecosystem Management and Restoration Program

The Ecosystem Management and Restoration Program (EMR) continues to balance its role of national program management with providing direct support to park-specific needs. EMR provided consultations to 17 parks in 12 states, through site visits and email to address topics such as:

- Assess hurricane damage and general natural resource management needs;
- Review of management and restoration planning;
- Recommendations for assistance from subject matter expertise;
- Recommendations from current scientific sources;
- Soil sampling and analysis; and,
- Assistance with funding proposals.

The availability of appropriate plant materials (i.e., seed or seedlings) for site and disturbance-specific needs adversely affects re-vegetation and restoration projects. EMR continues to work with the USDA Natural Resources Conservation Service and USDA Forest Service to identify ex-

expertise and resources for parks.

Highlights from FY 2006 include:

- **Livestock Grazing Coordination**—The Coordinator conducted the first Servicewide workshop on livestock grazing which was attended by over 50 NPS staff.
- **At Big Thicket National Preserve** assisted managers in identifying priority response needs for natural resources after Hurricane Rita.
- **At Fort Union Trading Post National Historic Site** supported invasive plant control in preparation of a participatory approach to integrated roadside vegetation management in 2007.
- **At Zion National Park, Delaware Water Gap National Recreation Area, and San Antonio Missions National Historical Park**, identified and coordinated support (including technical input) of local expertise to work with park management issues and research projects.

Endangered Species Program

The Endangered Species Program continues to make progress in improving the condition of federally listed species in national parks, exceeding its GPRA goal for the fifth consecutive year. Because candidate species are also priorities in most parks, the program has begun an evaluation of candidate species with primary habitat in a national park in conjunction with the Fish and Wildlife Service. The Park Service has 437 threatened, endangered, proposed, experimen-

tal, managed via conservation agreement, and candidate species. They are represented in 1,172 current or historic populations in 193 units. The status of listed species and the expenditures on them in each park are updated and summarized annually in the NPS ESA Database. The program has funded conservation needs for eight taxa groups. Mammals and birds represent 24 percent of the listed species in parks and draw 60 percent of the funding reported by parks. The database is providing information that could be used to change this trend.

The National Park Service is continuing several efforts to save federally listed plants. In a cooperative agreement in 2006, three Chicago Botanical Garden interns specializing in botany were placed at Craters of the Moon National Monument, Gateway, and Glen Canyon National Recreation Areas.

The Endangered Species Program provided technical assistance on listed species to several NPS units:

- Advised the following parks on issues involving genetics: **Point Reyes National Seashore**, exotic deer; **Rocky Mountain National Park**, canid identification from scat; **Badlands National Park**, bighorn sheep; and **Yellowstone National Park**, bison.
- At **Cape Hatteras National Seashore**, the program reviewed the Off Road Vehicle (ORV) plans, the biological assessment, and FWS biological opinion on those plans to limit beach

The hemlock woolly adelgid, *Adelges tsugae*, is a serious pest of eastern hemlock and Carolina hemlock. In the eastern United States, it is present from northeastern Georgia to southeastern Maine and west to eastern Tennessee. Invasive Animal Program staff supported hemlock woolly adelgid treatment in multiple parks. Photo: Connecticut Agricultural Experiment Station Archives.



access during nesting seasons for piping plovers and other shore birds.

- At the request of **Everglades National Park**, the program participated in a meeting to determine the fate of habituated Florida panthers using an area that included a residential environmental education facility.
- At **Death Valley National Park**, continued assistance was provided for the Devils Hole pupfish by initiating a structured decision-making process.
- At **Channel Islands National Park**, the program continued to advise the park on genetic management of the small populations of an isolated endangered subspecies of the island fox.

Integrated Pest Management Program

The NPS Integrated Pest Management Program (IPM) celebrated its 35th year of reducing risks to people, resources and the environment from pests and pest related management strategies. The Servicewide IPM Coordinator, Regional and Park IPM Coordinators provide technical expertise and policy guidance on the management of pest species. Organisms are considered pests if they interfere with the management objectives of a specific site in a park or jeopardize human health or safety. Pests may be native or nonnative species. The integrated pest management process involves the coordinated use of pest biology, human behavior, site ecology, monitoring, action thresholds, and available technology to detect, prevent, and effectively manage pests using cost effective means and posing the least possible risk to visitors, employees, and park resources.

Highlights from FY 2006 include:

- The IPM Program developed a "Pest Alert" system and collaborated with the NPS Reservation System to install it on the new Recreation.gov website which serves DOI, USDA Forest Service, Army Corps of Engineers, and the U.S. Fish and Wildlife Service. The Alert, which can be updated at anytime, informs registering campers of pest quarantines or related issues in specific states and how their actions can assist in preventing the spread of invasive species.
- Servicewide, the IPM Program reviewed 2,399 pesticide use proposals in 2006, 155 of these required review by the national coordinator because they involved threatened or endangered species, aquatic systems, aerial application, restricted use pesticides, or were applied to over 400 contiguous acres.
- IPM Principles training was given to nearly 100 employees from natural and cultural resources, maintenance, and concessions programs. The

IPM staff also provided IPM training sessions at the DOI Museum Property Management Workshop and the Cultural Resources Vanishing Treasures Workshop.

- Provided technical pest management assistance to 105 requests from more than 30 NPS units in 25 states. Four were external requests where consensus and cooperation is essential in order to manage pests that move from federal into private lands.
- Coordinated management of risks from mosquito-borne disease with Yavapai County Public Health Program and **Tuzigoot National Monument** personnel.

Invasive Species Program

The Invasive Species Program serves NPS lands by providing a wide range of innovative and science-based services and policy guidance to manage invasive species on park lands. Focal points of the program include: the Invasive Animal Program and the Invasive Plant Program. The Invasive Animal Program includes Forest Health projects funded through grants from the USDA Forest Service. The Exotic Plant Management Team (EPMT) Program is a major component of the Invasive Plant Program.

Invasive Animal Program

The Invasive Animal Program advises and assists parks and regional offices, and provides national leadership on issues and management related to invasive animals and ecosystem restoration.

Highlights from FY 2006 include:

- Conducted *Eythrina* gall wasp control in **Ka-laupapa National Historical Park** to save the native williwili tree.
- Supported hemlock wooly adelgid treatment in **Morristown National Historical Park**, **Shenandoah National Park**, **Blue Ridge Parkway**, **Delaware Water Gap National Recreation Area**, and **Great Smoky Mountains National Park**.
- Conducted southern pine beetle control in **Big Thicket National Preserve**.
- Staff secured a recreation fee funding of \$455,000 to address the recently discovered outbreak of Sudden Oak Death (SOD) in eastern and western parks. The first year focus is in three critical parks in California where forests are at risk: (1) **Point Reyes National Seashore** where SOD is already present but where detailed delineation is needed, (2) at **Santa Monica Mountains National Recreation Area** where the objective is to detect first arrival of SOD, and (3) **Redwood National Park** where arrival of SOD is imminent.
- Staff supported **Yellowstone National Park** in

developing and implementing a boater education program at Yellowstone Lake where the objective was to prevent the introduction of invasive aquatic plants and animals into Yellowstone waters. Over 800 visitors were contacted during the 2006 summer session.

Invasive Plant Program

The Invasive Plant Program advises and assists parks and regional offices, and provides national leadership on issues and management related to invasive plants and ecosystem restoration. Effective management of park invasive plant programs requires well informed and trained personnel. The program is currently leading an effort with professional societies, universities, and other agencies to develop training opportunities for park personnel in the eastern states.

The Exotic Plant Management Teams (EPMT) are an integral part of the invasive species program for the National Park Service. They were established to provide a framework and a first response to exotic plant invasions in parks. The 16 teams are stationed across the country and are serving regional networks of parks. Each of the teams is headquartered in a park and serves multiple parks over a wide geographic area. The activities of the teams are coordinated through a steering committee, consisting of representatives from each of the parks the team serves. In addition to project work, teams provide technical assistance to parks, regions and the Inventory and Monitoring networks in invasive plant management. Teams spend: between 5–20 percent of their time on inventories, 5–20 percent on monitoring, 5–15 percent on prevention and cooperative efforts, 60–85 percent on control and less than 10 percent on research.

Highlights for FY 2006 include:

- The Park Service signed a Cooperative Agreement with Lady Bird Johnson Wildflower Center to enhance respective missions to protect native plants.
- A NASA funded collaboration between NASA, USGS, and the Park Service utilizes invasive species habitat models and remote sensed fire products to assess fire - invasive species interactions in parks, including Yellowstone, Grand Teton, Sequoia/ Kings Canyon, Denali, and Gates of the Arctic National Parks, as well as Yukon-Charley Rivers National Preserve.
- The 16 Exotic Plant Management Teams treated 14,700 acres, targeting 343 invasive plant species in over 157 NPS units. Student teams sponsored by the Student Conservation Association added 18,000 hours treating invasive

plants in parks. This innovative program won the Take Pride in America Volunteer 2006 award with a presentation by the Secretary of the Interior.

- The Northern Great Plains EPMT assisted Knife River Indian Villages National Historic Site with prairie restoration.
- The Colorado Plateau team completed removal of tamarisk at all known sites in Colorado National Monument.
- The Southeast EPMT completed the initial treatment of the Brazilian pepper tree on the Western Mainland Tract of Canaveral National Seashore. This 4,000 acre tract, jointly managed by the Seashore and the Merritt Island National Wildlife Refuge is habitat for the federally listed Florida Scrub jay.

Migratory Bird Program

The Park Flight Migratory Bird Program works to protect shared migratory bird species and their habitats in U.S. national parks. The program also develops bird conservation and education projects, and creates opportunities for technical exchange and cooperation between U.S. national parks and protected areas or parks in Latin America and the Caribbean. Park Flight is a partnership between the National Park Service, National Park Foundation, American Airlines, National Fish and Wildlife Foundation, U.S. Agency for International Development, and the University of Arizona. The program is made possible through the generous support of American Airlines, the NPS Natural Resource Challenge, and the Park Flight partners. Technical direction is provided by the University of Arizona Desert Southwest Cooperative Ecosystem Studies Unit and the NPS Biological Resource Management Program.

As part of the Park Flight technical exchange effort, 12 international interns from 8 Latin American countries and one from Canada assisted with bird monitoring and education efforts at 8 NPS units. These interns, whose involvement was coordinated through the NPS Office of International Affairs International Volunteers in Parks program, contributed more than 4,297 hours valued at more than \$77,518.

Vegetation Mapping Inventory Program

The Vegetation Mapping Inventory Program classifies, describes, and maps vegetation communities in parks. Park managers utilize the vegetation data to address land management issues such as fire, risk reduction, and public safety in wildland-urban interface zones. In FY 2006 the program invested \$4.5 million in existing and start-up inventories, and an additional \$250,000 in Inventory funds to augment the efforts at

Grand Canyon National Park and the Upper Columbia Basin Network (UCBN). The UCBN funding enabled the scoping meeting and collaborative efforts with the surrounding Bureau of Reclamation and tribal entities. The result was a favorable collaborative effort in the design and proposed coverage of the vegetation inventory of the **Lake Roosevelt National Recreation Area** (above Grand Coulee Dam in Washington) and neighboring environs having local and significant effects on park resources. Work also began in **Craters of the Moon National Monument & Preserve**, **Minidoka Internment National Monument**, **Hagerman Fossil Beds National Monument**. Additionally, the program provided start-up technical assistance to 8 networks (15 park units) for imagery, sampling, and budgetary guidance.

At the start of FY 2006, the Park Service had 99 ongoing vegetation mapping projects funded and began an additional 15 inventories. A major FY 2005 effort to start inventories now absorbs a large percentage of the remaining project funds annually to continue those ongoing efforts. Every year, new start proposals are received, ranked, and funded. In FY 2006 the program met the GPRA target of completing 80 vegetation inventories.

Wildlife Health Program

The Wildlife Health Program provides professional veterinary and wildlife management expertise to parks and regions on wildlife diseases and their management, preventive health actions, fertility control methodology, field anesthesia, and animal welfare issues. The Wildlife Health Team is a component of the Wildlife Health Program and provides rapid veterinary assistance, and other technical assistance necessary for wildlife disease management, with current emphasis on chronic wasting disease (CWD).

Through a cooperative agreement with Cornell University, the Biological Resource Management Program has access to expertise in the human dimensions of wildlife management from a Student Career Experience Program (SCEP) employee and the student's major professor. This year, the SCEP student began her third year of investigations into the human dimensions of white-tailed deer management in NPS units in the eastern United States. By integrating the biological and human dimensions of managing deer impacts, this project seeks to develop a model to improve NPS ability to respond to wildlife management needs of park units across the country. In-depth studies were performed at **Fire Island National Seashore**, **Valley Forge National Historical Park**, and **Prince William Forest Park**.

The Wildlife Health Program provided Service-wide leadership in addressing highly pathogenic avian influenza in wildlife, chronic wasting disease and other wildlife health issues on NPS lands. Highlights include:

- Developed plans to guide park preparedness, communications and response to highly pathogenic avian influenza (HPAI) in wildlife. Provided training and assistance in establishing surveillance for HPAI in wildlife to multiple NPS units nationwide.
- Provided \$55,000 in funding to support environmental compliance for chronic wasting disease management planning at **Antietam** and **Monocacy National Battlefields** and **Shenandoah National Park**.
- Provided project management for the Elk Management Plan at **Wind Cave National Park** and contributed significantly to development of culling and disease management aspects of the draft plan.
- Performed diagnostic investigation into the cause of mortality from 128 wildlife cases submitted from 18 parks in 5 of the NPS Regions and facilitated sample submission to other laboratories, including cases from the remaining 2 NPS Regions. Performed diagnostic tests for chronic wasting disease on an additional 87 cases and investigated disease exposure using serology on an additional 326 animals.
- Facilitated the safe and effective capture of wildlife by providing onsite field anesthesia training and assistance on three major capture projects at **Rocky Mountain**, **Glacier**, and **Hawaii Volcanoes National Parks**.
- Assisted natural resource management staff at **Acadia National Park** in applying human dimensions concepts to management of white-tailed deer issues; helped establish a "visiting scientist program" associated with the Schoodic Education and Research Center (science and learning center); and developed a research needs assessment (research agenda) for the human dimensions of wildlife management.
- Coordinated with the Environmental Quality Program and Biological Resources Management Program Wildlife Ecologist to proactively address a potential burgeoning white-tailed deer issue at **Blue Ridge Parkway**.

GEOLOGIC RESOURCES PROGRAM

FY 2006 Allocation: 2,672,000

The Geologic Resources Program provides support to parks on a broad range of geologic science and minerals management activities. It coordinates Servicewide functions and provides park managers with geoscience and regulatory expertise related to cave and karst systems, coastal and surficial geologic processes, dis-



At Coronado National Monument, Geologic Resource Program staff evaluated several landslides and debris flows resulting from record precipitation.
Photo: Dave Steenson, NPS

turbed land restoration, fossil resources, geologic hazards, soil resources management, environmental effects of mineral extraction, mineral extraction technology and engineering, and associated NPS policy and legal authorities to enhance resource management decisions.

The creation of the Geologic Resources Program and advances in NPS resource management resulting from the Natural Resource Challenge have led to an increase in geoscience expertise in the Park Service. In 1995, when the Program was created, there were fewer than 70 geology specialists working in the Service. Now there are over 100 geoscientists working across the National Park System, with almost 60 in park-based positions. These geoscience specialists provide unique expertise to manage projects and to collaborate with non-NPS geoscience organizations.

The Program's functions and FY 2006 accomplishments are summarized below under six broad program areas:

- Disturbed Lands Restoration
- Geologic Education and Outreach
- Geologic Processes and Features
- Geologic Resource Evaluation

- Minerals Management
- Soil Resources Inventory and Management

In addition to these program activities, the Program is leading NPS efforts to develop the National Cave and Karst Research Institute.

In FY 2006, the Program was actively involved in park management projects across the National Park System, ranging from coastal management and hurricane response to disturbed lands restoration to fossil resource protection and the permitting of mineral operations. Partner organizations, such as the American Geological Institute, Geologic Society of America, U.S. Geological Survey, and State Geologic Agencies have facilitated geologic research, education and interpretation efforts and leveraged NPS funds for park resource management projects.

The Geologic Resources Program directly assists NPS in meeting its Strategic Plan goals. Program staff serves as the Servicewide coordinators for the NPS Disturbed Land Restoration and Paleontology goals. The NPS performance in 2006 under GPRA Goal 1a1A—Disturbed Lands Restoration was restoration of 1730 acres for a cumulative total of 10,600 acres (2.4 percent of

437,150) reclaimed since 2004. The NPS in 2006 met the target with 3 percent or 14,000 disturbed acres restored. The FY 2006 Strategic Plan target for Goal Ia9 - Paleontological Localities was to have 38 percent of documented paleontological localities in parks in good condition, which the NPS met with parks reporting 42 percent (1,369 of 3,250 localities) in good condition.

Highlights of program accomplishment in FY 2006 include the following:

- Coastal geology staff continued to provide support to parks recovering from the series of major storms in 2005, including Hurricane Katrina that made landfall on units of Gulf Islands National Seashore and Jean Lafitte National Historical Park and Preserve.
- Disturbed land restoration staff managed \$795,000 in Servicewide NRPP restoration project funding for 13 park projects, distributed through five NPS regions. These projects restored hundreds of acres of severely disturbed land.
- Technical support to 6 parks addressed geologic hazards. Staff assessed a rock fall near a popular hiking trail and advised park management on potential future occurrences and safety issues at El Morro National Monument, evaluated several landslides and debris flows resulting from record precipitation at Coronado National Monument, assessed rock fall hazards at cave entrances and safety mitigation recommendations at Carlsbad Caverns National Park and Cumberland Gap National Historical Park, evaluated the potential for persistent rock fall stemming from an earthquake at Acadia National Park, and assessed geologic processes and associated impacts from anthropogenic development factors at Hot Springs National Park.
- The Program's coastal geology staff coordinated the first Resource Advisor Workshop for Hurricane (All Risk) Response. The 36 participants were instructed in preparing for assignment to an incident, health issues, and protocol for interactions with an Incident Command Team.

Due to across-the-board reductions in FY 2006 coupled with personnel cost increases and existing base funding limitations, the Program relied on over \$65,000 in funding from other sources in FY 2006, including other natural resource programs, parks and external agencies to provide critical geologic resources management assistance and support services to parks. In addition, park requests for technical assistance were not undertaken due to limited staff availability.

Disturbed Land Restoration/Abandoned Mineral Lands Reclamation

Projects restored hundreds of acres of severely disturbed land. FY '06 examples include: the restoration of the abandoned Gaylor Pit in Yosemite National Park; restoration of a former landfill at the Bradford Tract in Prince William Forest Park; restoration of stream banks and river corridor in newly acquired lands in Buf-falo National River; protecting genetic diversity through prairie restoration on disturbed lands in Saint Croix National Scenic River; land restoration following environmental remediation on the Presidio of San Francisco; removal and restoration of the Old Pinnacles Road in Pinnacles National Monument; restoring the hydrologic function for fish, wildlife and vegetation on the upper Hoh River in Olympic National Park; and reclaiming the abandoned Ames Mine to protect endangered Virginia Big-Eared bats in New River Gorge National River. Program restoration and reclamation specialists responded to over 25 technical assistance requests.

Geologic Education and Outreach

Program staff manages the Geoscientists-in-the-Parks (GIP) partnerships, working with professional geologic organizations and the academic community to meet the large backlog of park geoscience needs. In FY 2006 31 geoscientists were placed in parks, directly benefiting visitors through interpretive and research activities. An example of GIP projects and the collaboration in FY 2006 includes the Association for Women Geoscientists sponsored placements at Golden Gate National Recreation Area to assist development of a bathymetric map and the estimation of sediment storage within Rodeo Lake and Lagoon. This project meshes with another to determine the sediment budget for the area's watershed. The information gathered will be applied to management actions to reduce sediment and restore wildlife and fisheries habitat.

Geologic Processes and Features

Caves and Karst

The NPS manages over 121 parks containing karst and cave features. Highlights for the year include:

- Prepared an assessment of caves and recommendations for cave resources management planning at Glacier National Park, and developed an initial cave search and rescue plan to provide for visitor safety and cave resource protection for Gap Cave at Cumberland Gap National Historical Park, both with the assistance of cave staff from Carlsbad Caverns National Park;
- Provided support to cave resource manage-

ment planning at Coronado National Monument and Dinosaur National Monument, a proposed lighting project at Carlsbad Caverns National Park, and conducted an inventory and protection of John Brown's Cave at Harpers Ferry National Historical Park.

Coastal Geology

The Program's coastal geology staff provides technical support and programmatic guidance to over 74 NPS units with coastal and lakeshore geology concerns. During 2006, program staff focused on continuing to help park units respond to and recover from the series of major storms that hit in 2005, including Hurricane Katrina that made landfall on the Mississippi units of Gulf Islands National Seashore and in Jean Lafitte National Historical Park and Preserve. Highlights include:

- At Gulf Islands National Seashore staff provided extensive technical and programmatic guidance to both the park and NPS senior management on post-hurricane coastal geology resource protection and Santa Rosa Island infrastructure repair and replacement alternatives.
- Conducted a hurricane response meeting which provided 36 NPS employees with Incident Command System and Resource Advisor training. The training was of especial benefit to Fort Pulaski National Monument staff enabling them to more effectively respond to natural and cultural resource impacts when a spill in the Savannah River oiled the park shorelines and marshes in July 2006.
- As a result of the ongoing USGS-NPS "Vulnerability of Coastal Resources to Climate Change" project assessments of vulnerability to sea-level rise were published for Glacier Bay National Park and Preserve, Golden Gate National Recreation Area, Kaloko-Honokohau National Historical Park, and Point Reyes National Seashore.
- At Boston Harbor Islands National Recreation Area staff oversaw a study to determine the impact of boat wake on park resources.

Geohazards

The Geologic Resources Program provides technical rock mechanics and safety engineering assistance to many park managers for the assessment of a variety of geohazards. The goal of assessing geohazards is to minimize property damage and injury to visitors and staff. Geologic hazards pose a constant threat in NPS areas where geologic features are often the primary reason for the creation of many of our units in the National Park System. At the very least, geologic features often play an integral role in

the siting of park roads and facilities. The program provides assistance to park units that find it necessary to mitigate geohazards. Teamwork amongst parks, the program and geology experts from other government agencies has proven to be an effective way to deal with the geohazard issues.

Examples of technical support for FY 2006 include:

- Assessment of a rock fall near a popular hiking trail at El Morro National Monument.
- Evaluation of several landslides resulting from record precipitation at Coronado National Monument.
- Appraisal of rock fall hazards at cave entrances at Carlsbad Caverns National Park and Cumberland Gap National Historical Park.
- Advised park staff on the possibility of persistent rockfall problems from an earthquake at Acadia National Park.
- Evaluated rockcuts, associated hazards, and impacts to hydrothermal resources at Hot Springs National Park.

Paleontology

Diverse fossil resources have been documented in 181 parks and include plants ranging from microscopic algae and pollen to leaves and petrified logs, and animals ranging from marine shells to dinosaurs to Ice Age mammals, as well as trace fossils such as vertebrate tracks, burrows and coprolites. Program staff serves as the Service-wide coordinator for GPRA Goal Ia9 - Paleontological Localities, which measures the condition of documented paleontological localities (in-situ fossil sites) in parks. In FY 2006, the Service exceeded its Goal Ia9 target of 1,235 (38 percent) documented paleontological localities in parks in good condition. Parks reported 1,369 (42 percent) of the 3,250 baseline localities Servicewide in good condition, meaning that human activity is not adversely affecting the fossil resources, sufficient scientific information on the localities is available for resources management decision-making, appropriate management actions are being taken to protect and preserve resources, and the localities provide opportunities for further scientific research.

In FY 2006, paleontology literature research and summary reports were initiated on the Chihuahuan Desert, Southern Colorado Plateau, San Francisco Bay, and Pacific Islands I&M Networks comprising 40 parks. The Program also provided technical support to 6 parks and 1 national natural landmark on paleontological resources management issues in FY 2006.



The Geologic Resource Evaluation scoping session at Montezuma Castle National Monument allowed park managers and geologic experts to work together to evaluate the park's resources and its management issues. Geologic maps created as a result of this process continue to be a significant tool for groundwater modeling at the park.

At Big South Fork National River and Recreation Area Geologic Resource Program staff continued to play an important role in the development of an Oil and Gas Management Plan for the park. Working with park and Environmental Quality Program staff, the Program provided strategies to improve the efficiencies and effectiveness of the approach taken in the plan to assure it addresses the unique oil and gas management challenges facing the park.

Geologic Resource Evaluation

The Geologic Resource Evaluation (GRE) program, funded by the Natural Resource Challenge through the Inventory and Monitoring Program, provides digital geologic maps and geology-related information to parks. The program helps park managers integrate the use of geologic resource information in resource management decisions. The program provides parks with three main products: an onsite scoping meeting with park staff and geologic experts to evaluate and discuss the park's geologic resources and related resource management issues, along with investigating existing geologic research and paper maps; a comprehensive digital geologic map; and a comprehensive geologic report.

Highlights from FY 2006 include:

- Onshore and nearshore geologic maps provided new information for coastal park management. For example, new landform mapping was begun at Assateague and Canaveral National Seashores to assess shoreline changes, work was initiated at Gulf Islands National Seashore to study and document Hurricane Katrina impacts, and new benthic habitat mapping was aided at Biscayne National Park.
- Geologic maps funded through the GRE program continue to be a significant tool for hydrologic studies at several parks. In addition to providing the framework to understand groundwater flow, entire karst ecosystems have been identified using the information contained in the bedrock geologic maps. NPS Water Resources Program staff often use the GRE maps for groundwater modeling, such as at Montezuma Castle National Monument, and to identify potential ground water impacts from neighboring industrial activity, such as at Monocacy National Battlefield.
- Geologic maps remain the basic tool for identifying and evaluating geologic hazards such as rockfalls, slope failures, and mass wasting. In 2006, there were significant geologic hazard impacts adjacent to Yosemite National Park and Coronado National Monument, where both parks have maps completed or nearly completed for use in restoration efforts.
- Evaluation of external mineral development potential is facilitated by geologic mapping, such as in and around Fort Union Trading Post National Historic Site to help delineate potential oil and gas development and impacts on lands adjacent to the park.
- Critical habitat and wetlands occurrence can be identified with geologic research and mapping of floodplain landforms, as is being done to assist park resource managers at Congaree National Park.

- Park staff are using surficial geologic mapping by the Kansas Geologic Survey to determine the potential locations of archeological resources at Tallgrass Prairie National Preserve.

Minerals Management

Currently, thirty NPS units contain nearly 750 active private mineral exploration or development operations, most of which involve the production of oil and gas. Private entities that hold property rights to oil, gas, and other minerals located inside parks must obtain NPS approval of development plans and performance bonds before initiating mineral related activities. In 2006, staff assisted park managers by reviewing 11 new oil and gas proposals covering 16 operations in four parks.

On lands adjacent to parks, the NPS works with other federal and state permitting agencies, along with mining project proponents, to have park protection measures incorporated in mineral leasing or other energy development decisions. In 2006, Program staff assisted park and regional offices as well as other federal and state agencies on a variety of projects, such as Tennessee Valley Authority's draft Environmental Impact Statement (EIS) for the Koppers Coal Reserve adjacent to Big South Fork National River and Recreation Area and the proposed rezoning and expansion of a limestone quarry adjacent to Cedar Creek and Belle Grove National Historical Park. Other 2006 highlights include:

- Program staff worked closely with the Solicitor's Office to defend the NPS in a lawsuit filed by the Sierra Club over the NPS's interpretation and application of the directional drilling provision in the Service's nonfederal oil and gas regulations at the Big Thicket National Preserve. The provision encourages operators to access their nonfederal oil and gas rights in a park from surface facilities outside park boundaries using directional drilling techniques.
- At Chaco Culture National Historical Park, the Program assisted park staff in authoring a letter for the Superintendent's signature informing BLM of NPS concerns about several potential oil and gas lease parcels directly adjacent to the park which resulted in the parcels being withdrawn from consideration from leasing pending further environmental and cultural resource study.
- At Boston Harbor Islands National Recreation Area, the Program identified NPS regulatory authorities as well as possible environmental impacts related to the proposed Outer Brewster Island Liquefied Natural Gas (LNG)

terminal. NPS concerns communicated to state and FERC regulators were instrumental in the postponing of this project for the foreseeable future.

- At Whiskeytown National Recreation Area, Program staff helped respond to a June 2006 spill of several tons of drilled material from an upstream gold mine into park waterways.
- In Big South Fork National River and Recreation Area and Obed Wild and Scenic River, Program staff continued to play a pivotal role in the development of an Oil and Gas Management Plan for the two parks. Working with park and Environmental Quality Program staff, the Program provided strategies to improve the efficiencies and effectiveness of the approach taken in the plan to assure it addresses the unique oil and gas management challenges facing these two parks.

Soil Inventory Program

The Soil Inventory Program operates extensively through a partnership with the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) and the National Cooperative Soil Survey to undertake soil surveys in parks. Through this partnership, the program helps parks secure the information needed to manage soil sustainability and to protect water quality, wetlands, vegetation communities, and wildlife habitats. The information also assists in the control of exotic species and establishment of native communities, as well as management of potentially high-use or developed areas in the park (e.g., visitor centers, campgrounds, trails, access roads). This directly contributes to the achievement of NPS GPRA goal Ib1 (natural resource inventories).

As of the end of FY 2006, 100 NPS units have a completed soil inventory, with an additional 124 parks underway. Soil scoping sessions were initiated for two parks in 2006, and technical assistance was provided to an additional four parks on the use of the completed soil resource inventories for a wide variety of soil resource management issues.

The soil inventory for San Juan Island National Historical Park illustrates how this program helps to advance the achievement of GPRA Goal Ib1. This comprehensive project, completed in 2006, was mapped by NRCS at a detailed scale of 1:12,000 and generated comprehensive descriptions of soil types and their physical, chemical, and biological properties. As an aid to understanding the unique soil forming factors in the area, the soil map integrated geomorphic, climatic, hydrologic, vegetative, and land use history information. In addition to the soil map, park

managers received a detailed soil survey report which contains special soil interpretations for a variety of ecological and restoration applications. The park will use the inventory to provide a soil resource baseline to assist in an ongoing prairie restoration project, addressing impacts on soil resources from invasive animals and plants, and for information and education purposes.

National Cave and Karst Research Institute

FY 2006 was a transitional year in the development of the National Cave and Karst Research Institute (NCKRI). The legislation that directed the NPS to establish the Institute near Carlsbad, New Mexico, also included direction that the Service jointly administer the Institute with another private entity responsible for day-to-day administration. This management plan was brought to fruition in FY 2006 with the formal transfer of administrative responsibility to New Mexico Tech and the creation of a broad-based Board of Directors to guide the Institute. The NCKRI Executive Director position was transferred to New Mexico Tech, and their recruitment action resulted in the October selection of Dr. George Veni as the full time director, to begin duty in early 2007.

In FY 2006 the effort to construct a NCKRI building, jointly funded by National Park Service and the State of New Mexico and led by the City of Carlsbad, met with some setbacks due to receiving initial bids that greatly exceeded the available budget. Soon thereafter, the death of the primary architect resulted in the need to restart the architectural design and construction bidding process. However by the close of the fiscal year, the building efforts were moving forward again with assistance from the NPS Construction Office and Denver Service Center.

The Institute continued to extend its network of partners in 2006 through a variety of efforts. In 2006, the Institute's lecture series continued to provide a wide verity of informative lectures to the general public and members of the cave and karst community.

NATIONAL NATURAL LANDMARKS

FY 2006 Allocation: \$496,000

Funding for the National Natural Landmarks (NNL) Program was reduced by approximately 50 percent in FY 2006, which necessitated staff reductions through buyout authority and placement of NNL staff in other programs. Active monitoring and support of conservation at existing Natural Landmarks were reduced to correspond with the availability of fewer travel and project dollars. Evaluation of one potential National Natural Landmark was contracted,

using funding that was dedicated for NNL evaluations in previous years. The first new National Natural Landmark in over 18 years was designated. A multi-year project to revise the boundaries of 66 National Natural Landmarks was completed with Secretarial approval of the recommended revisions. A new process was established to obtain review of proposed Landmarks by the Science Committee of the National Park System Advisory Board, and the full board. The annual NNL photo contest was held for the third straight year, followed by production and distribution of the 2007 NNL calendar using the winning photos.

NATURAL RESOURCE PRESERVATION PROGRAM (NRPP)

FY 2006 Allocation: \$8,229,000

Resource management continues to emerge as a highly technical field with resource managers having to develop new and complicated solutions to evolving issues. Increased fixed costs and significant funding constraints have severely limited the ability of parks to address both new and chronic management issues. As a result, parks need access to dedicated project funding. The major source of such funds is the Natural Resource Preservation Program (NRPP). NRPP supports activities in diverse areas such as wildlife, fisheries, and vegetation management; specialized inventories; planning; mitigation actions; and restoration activities. NRPP funds strategically target specific needs such as Small Park Projects, Disturbed Lands Restoration, Threatened and Endangered Species Projects,

and funds that are distributed to the regions for their use for natural resource projects in parks.

New funding through the Natural Resource Challenge (NRC) has had a significant impact on park management. Funding for NRPP has increased from \$5,432,000 in FY 2000 to \$12,789,000 million in FY 2003; however, recent budget cuts and reprogramming to fund the Vital Signs Program have decreased NRPP funding in FY 2006 to \$8,229,000. Since 2005, NRPP has been reduced by \$4,066,000. These reductions translate into twenty to twenty-five fewer on-the-ground projects in parks per year—and reduced performance outcomes. In addition to the above reductions, regions were allowed to assess NRPP projects up to 1 percent of their budget in order to provide funding for contingency uses. For a full list of FY 2006 NRPP funded projects see Appendix B.

Natural Resource Management Projects

Natural Resource Management Projects make up the largest segment of the NRPP. Projects eligible for funding through this source include resource management actions; tactical biological studies; development of new physical science theory, management approaches, and protocols; and combined research and follow-up resource management or mitigation actions.

The total number of projects funded through the NRPP—Natural Resource Management program has significantly increased, until FY 2006, with funding provided by the Natural Resource Chal-

Ashfall Fossil Beds, located in Antelope County, Nebraska, is the first National Natural Landmark to be designated in over 18 years. Photo by R. Otto





Anaka Mines, a Western Arctic National Parklands seasonal technician, collects lichen species on a plot along the Red Dog Haul Road in Cape Krusenstern National Monument, Alaska. Photo: Shanti Berryman

challenge beginning in FY 2000.

- At Capitol Reef National Park NRPP funded a project to build a fence to prevent bison from entering the park and causing safety hazards and resource damage. The non-native bison transplanted by the Utah Department of Wildlife Resources (UDWR) are trampling fragile soils and impacting populations of a federally listed plant species. The fencing is a cooperative project between BLM, UDWR, and the park to help effectively manage the bison herd. A fence design used at Wind Cave National Park was modified and adopted for use here. Fencing materials were purchased and flown in by contract helicopter to six work locations. Fence construction should be completed by the end of FY 2007.
- At Cape Krusenstern National Monument researchers examined patterns of bioaccumulation of heavy metals and associated biomarkers in terrestrial fauna along the Red Dog Mine Haul Road. The USGS-Columbia Environmental Research Center (CERC) joined with the Western Arctic National Parklands ecology program to conduct field work along the DeLong Mountain Transportation System Haul Road in the monument. Field work focused on: bioaccumulation of heavy metals in several bird

- and small mammal species; effects of metals deposition on vegetation; and current deposition levels as a follow up to previous work on metal deposition patterns. The findings will be important both in terms of understanding the issue of bioaccumulation and as a test validation of the Risk Assessment recently completed by a contractor for the mine.
- A multi-year, seasonal assessment of the size of the Brazilian (Mexican) free-tailed bat colony at Carlsbad Caverns National Park uses a new method—advanced infrared thermal imaging and adaptive computer processing. Accurate census estimates for this colony are of interest both for the scientific community, to illuminate unknown aspects of the biology of this species, and for park managers, to facilitate science-based resource management decisions and assessments of long-term trends in the Mexican free-tailed bats at Carlsbad Caverns.
- At Golden Gate National Recreation Area and Point Reyes National Seashore, 57.59 acres were successfully treated to reduce non-native Cape-ivy to maintenance levels. The majority of the initial work was completed by contractors using mechanical and herbicide methods, with follow up resprout removal completed by thousands of volunteer hours and several small contracts. Both parks lever-

aged support from partnerships with the Marin Conservation Corps (AmeriCorps), park Habitat Restoration Volunteer Programs, and the California Exotic Plant Management Team.

- Fish, soil, and water samples were collected in Voyageurs National Park for a study investigating the impact of fire on mercury in soil, water and age-1 yellow perch. The 2004 Section 33 wildfire that consumed more than 80 percent of the Shoepack Lake watershed remains the primary focus of the work on fire effects, with Ryan, Peary, and Brown Lakes as nonburned control lakes.
- The Western Airborne Contaminants Assessment Project (WACAP) was initiated to determine the risk to ecosystems and food webs in western national parks from the long-range transport of airborne contaminants. It has been designed and implemented by the National Park Service in cooperation with the Environmental Protection Agency, the U.S. Geological Survey, the USDA Forest Service, Oregon State University and the University of Washington. Scientists involved with WACAP have now completed the collection of field samples and are focusing on laboratory analyses and report writing. Preliminary results from snow and water chemistry, lake sediment, vegetation and fish studies, demonstrate that current-use and banned chemicals are present in all western national parks sampled. In Sequoia and Kings Canyon National Parks and Denali National Park and Preserve the presence of microscopic changes in fish kidney, liver, and spleens indicated a stress response commonly associated with contaminants and poor nutrition. In Rocky Mountain and Glacier National Parks scientists observed feminization of some male trout possibly in response to man-made compounds that mimic the female sex hormone estrogen. The mercury flux to the Alaska Parks is up to 10 times less than for the parks in the lower 48 states, yet the mean fish concentrations in some Alaskan lakes are significantly higher. This appears to be due to watershed and food web characteristics in the Alaska that efficiently bioaccumulate mercury in the top aquatic predators—fish.

Threatened and Endangered Species Projects

A portion of the NRPP funding was allocated for projects focusing on federally listed threatened and endangered species. This portion of the NRPP assists in implementing the Natural Resource Challenge and in meeting the Service's strategic plan performance management goals. Approximately \$469,000 is allocated specifically for this project category.

Projects for FY 2006 include:

- Standard radio-tracking methods were used to determine nesting areas, home range, and foraging ecology of canyon dwelling Mexican spotted owls (*Strix occidentalis lucida*) in Grand Canyon National Park. During this final year of the three-year study, 33 canyons were surveyed and 12 nest or roost sites were identified. Production was measured at seven nest sites with an average 2.1 young owls produced at each nest. Park managers are already using data from the study to guide resource management efforts.
- There are nine federally listed plant taxa on Santa Cruz Island in Channel Islands National Park, each occurring in a few, small, isolated populations at scattered locations across the island. This recovery research provides life history and demography information, establishes new populations, and provides seed for banking.
- A research project to expand the known range of the federally endangered dwarf wedgemussel (*Alasmidonta heterodon*) in national parks along the eastern seaboard compiled a database of known dwarf wedgemussel populations with assistance from the U.S. Fish and Wildlife Service and the Maryland Department of Natural Resources. The dwarf wedgemussel and general mussel databases have been appended to create a single comprehensive mussel database. A series of snorkel surveys were conducted over July and August 2006 in search of dwarf wedgemussel and other mussel species. Three parks were sampled: Delaware Water Gap National Recreation Area; Prince William Forest Park; and Fredericksburg/Spotsylvania National Military Park.

Disturbed Lands Restoration Projects

A portion of the NRPP was established in FY 2000 for projects related to disturbed land restoration. Disturbed lands are those park lands where the natural conditions and processes have been degraded, damaged, or destroyed by developments (e.g., facilities, roads, mines, and dams) and/or by agricultural practices (e.g., cropping, grazing, or timber harvest). This portion of the NRPP assists in implementing the Natural Resource Challenge component related to natural resource restoration and in meeting the Service's Strategic Plan performance management goals 1a1A, 1a1C, 1a1D, 1a1E, 1a1F, and 1a1G. Projects in 2006 include:

- The first year of work for the reclamation of the Lincoln Cirque mining exploration area Great Basin National Park included the reclamation of the trenches and waste piles along the Cirque Road and the reclamation of the Cirque Road to the junction of the Wall



At Pinnacles National Monument the final phase of the Old Pinnacles Road removal was completed. The project restored three kilometers of stream and floodplain, returned flow and sediment regimes to natural conditions, improved floodplain function, and reduced conflict between visitor services and physical processes.

Jared Withers downloads audio data from the Muldrow Glacier sound station in Denali National Park and Preserve. Photo: Philip Hooge

Road (0.9 miles). The site consists of 31.5 acres with 10 trenches, 12 waste piles and 1.7 miles of roads. Approximately 15 acres of land were reclaimed in FY 2006. Eleven waste piles and all trenches were reclaimed. As the road was reclaimed, hand crews successfully converted the center of the road to a trail. The new trail meets all NPS trail standards and successfully negates the hydrologic issues of the old road.

- At the **Presidio of San Francisco** work continued to address the restoration of four coastal landfill areas, totaling about seven acres, within the Presidio Superfund site. Landfill removal was completed at 2 sites with 39,000 cubic yards of waste removed. Over 6,000 native plants of 70 species were planted in FY 2005, and 550 bags of exotic plant species were removed in FY 2005 and 620 in FY 2006. Monitoring of several rare plant species that were reintroduced to the site in FY 2005 showed that survivorship was high. In FY 2006 the federally endangered plant San Francisco Lessingia was reintroduced to the site, and is thriving. Follow up on the Cape ivy treated in FY 2005 directly adjacent to one site proceeded with over 300 hours of labor. An additional 3 acres of Cape ivy were removed. Volunteers contributed 211 hours of restoration service during this period.
- Stabilization efforts using cedar tree revetments were completed at four rapidly eroding banks, totally over 3900 ft, along the Buffalo River and a principal tributary. In addition, riparian corridor was restored to a minimum width of 100 ft at 13 impaired sites through the planting of native hardwood seedlings. The project exceeded its objectives for the length of bank stabilized. The success of the bank stabilizations and corridor restoration efforts cannot be thoroughly evaluated until tested over time. However, all revetments withstood a moderate high water event that occurred during the final days of the field effort. Past projects at **Buffalo National River** indicate that a 75–80 percent success rate can be expected of the cedar revetments. Assuming a repeat planting of native seedlings and the usual addition of numerous volunteer trees, adequate colonization can be expected at most restored corridor areas.
- At **Pinnacles National Monument** the final phase of the Old Pinnacles Road removal was completed. The project restored three kilometers of stream and floodplain, returned flow and sediment regimes to natural conditions, improved floodplain function, and reduced conflict between visitor services and physical processes. These objectives were accomplished in full by increasing the accessible floodplain area, allowing natural overbank flow, realigning a trail, removing impacts of an abandoned

quarry, recontouring and revegetating the area, improving riparian plant communities, and fostering greater appreciation of riparian ecology through interpretation.

Regional Small Parks Block Allocation Projects

Funding is provided to regions to allocate to small parks for projects. Small parks are defined, for the purposes of this funding, as those parks that fall in the lower third of funding for all parks.

Highlights include:

- At **Mammoth Cave National Park** and **Abraham Lincoln Birthplace National Historic Site** staff planted 400 disease resistant American elm trees. The variety planted is known as the Valley Forge American elm, which contains the putative genetics capable of withstanding Dutch elm disease. These trees will provide the genetic foundation to establish a self-sustaining population of American elm, which will produce the offspring needed to fully restore this tree as a proper function component of the rich-woods ecosystem. Plans are in place to plant additional Valley Forge elms in 2007.
- At **Stones River National Battlefield** park staff removed invasive exotic species and planted native plants where exotics have been treated. Park staff focused on a 15 to 25 acre area adjacent to Stones River. This cultural and natural landscape is a high priority Civil War site that has been severely compromised by a variety of invasive exotic plants including Chinese privet, bush honeysuckle, Japanese honeysuckle, and Chinese yam. In 2006, park staff continued reducing the abundance, extent, and reproductive capacity of invasive plants at the Artillery Monument site by treating individuals with herbicides. The site will be planted with native herbs and shrubs at a later date. In the short term, to prevent erosion and furnish competition to exotic species, the park will plant Virginia wild-rye (*Elymus virginicus*)

Regional Small Parks Block Allocation Projects

Region	Funding ¹	# of parks	# of projects ²
Alaska	19	2	2
Intermountain	246	15	16
Midwest	173	9	9
National Capital	19	2	2
Northeast	118	5	5
Pacific West	164	9	11
Southeast	209	10	12
Total	\$948	52	57

¹ Funding in thousands of dollars.

² See Appendix B for project details.

immediately after treatment.

Regional Program Block Allocation Projects

NRPP funding is available for block allocation Servicewide to regions for park projects as a part of regional natural resource programs. Qualified projects are those that improve natural resource knowledge and condition, including projects such as specialized inventories (those currently outside the scope of the Servicewide I&M Program's 12 databases) and mitigation actions (i.e., fossil inventories and invasive plant or invasive animal control).

2006 projects include:

- In a cooperative effort with the Alaska Department of Fish and Game, the Park Service developed and tested a technique for monitoring wolverine (*Gulo gulo*) distribution in large remote areas, and; 2) collected baseline ecological data on habitat use and inter-specific correlates for wolverine in interior Alaska. This study enhances wolverine management in interior Alaska by providing quantifiable and scientifically defensible data on which to base management decisions. Preliminary results indicate that wolverine presence within a sampling block was positively associated with the presence of marten (*Martes americana*), and terrain ruggedness. Wolverine presence was negatively associated with wolves (*Canis lupus*) and snowmobile tracks.
- At Shenandoah National Park staff and volunteers removed non-native plants from a globally rare plant community. Four hundred hours were spent hand-pulling invasive species. To maximize pulling effectiveness, the two most pristine areas of the wetland were selected for initial protection. Each area measured 2,916 square meters and a total 0.58 hectare were cleared of invasive species.
- At Assateague Island National Seashore NRPP funded the expansion and upgrades

of three continuous water quality monitoring stations and updated two tide stations in order to have near real time data available on the World Wide Web. Two of the three stations are integrated with NPS Tide Gauge Stations which measure water height every six minutes. The final enhancements are currently being finished by the Maryland Department of Natural Resources (MDDNR) and data is available on line: http://mddnr.chesapeakebay.net/newmontech/contmon/current_results.cfm. At present, a link from the Assateague Island NPS web page to the MDDNR web page is being developed. Although the work has just been completed, the data generated by these enhancements is already being used by managers at Assateague as well as our partners in the Maryland Coastal Bays Program.

Alaska Special Projects

This funding category was established in FY 2003 to enable the NPS to undertake projects to better protect and manage Alaska's National Park Service units, which are managed under the Alaska National Interest Lands Conservation Act (ANILCA) and other Alaska-specific requirements. Examples of projects include:

- The National Park Service partnered with USGS-BRD and USFWS funds to provide a comprehensive monitoring and research program for the Chisana caribou, a declining herd along the border of Yukon Territory and Wrangell-St Elias National Park and Preserve. The Chisana caribou captive rearing project was continued and included 50 pregnant cows. Following release, cows and calves were monitored via aerial telemetry for movement and survivorship. As of early September, survivorship of pen-reared calves (53 percent) was approximately the same as wild calves (59 percent). Survivorship for pen-reared calves was lower than previous years, and survivorship for wild calves was much greater than preceding years. Following release, cows returned to native summer range in Wrangell-St Elias National Park and Preserve.
- Acoustical data was collected and analyzed from seven sites in Denali National Park and Preserve throughout the summer visitor's season. With the exception of one site which could not be occupied due to equipment being disabled by wildlife, a representative sound profile was compiled for each site. An acoustical database will be developed, allowing for effective testing of desired conditions prescribed in the Backcountry Management Plan. A stratified, random sampling design is being developed for sound monitoring on a landscape scale. The analyzed acoustical data

Regional Program Block Allocation Projects			
Region	Funding ¹	# of parks	# of projects ²
Alaska	189	4	10
Intermountain	189	9	9
Midwest	189	8	8
National Capital	189	9	19
Northeast	189	9	12
Pacific West	190	8	8
Southeast	189	9	9
Total	\$1,324	56	75

¹ Funding in thousands of dollars.

² See Appendix B for project details.

is being used by park planners and managers as indicators of the frequency and intensity of man-made noise intrusions on the parks natural sounds. The data will also serve as a baseline for assessing change in sound quality over time. This information will help managers protect visitors' wilderness experiences.

USGS—Biological Resources Park-Oriented Biological Support

The U.S. Geological Survey (USGS) through Biological Resources and the National Park Service (NPS) through the Natural Resource Preservation Program jointly support biological projects that provide exploratory research and/or technical assistance to parks. This partnership effort operates through an interagency agreement. Of 35 projects active in FY 2006, 17 separate projects received FY 2006 funding and, of these, 5 received their last funding allotment. For a complete list of projects see Appendix E.

Projects for FY 2006 include:

- The Giacomini Wetland Restoration Project, a large tidal marsh wetland restoration in coastal California, will provide significant changes in the Tomales Bay watershed in the **Golden Gate National Recreation Area**. Tomales Bay represents a wide variety of habitat types for resident and migratory waterbirds. Restoration of this site would create a fringe of mudflat and a mosaic of marsh habitat that would increase avian species diversity. The project has completed all field surveys and is preparing a final report that will provide baseline information on the avian community on the Giacomini Ranch restoration site and reference sites prior to restoration action. Monitoring based on the results of this project will help assess habitat changes and the response of the avian community as the Giacomini Ranch restoration proceeds. These baseline data will be an integral part of assessing progress and providing a basis for adaptive management.
- This study investigated presence and abundance of the Foothill yellow-legged frog (*Rana boylei*) and Western pond turtle (*Emys marmorata*) in the presence of invasive species at **Whiskeytown National Recreation Area**. Overall, there appeared to be a healthy population of Foothill yellow-legged frogs in the park unit, unlike elsewhere where populations of this species are declining. Capture of 125 Western pond turtles and 2 introduced Red-eared sliders (*Trachemys scripta*) at 6 sites in and around Whiskeytown Reservoir suggest native turtles appear to be stable in the presence of invasive bullfrogs and a few introduced turtles. Further monitoring of invasive species

is warranted and specific studies are needed on effects of introduced species on native biota.

- Identifying and quantifying the effects of river regulation and water development on native fish communities in the **Chattahoochee River National Recreation Area** are crucial for evaluating potential conservation and restoration strategies. GPS and electronic depth recorders were used to map stream habitats at three flows, representing low, moderate, and high discharge conditions; models were developed for estimating habitat availability at two study reaches representing impact and recovery from hydropower generation; and fishes were sampled using a quadrat sample design to estimate native fish community structure at each study reach. The models will allow NPS to evaluate the influence of various water management scenarios on the abundance and distribution native biota in the river.
- Issues arising from unanswered questions about cougars (*Puma concolor*) in and near **Zion National Park** in southwestern Utah include whether the park functions as a source for lions dispersing into neighboring jurisdictions, whether increasing sightings of cougars and cougar sign near park visitor facilities suggest need for concern about human safety, and whether a dearth of cougars in parts of Zion National Park has resulted in a cascade of effects resulting in deleterious changes to riparian areas. This study began during 2005 to provide information on cougar movements and behaviors, including use of riparian areas, habitat selection, response to human facilities, and use of areas outside NPS jurisdictions. Global positioning system collars were deployed on three cougars in and near Zion during 2005–2006, with a fourth collar to be deployed during the remaining months of 2006. One collar has delivered locational data daily via Argos satellites and was deployed to test performance of this technology in the precipitous terrain of Zion. The near real-time delivery of data provided by this collar has allowed for timely investigation of kill sites for the cougar fitted with the Argos collar. Deployment of two more collars is planned during 2007, including an additional collar with capacity for Argos data delivery. Preliminary results suggest that collared cougars using the park also use extensive areas beyond park boundaries.

Servicewide Support Projects

In addition to parks, there are often project needs outside specific Servicewide programs that require funding unavailable from other sources. These projects are proposed and recommended by Servicewide program managers—often in response to recommendations of the Natural Re-

source Advisory Group—to the Associate Director, Natural Resource Stewardship and Science and funded through a portion of NRPP set aside for this purpose.

A significant amount of the funding and projects goes to provide specialized assistance to parks, either through direct provision of experts or through special topic workshops on issues affecting parks, or the development and support of tools to assist parks. Projects related to geological resource management, coastal disaster assessment, and eastern forest health are examples of projects funded in FY 2006. Support of efforts to establish and provide leadership to Cooperative Ecosystem Studies Units remains a major focus, as does development, production, and distribution of education and information-related material. Several special projects were initiated through this program in FY 2006, including the following:

- The 2006 Integrated Pest Management (IPM) symposium “Delivering a Promise” was the 5th National IPM Symposium hosted by USDA Cooperative State, Research, Education, Extension Services. The symposium promoted use of science-based integrated pest management strategies and provided useful tools for managing native and nonnative pest species that affect NPS resources. NPS received recognition in the Symposium proceedings, and for its IPM Program’s training course and poster session. Transfer of knowledge from contact and partnerships with other Symposium members has already begun to benefit park managers. Apple IPM experts have been linked with resource staff at Capitol Reef National Park and Antietam National Battlefield to improve orchard management and address immediate pest issues. IPM 3, a training consortium of several partners, has agreed to provide and is developing a demonstration termite management course and a turf and ornamentals course to NPS employees. NPS IPM will be involved on the development/implementation team of low risk strategies for termite management headed by the University of Florida and University of Hawaii.
- A cooperative agreement was signed with the University of Tennessee to retain Dr. Scott Schlarbaum as a science advisor to the National Park Service on eastern forests insects and diseases. Dr. Scott Schlarbaum, occupies an endowed chair of forest genetics in the Department of Forestry, Wildlife and Fisheries at the University of Tennessee at Knoxville and authored the book *Fading Forests*. He addressed the National Leadership Council on Eastern Forest Health. Dr. Schlarbaum

described the need for a conservation/management forest health strategy for national parks. In December 2005, an NPS Eastern Forest Health Workshop was held in Virginia. Participants included park and regional natural resource staff as well as staff from USDA Forest Service. The outcomes of the workshop were to increase understanding of the impact of invasive species and diseases on NPS eastern forests, to develop a framework for an NPS strategy on eastern forest health, and to develop an action plan for the development of such a strategy.

- A livestock and grazing management workshop, “Livestock and Landscapes,” attracted over 60 participants, from 14 states and Washington, DC. Participants shared experiences and ideas and learned from each other. The purpose of this workshop was to provide NPS staff with an understanding of the human dimension of livestock management, as well as the latest information on managing livestock herbivory and behavior, developing partnerships, and permitting for both cultural and natural landscapes.
- Natural resource staff provided assistance with coastal disaster assessments to **Gulf Islands National Seashore** and **Jean Lafitte National Historical Park and Preserve** following the storms of the 2005 hurricane season. In addition to the assessments, maps are being created for both parks that reveal historic shoreline and habitat changes. Researchers are using the information to develop models to assist with forecast shoreline position in the future. This information will assist park managers with planning for future storm events.

NATURAL SOUNDS PROGRAM

FY 2006 Allocation: \$1,399,000

The mission of the Natural Sounds Program (NSP) is to protect, maintain and restore soundscape resources and values by working in partnership with parks and others to increase scientific and public understanding of the value and character of park soundscapes. An important element of this mission is working with the Federal Aviation Administration (FAA) to implement the National Parks Air Tour Management Act (NPATMA) and comprises approximately 65–75 percent of the NSP budget and staff resources.

In 2006, the Natural Sounds Program was very successful in expanding capacity for productivity by leveraging its budget against various project partners including: acoustic monitoring for Air Tour Management Plans with FAA and The Volpe National Transportation Systems Center, Social Science/Visitor Use research in five parks with various academic institutions and private

sector partners, soundscape planning and workshops with various parks, and model validation and improvement with the Federal Interagency Committee on Aircraft Noise (FICAN).

In 2006 the Natural Sounds Program assisted 38 parks in the protection of park resources and values as highlighted in the table below.

Acoustic Monitoring and Information Technology and Management

Program accomplishments include:

- Data were collected in 11 park units in 2006 (Devils Postpile National Monument, Great Basin National Park, Hawaii Volcanoes National Park, Kaloko-Honokohau National Historical Park, Minute Man National Historical Park, Mount Rainier National Park, Muir Woods National Monument, North Cascades National Park, Point Reyes National Seashore, Sequoia and Kings Canyon National Parks, Yosemite National Park); 9 of these are ATMP parks. NSP staff provided guidance for data collection in 6 additional park units (Canyonlands National Park, Denali National Park and Preserve, Grand Teton National Park, Hovenweep National Monument, Natural Bridges National Monument, Yellowstone National Park); 5 of these are parks with Air Tour Management Plans.
- Natural Sounds Program engineers redesigned the automatic data collection systems to realize reductions in system cost (40 percent), power consumption (80 percent), and weight (90 percent), while improving the continuity of the data; a Palm PDA system was developed resulting in more efficient and expedient field studies and fully automating data transfer and processing; data processing software was written to produce daily images of sound level data resulting in a more useful and informative tool for public presentations, more rapid data prod-

ucts for park planning staff, and guidance for more intensive data analyses.

- Developed a generic compression algorithm for the audibility calculations, the Volpe aircraft noise model adopted by FAA and NPS to model noise impacts which resolved a critical impasse for the Grand Canyon Alternative Dispute Resolution process as well as improving the accuracy and reliability of the model for general applicability by enabling the Integrated Noise Model to estimate the audibility of overlapping noise sources thereby addressing one of the model's major shortcomings.

Air Tour Management Program

Park Specific highlights include:

- A working Draft ATMP/EA for Mount Rushmore National Memorial was completed; a baseline ambient acoustic data collection report was completed; acoustic computer modeling and analysis was completed for speech interruption at multiple threshold level; FAA/NPS Review Team meetings were held from April through July 2006 to incorporate NPS, FAA Office of Environment and Energy, FAA legal and ATMP National Team direction.
- At Haleakala National Park and Kalaupapa National Historical Park, drafts of the Purpose and Need, Alternatives, Affected Environment, and Environmental Consequences chapters were completed, and for Hawaii Volcanoes National Park a draft of the Purpose and Need chapter was completed; numerous discussions and planning meetings took place regarding a process to refine the EA alternatives (with systemwide applicability); baseline ambient data collection reports were completed for: Hawaii Volcanoes National Park, Pu'ukohola Heiau National Historic Site, Kaloko-Honokohau National Historical Park, and Pu'uhoonua o Honaunau National Historical Park; Haleakala National Park; and Kalaupapa National Historical Park; acoustic

Natural Sounds Program Assistance to Parks in FY 2006

Region	Park Units	Acoustic Monitoring	Airport Plans w/FAA	Air Tour Manag. Plan	Military Assistance	NEPA	Other*	Soundscape Manag. Planning	Social Science/ Visitor Use Research
AKR	1						1		
PWR	17	10	4	7	3	9	5	12	2
IMR	11	7	6	1	1	5	4	3	1
MWR	3	2		2		1	1	1	
NER	3	2		1			2	1	1
SER	3	1		1	1		1		1
NPS Total	38	22	10	12	5	15	14	17	5

*Other Park Planning including, but not limited to, General Management Plans (GMPs) and CSPs



Automated acoustic monitoring system at a high-country site at Yosemite National Park.

zones were revised, location points were added, and results of sensitivity modeling analysis for Haleakala National Park were presented to FAA/NPS.

- **Legislative Amendments:** The Park Service is working with FAA and others on potential legislative amendments to the NPATMA that would help streamline the ATMP process by increasing flexibility without compromising protection of park resources (e.g., voluntary agreements, modifications to Interim Operating Authority, discretionary exemptions to the ATMP process).
- **Grand Canyon Alternative Dispute Resolution Process:** Public scoping was initiated in January 2006 with the publication of the EIS Notice of Intent in the Federal Register; three public scoping meetings for the NEPA EIS process were conducted in late February; completed the summary report of public scoping comments; working with FAA and 20 stakeholders involved, Natural Sounds Program assisted in the development of NEPA alternatives; NSP staff co-chaired 6 Grand Canyon Working Group (GCWG) meetings in support of the alternative dispute resolution process.

Other 2006 Park Planning

- **Soundscape Management Plans:** assisted 17 parks with soundscape management by developing indicators and standards against which impacts to the acoustic environment can be measured pursuant to park management objectives and establishing baseline acoustic ambients to characterize the overall acoustic environment (Minute Man National Historical Park, Zion National Park, Grand Canyon National Park, Hawaii parks, Mount Rushmore National Memorial, Muir Woods National Monument, etc)
- **Military:** Natural Sounds Program staff regularly attends regional Airspace/Military coordination meetings in order to promote and foster productive working relations with the various branches of the U.S. military. In 2006, staff established an Air Force contact for dealing with overflight issues at Big Bend National Park. Attendance at regional Airspace/Military coordination meetings will continue in 2007 as it facilitates continued cooperative relationships between parks and military airspace managers and allows issues to be dealt with in an efficient manner.
- **Airports/Airspace redesign:** NSP staff assisted five parks in responding to FAA requests for

information regarding airport enhancement projects in 2006 as well as responding to FAA's requests for input in the Northeast Airspace redesign EIS.

- The Natural Sounds Program regularly participates in the Federal Interagency Committee (FICAN) on Aircraft Noise along with 10 other federal agencies addressing technical acoustic issues that have broad federal agency interest.

RESOURCE DAMAGE ASSESSMENT AND RESTORATION PROGRAM

FY 2006 Allocation: \$1,344,000

Under the Park System Resource Protection Act (PSRPA) (16 USC 19jj), the Oil Pollution Act (OPA) of 1990, the Clean Water Act (CWA) as amended by OPA, and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the National Park Service takes emergency actions and spill response activities to prevent or minimize destruction or the loss of or injury to park system resources. Following incidents, the National Park Service conducts assessments to determine damages to park resources and develops and implements restoration of the impacted resources. The Resource Damage Assessment and Restoration Program supports: 1) Policy development and guidance; 2) direct technical assistance to parks in taking emergency response actions and conducting damage assessments following incidents, and in planning and implementing restoration projects; 3) outreach and training on emergency response and damage assessment for NPS personnel; 4) Case Management, and 5) Cost Recovery actions.

In 2006, \$578,855 in damages were collected and deposited into the DOI Restoration Fund for restoration of damaged park resources. On the

restoration side, over \$1,392,644 was withdrawn from the DOI fund to initiate restoration projects in over 27 different park units. Two major restoration projects were completed in 2006, including the demolition and removal of the Jaite Paper Mill complex in Cuyahoga Valley National Park and replacement of several park structures in Great Sand Dunes National Park and Preserve lost in the Zapata wildfire.

ENVIRONMENTAL IMPACT PLANNING AND COMPLIANCE

While not included in the Natural Resource Challenge funding, the Environmental Impact Planning and Compliance program is part of the Natural Resources Stewardship and Science Directorate in the National Park Service. These programs integrate natural and cultural management and decision-making and contribute to the wider conservation of resources and sound decision-making within units of the National Park System and NPS responsibilities.

The Environmental Impact Planning and Compliance program supports parks, regions, and other offices in the process of completing Environmental Impact Statements (EISs), Environmental Assessments (EAs), and other compliance actions related to the National Environmental Policy Act (NEPA). The National Park Omnibus Management Act of 1998 and NEPA require park management decisions to be based on a full examination of alternatives and impacts and opportunities for public involvement. This program enhances the Park Service's ability to prepare environmental impact statements and fulfill other environmental planning and evaluations required by law. The work is directed at responding to an increasing number of court or legislatively mandated environmental documents

Settled Damage Assessment Cases for FY 2006

Park	Description, Case Name, Responsible Party	Statute for Case	Settlement Amount
SACN	Encroachment case - habitat loss	16 USC 19jj	\$1,700
VIIS	Ship grounding - marine resource damage	16 USC 19jj	\$53,400
NERI	Encroachment case - habitat loss	16 USC 19jj	\$95,000
BISC	Ship grounding - marine resource damage	16 USC 19jj	\$151,800
ASIS	Wildlife loss	16 USC 19jj	\$10,000
YELL	Oil Spill	16 USC 19jj	\$81,011
FRSP	Habitat loss and damage to cultural resources	16 USC 19jj	\$88,351
APPA	Fire - loss of historic structure	16 USC 19jj	\$43,506
CAVA	Encroachment case - habitat loss	16 USC 19jj	\$38,583
OCMU	Motor Vehicle Accident	16 USC 19jj	\$2,382
YELL	Motor Vehicle Accident	16 USC 19jj	\$7,334
FOSM	Motor Vehicle Accident	16 USC 19jj	\$5,789

Note that this table represents cases settled only. No on-going cases, nor those that have been excluded from the docket have been listed.

to support sound resource based decisions. Funding supports technically proficient project leaders working with park based specialists in preparing complex documents, facilitating public and agency reviews, and helping ensure that decisions are legally and environmentally sustainable.

The Environmental Compliance and Review program provides review and comment on environmental impact statements, federal licensing and permitting applications and other actions which may impact areas of National Park Service jurisdiction and expertise. It ensures compliance with the National Environmental Policy Act and other environmental protection mandates. It also provides comments on the effects on environmental quality resulting from proposed legislation, regulations, guidelines, Executive Orders regarding wild and scenic rivers, national trails, wilderness, resource management plans and activities from other agencies, recreation composites, Federal surplus property transfers, and related projects and undertakings.

RESOURCE PROTECTION PROGRAM

FY 2006 Allocation: \$286,000

In its fifth year of funding, the Resource Protection Program supports projects that use innovative approaches involving natural resource specialists, protection rangers, researcher and partners from other agencies to focus on resources at risk. Programs that were begun with Resource Protection funding, such as the resource stewardship and protection curriculum and the biome-based resource protection model have been applied beyond the parks and regions where they originated. **Klondike Gold Rush National Historical Park**, working with its gateway community of Skagway, completed a garbage management program that should save many bears. Highlights from this program area in 2006 include systematically addressing the loss of petrified wood at **Petrified Forest National Park** by developing maps of the most sensitive paleontological resource sites in the park and then conducting training for protection staff. There were also projects initiated for fisheries protection at **Biscayne National Park**, protecting threatened dune plants at **Pictured Rocks National Lakeshore**, and evaluating the damage resulting from undocumented alien traffic at the Texas-Mexico border parks. Developing these projects has often involved partnering with universities and other government agencies, a collateral benefit of the program.

WATER RESOURCES PROGRAM

FY 2006 Allocation: \$12,325,000

The Water Resources Program, in partnership

with parks and others, provides Servicewide leadership, technical assistance, funding support, and project management with respect to the preservation, protection, and management of water and aquatic resources of units of the National Park System. The program provides services directly to parks through a broad range of programs in the areas of water quality; water rights; floodplain management; ground water analysis; watershed and wetlands protection; water resources management planning; fisheries and marine resources management and protection; policy, legislative, and regulatory analysis; information management; and training. Water Resources Programs support attainment of and reporting to NPS Servicewide Strategic Goals Ia4A and Ia4B (Surface Water Quality) and Ia4C and Ia4D (Surface Water Quantity), as well as to NPS and DOI Land-Health goals related to wetland, riparian, upland, and marine resource protection (Goals Ia4C, Ia4E, Ia4F, and Ia4G).

Examples of significant accomplishments of the Program for FY 2006 are:

- Provided leadership to the efforts to prevent the extinction of the Devils Hole Pupfish by detailing expertise to **Death Valley National Park**, supporting research and monitoring efforts, and serving as the NPS representative to the Devils Hole Pupfish Unified Command Team.
- Provided Servicewide leadership in the NPS coordination of ocean policy and oceans program planning, coordinated NPS-related U.S. Coral Reef Task Force activities.
- Launched a new Natural Resource Challenge effort to conduct ecological condition assessments for park watersheds for 275 natural resource parks.

Water Resource Projects

The Natural Resource Challenge resulted in an increase of \$823,000 in the water resource protection projects budget beginning in FY 2001. These efforts are targeted toward development of scientific information that will benefit decision makers, including federal managers, court judges, or state administrators such as state engineers. In FY 2006, water-dependent resources that were studied include riparian vegetation, fish migration, and geomorphology. These results are needed by decision makers to understand the potential effect on the water-dependent resource of potential changes in stream or ground water flow.

To increase the effectiveness of its water resource protection funding, NPS partners with other non-federal entities. Some studies occur

as a result of collaboration with state or private entities with common science objectives. For example, hydrologic data collected by NPS studies for **Lake Mead National Recreation Area**, **Death Valley National Park**, and **Great Basin National Park** are shared with the Nevada State Engineer, southern Nevada water purveyors, and private developers, thereby contributing to the larger-scale investigation of regional aquifers and ground water availability in southern Nevada. In another example, data and other science information collected at **Chickasaw National Recreation Area** contributes to an on-going state-federal study of the Arbuckle-Simpson Aquifer in southeastern Oklahoma.

For a complete list of Water Resource Protection Projects see Appendix D.

Water Resources Program Competitive Projects

Water Resources Program competitive projects support many park-based activities, including the design of information management systems, regulatory assessments, riparian/stream and watershed restoration and protection projects with water quality goals, or other water quality improvement projects.

Water Resources Program competitive project funding for FY 2006 totaled \$996,200. This funding was derived from the Program's base project funds (\$161,500) and support to the backlog of watershed and water quality assessment needs currently identified in NPS PMIS from the new Watershed Condition Assessment Program before it transitions to a long-term program of systematic park-based assessments of NPS watershed conditions (\$834,700).

Once the Watershed Condition Assessment Program is fully operational, the Program's base funding will no longer be adequate to sustain the competitive project program. Therefore, it is scheduled to become inactive in FY 2007. Over past ten years, in order to meet increased salary costs per FTE and budget rescissions, the Water Resources Program has had to reduce funding to its project programs by \$1.4 million. This has resulted in the Program's inability to support the competitive project program after FY 2006.

Water Quality Monitoring

In FY2006, the Water Resources Program received \$2,781,300 for the Water Quality Monitoring component of the Natural Resource Challenge. This was the 6th year of funding for a program specifically intended to track and support the attainment of water quality standards in units of the National Park System as required by the NPS and DOI Strategic Plans. The program

is now "fully-funded," minus rescissions.

Full program funding was allocated to all 32 Park Vital Signs Networks in FY 2006. In addition, funds supported the development of an NPS Servicewide water quality data management program within the U.S. Environmental Protection Agency (EPA) STORET national water quality database.

Vital Signs Monitoring Networks: In FY 2006, 32 Park Vital Signs Monitoring Networks fully committed their water quality funding to compilation of background information, analysis of issues and threats, detailed program planning, and supporting synoptic-level field assessments, and five networks have initiated field-level monitoring. Network planning approaches included personnel hiring, in-house allocation of staff, university cooperative agreements, and USGS Interagency Agreements. In addition, some equipment acquisitions were made. All 32 Networks accomplished prescribed activities.

The Water Resources Program continued to support network water quality monitoring programs by providing national program administration and reporting, establishing baseline inventories and analyses of available water quality data, supporting digitization of legacy data from analog reports and other archival materials, maintaining a Servicewide water quality database in the EPA-STORET national water quality database, and enhancing the means to flow data from the Networks into STORET. Three water quality research associates and a student from Colorado State University worked to support the database development, management, and reporting activities. The Servicewide STORET database archive has served as the starting point for most network water quality data compilation and analysis efforts.

Water Resource Protection—Aquatic Resource Professionals

In FY 2005, the National Park Service received \$1,205,000 to fund aquatic resource specialists in the field. Fifteen positions were fully funded in FY 2005. Twelve of the positions are duty-stationed in parks, and one each is located in the Sonoran Network Office, the Center for Urban Ecology in the National Capital Region, and the Utah State Office.

These new professional staff provide technical assistance to parks, identify and conduct technical investigations to determine the condition of park aquatic resources, determine if actions of the National Park Service or external parties impair or impact resources, assist in developing and

implementing aquatic resource mitigation and restoration projects, and interpret and implement NPS water resource-related policies and regulations.

Highlights for FY 2006 include:

- Reviewed and provided comments on the Draft Plan of Operations for subsurface oil and gas explorations and 3-D geophysical seismic surveys for **Big Cypress National Preserve**.
- Provided comments to the Superintendent of **Booker T. Washington National Monument** regarding site construction plan, stormwater management, and riparian buffer protection related to upstream development outside of the park boundary.
- Continued ongoing hydrological support to resource staff at **Chaco Culture National Historical Park**. The data collected support ongoing park efforts at assessing effects of climatic conditions on physical habitat and ecological conditions at the park.
- Completed the shoal bass genetics study to assist **Chattahoochee River National Recreation Area** with the FERC re-licensing of Morgan Falls Dam.
- Provided technical assistance and biological opinions in support of several issues at **Chesapeake & Ohio National Historical Park**, including a fish kill in the canal, the threat of amphibian diseases discovered within the park, and the development of a fish ladder facilitating anadromous eel migration.
- Planned, coordinated, and participated in treatment aimed at control of iron-reducing bacteria at new water supply well in Pinery Canyon in **Chiricahua National Monument**.
- Provided technical assistance regarding classification of wetlands for the development of vector control and monitoring program for communities within the **Fire Island National Seashore** boundaries.
- Provided technical assistance to **Fort Pulaski National Monument** during the oil spill in the Savannah River in July 2006. This assistance involved field assessments of damage to wetland habitat and providing recommendations for restoration of the salt marsh habitat impacted by the spill.
- Provided a site assessment and hydrologic opinions regarding restoration of park trails impacted by a 100-year flood event for **George Washington Memorial Parkway**.
- Worked with Pacific West Region staff during development of interim plan for the protection of historic resources at Tassi Spring at **Grand Canyon-Parashant National Monument**.
- Worked cooperatively with aquatic specialist from Grand Portage Band of Lake Superior Ojibwa to 1) analyze water quality data and to 2) begin developing appropriate nutrient criteria at **Grand Portage National Monument**.
- In cooperation with volunteers and the Midwest Regional Fisheries Biologist, conducted a pilot survey of shoreline rock pools at **Isle Royale National Park** to 1) document potential effects of proposed Coast Guard lighthouse activities and 2) support development of a full proposal related to the pools.



Benthic macroinvertebrate sampling in the South Fork of Panther Creek at Mount Rainier National Park. Photo: Ashley Rawhouser

- Completed a draft Water Resources Information and Issues Overview Report for Mississippi National River and Recreation Area to support water resource management activities and interagency coordination.
- Provided site assessment and field support in the documentation of magnolia bogs in National Capital Parks—East.
- Continued technical support for ongoing monitoring at Quitobaquito Springs in Organ Pipe Cactus National Monument to support an endemic endangered desert pupfish and biologically rich oasis in the Sonoran Desert, which had been experiencing a declining trend in water availability for a decade.
- Assisted with qualitative and quantitative zebra mussel monitoring in Lake St. Croix and the St. Croix Falls flowage in Saint Croix National Scenic River.

Watershed Condition Assessment Program

The Water Resources Program received \$2.65 million in FY 2006 as part of the Natural Resource Challenge to assess watershed conditions on a system-wide basis. The Watershed Condition Assessment Program (WCAP) provides technical guidance and accountability oversight for this effort. Assessment projects are conducted at the level of individual parks, or groups of similar parks, and result in a written report and geospatial map products that convey findings about current resource condition status, critical data gaps, and existing or emerging vulnerability/risk factors for park-managed natural resources, habitats, and watersheds. These are interdisciplinary assessments that draw upon existing data from varied NPS and non-NPS information sources. During the FY 2006–2014 time-frame, the WCAP plans to fund one of these assess-

ments for each of the more than 270 parks in the NPS Vital Signs Monitoring Networks.

FY 2006 program efforts focused on initiation of a set of pilot projects at 17 parks, designed to demonstrate practical approaches and useful products for a new series of natural resource condition assessments in parks. Pilot projects will be used to formalize national guidelines and standards for these assessments as they are continued and extended to all Vital Signs Monitoring Network parks. Assessments in 12 of the 17 parks were initiated as natural resource and watershed condition assessment projects. Assessments in five parks were initiated as coastal condition assessment projects.

Watershed Condition Assessment—Critical Projects

In FY 2006, Water Resource Program funded projects that addressed emerging, high-priority, park watershed condition issues that, because of the applicable timeframes, could not be appropriately directed through the competitive project funding program. Examples of FY 2006 projects include a supporting study for a wetland improvement project at Minute Man National Historical Park, evaluation of the influence of riparian vegetation on channel bank stability at Canyon de Chelly National Monument, and an assessment of historic and functional conditions to support lake restoration at Ebey's Landing National Historical Reserve. Partnering with other federal agencies, state agencies, and/or local watershed groups in carrying out these projects was emphasized.



Chapter Four: Progress in Learning About Our Parks' Natural Resources

This chapter focuses on accomplishments in programs primarily directed at developing reliable information for resource management. Programs included are:

- Cooperative Ecosystem Studies Units
- Geographic Information System Program
- Inventory and Monitoring Program
- Natural Resource Data and Information Program
- RLCs

COOPERATIVE ECOSYSTEM STUDIES UNITS (CESUs)

FY 2006 Allocation: \$127,000

Cooperative Ecosystem Studies Units (CESUs) provide research, technical assistance, and education to federal land management, environmental and research agencies and their partners. Their broad scope includes the biological, physical, social, and cultural sciences needed to address natural and cultural resource management issues at multiple scales and in an ecosystem context.

Each CESU is composed of federal agencies, a host university, and partner institutions. CESU agreements allow each of the participating federal agencies to efficiently transfer funds and duty-station employees at university partners while maintaining responsibility for agency-sponsored activities within CESUs. CESUs are organized around biogeographic areas and linked together in the CESU Network. The National Park Service has 19 employees stationed at host universities to support CESU activities.

The CESU Network has the following objectives:

- Provide resource managers with high-quality scientific research, technical assistance, and education,
- deliver research and technical assistance that is timely, relevant to resource managers, and needed to develop and implement sound adaptive management approaches,
- ensure the independence and objectivity of research,
- create and maintain effective partnerships among the federal agencies and universities to share resources and expertise,
- take full advantage of university resources while benefiting faculty and students,
- encourage professional development of federal scientists, and
- manage federal resources effectively, efficiently

and responsibly.

Federal agencies participate in the CESU Network through a Memorandum of Understanding (MOU) and by joining individual CESUs. Some federal agencies have duty-stationed employees at CESUs. The CESU Network is led by a Council that includes representatives of the federal agency partners. The CESU Council meets regularly. A National Network Coordinator, appointed by the Council, facilitates Council activities.

Twelve federal agencies participate in the CESU Network, including the:

- Bureau of Land Management,
- Bureau of Reclamation,
- Department of Defense,
- Minerals Management Service,
- National Aeronautics and Space Administration,
- National Marine Fisheries Service,
- National Park Service,
- US Fish and Wildlife Service,
- USDA Forest Service,
- US Geological Survey,
- USDA Natural Resources Conservation Service and
- US Army Corps of Engineers, Civil Works

Since 1999, 17 CESUs have been competitively established across the nation. A total of 199 universities and other partners participate in the CESU Network. This total includes 160 universities and colleges (45 are minority institutions) and 39 non-governmental organizations or state organizations. These partners collaborate with the federal agencies to provide local expertise for key local needs and priorities. For all agencies in the Network, CESUs have been engaged in cooperative research, technical assistance, and education projects.

Documents and background materials about CESUs (such as CESU cooperative agreements, the Strategic Plan for the CESU Network for 2007–2011, the Network map and list of partners, and briefing statements) are available on the CESU website: <http://www.cesu.org/cesu>. Individual CESUs also have websites available that provide information about their activities and projects. Links to these individual websites are available through the CESU website.

A synthesis of key themes for NPS CESU programs in FY 2006 follow.

Cumberland Piedmont Network ecologist Steven Thomas exits a limestone cave with a live-trapped Allegheny woodrat during woodrat monitoring at Mammoth Cave National Park.

- **Vertebrate Re-survey of Yosemite National Park Between 1914 and 1920.** Joseph Grinnell with the University of California, Berkeley conducted vertebrate surveys along a transect that ran from the Central Valley through Yosemite National Park to Mono Lake on the eastern slope of the Sierra Nevada. The Grinnell study obtained more than 4,000 specimens, recorded over 2,100 pages of field notes and took nearly 1,400 photographs. The resulting report, *Animal Life in the Yosemite* remains the most comprehensive documentation of Yosemite's vertebrate fauna. This CESU project with the University of California-Museum of Vertebrate Zoology at UC Berkeley was designed to re-sample the original Grinnell transect to document any changes in wildlife distribution patterns, changes in habitat, and changes in species populations that have occurred during the past 80 years from this baseline study. The results of the re-sample have been remarkable. The elevation range for many wildlife species have shifted upwards of 1,000 feet. Some species that were common in particular locations are now rare in the same location today. Several species are now present in part of the transect where they were not found previously. Alpine species such as the pika are now restricted to the highest elevations of the park. Several species from the Great Basin (eastern Sierra) have now crossed the crest. The highlights of this CESU project were also covered in a popular article published in the *San Francisco Chronicle* about the affects of habitat dynamics and climate change on wildlife populations.

Several peer-reviewed scientific papers are also underway from this study. Several graduate students were directly involved in the implementation of this project.

- **Storm Hazards and Assistance to Incident Management Team.** The Gulf Coast CESU, Texas A&M University, and the Intermountain Fire program worked together to provide data to parks impacted by hurricanes Katrina and Rita. Researchers worked with the Incident Management Team to provide critical data on employee locations immediately following the evacuation and flooding of the greater New Orleans area as well as other communities along the Gulf Coast. Data included estimates of inundation and damage for each community and a database of imagery for the region. These data are now being incorporated into the longer term Storm Hazard project where storm response plans are being developed for coast parks using the spatial databases including park data, census data, and past storm history data compiled by the Environmental Hazard Center at Texas A&M University.
- **Thomas Farm Identification and Evaluation Study at Monocacy National Battlefield, Maryland.** This project was a 3-year study to identify and evaluate archeological resources at the Thomas Farm. The focus of the study was the archeological resources within the historic building cluster, and in an agricultural field above the Monocacy River.
- **Vegetation Response Following Invasive Tamarisk Removal by Burning or Cutting.** The Colorado Plateau CESU sponsored a retrospective

Detecting tamarisk, an invasive exotic plant, at Canyonlands National Park. The Colorado Plateau CESU sponsored research to study how vegetation responded following the removal of invasive tamarisk.



study of tamarisk (*Tamarix spp.*) removal sites across five states in the southwestern United States, investigated decreases in tamarisk cover, the effects of tamarisk removal on vegetation, and whether cutting or burning tamarisk has differing effects on plant communities.

- **Applicable Remote Sensing and Cultural Resources Monitoring in NPS Units along the US-Mexico Border.** Parks located along the U.S.-Mexico border have experienced dramatic increases in illegal cross-border traffic in recent years. Recent estimates based on field data indicate that over 300,000 illegal aliens passed through border parks annually, typically utilizing backcountry areas to avoid detection. Most of this traffic is on foot, though off road driving is not uncommon. The result is a spider web of unofficial trails and roads replete with discarded water bottles, clothing, food, human waste and other refuse. This effort was part of a larger effort to determine the best methodologies to examine the very serious degradation of NPS resources that has occurred along the US-Mexico border as a result of illegal border activities and subsequent enforcement actions. Maps and monitoring data derived from this project have helped focus interdiction and law enforcement efforts as well, potentially alleviating safety hazards to park visitors and staff.
- **Assessment of Reindeer Impacts to Lichen Ecosystems in Bering Land Bridge National Preserve.** This study gives preserve managers insight on the impacts of current levels of reindeer grazing on lichen winter range, and serves as a baseline for tracking change over time and with varying levels of grazing intensity. It will also allow for improvements in herd management stipulations; for instance, permits might prohibit grazing in the more sensitive areas containing late-successional communities or rare taxa, and managers could point toward alternative winter range areas with high forage but lower natural diversity.
- **Airboat/Off-Road Vehicle Trail Inventory for East Everglades Expansion Area.** East Everglades was added to the Everglades National Park in 1989, but acquisition of the land progress tract by tract until the last tract was added in 2005. The expansion area is almost 110,000 acres. Once the recreational domain of private land users, trails from airboats and off-road vehicles (ORVs) still remain. The purpose of this project was to create a detailed mapping, classification and inventory of trails from remote sensing data.
- **The Current Distribution of the Jackson Lake Spring Snail and Interactions with the Invasive New Zealand Mud Snail** The Jackson Lake spring snail (*Pyrgulopsis robusta*), found in limited habitats in **Grand Teton National**

Park, may be facing extinction and has been petitioned for threatened species listing by the USFWS. In addition, the presence of the New Zealand mud snail (*Potamopyrgus antipodarium*) in the Greater Yellowstone ecosystem may be threatening the survival of this population. Some evidence exists that the invasive mud snail is a superior competitor to the endemic spring snail. Researchers found populations of spring snail in only two locations in Grand Teton, where they shared microhabitats with the New Zealand mud snails. There was significant variability in snail densities from 2001–2005 at both locations in Grand Teton, arguing for long-term monitoring to determine the threat to the native snail species from the mud snail.

- **CESU Fellows: Student Internships at national parks.** The Gulf Coast CESU worked with Student Conservation Association (SCA) and Texas A&M University to develop the CESU Fellows program. Student interns in the program (Fellows) work at national parks for the summer, receive internship or cooperative education credit at their home institution, and receive a tuition scholarship (funded by SCA) to their home institution. Six students were placed in five different park units for the summer of 2006—all were minority students and they represented a diversity of disciplines from Business to Wildlife Biology.

GEOGRAPHIC INFORMATION SYSTEM PROGRAM FY 2006 Allocation: \$1,255,000

The goal of the NPS Geographic Information System (GIS) Program is to provide quality geospatial data, information, and applications utilizing GIS for park planning, program operations, and scientifically-based management of park resources. Today, most NPS units utilize GIS technology and data. GIS provides powerful visualization and analysis tools to assist park managers with resource management problems. GIS allows resource managers to bring together and geographically link information that otherwise would be impossible to integrate and enhances the abilities of managers to discover changes, patterns, and trends in resources over time.

The funded program originated as a natural resource program and many GIS data layers remain natural resource related, but the technology has been adapted for various cultural resource disciplines, facility location information, interpretation, and other uses throughout the National Park System. The NPS GIS Program is now led by the Office of the Chief Information Officer (OCIO), in recognition of its broad applicability across many NPS program.

The funding essentially operates as seed funding and is distributed to regions to support a combination of Regional Technical Support Centers (RTSCs), in addition to a natural resource GIS coordinator located in the Natural Resource Program Center. The Natural Resource GIS Coordinator serves on the NPS GIS Committee, along with regional, park, and program members, to represent the NPS GIS community and provide policy, funding, and operational recommendations to the Chief Information Officer and the Associate Director of Natural Resource Stewardship and Science. Additionally, there is significant coordination with the Department of the Interior through the Enterprise Geospatial Information Management team and across government through the Federal Geographic Data Committee (FGDC).

Funding breakdown by Region/Program for FY2006 was:

Alaska Region	\$209,000
Intermountain Region	\$219,000
Midwest Region	\$150,000
National Capital Region	\$60,000
Natural Resources	\$55,000
Northeast Region	\$201,000
Pacific West Region	\$205,000
Southeast Region	\$156,000

In FY 2006, approximately two-thirds of the GIS program funding supported park and regional staff or cooperators. About one-third of the funding financed projects and support costs. This funding is matched through other programs and activities for efforts undertaken by, or coordinated through the RTSCs. Several examples of how the GIS Program funds were utilized or leveraged throughout the fiscal year include:

- The I&M Central Alaska Network successfully deployed eight ruggedized tablet computers to the Denali and Yukon Charley Rivers park units as part of its vegetation monitoring protocol. A customized database application allowed field workers to enter the data directly into the database and later synchronize the data from the tablets back to a master database. The effort reduced data entry time by at least 60 percent and imposed quality control on data entered while in the field.
- In the Northeast Region, parks receive their GIS technical support through a cooperative agreement between the region and the University of Rhode Island (URI). Each spring NPS and URI staff co-teach a class learning to use global positioning systems (GPS) for mapping

and then take the students on a “GPS Swat Team” to a national park. There they map features of particular interest to the park. This year the group will map exotic invasive plants at **Morristown National Historical Park**.

- The New England Field Technical Support Center (FTSC) routinely performs many types of spatial analysis for the national parks. The viewshed developed for **Delaware Water Gap National Recreation Area** is a typical example of the type of spatial analysis utilized by parks. A proposal for a new powerline had it running through the park and along many areas expected to be visible from the park. Using GIS data the FTSC produced maps showing where the proposed powerline would be visible from as well as what park resources would be impacted by its construction.
- The New England FTSC created an innovative online map-based index for nearly 4000 aerial photographs of **Acadia National Park** from the 1940s through the 1970s. The FTSC developed an interface and dataset that allows park researchers to view and select air photos over the web instead of handling many photos as they find and select the ones of interest for a particular project. This protects an irreplaceable archival record of photography from excessive handling and saves researchers time and money in traveling to the park to review the photos by hand.
- The National Capital Region (NCR), Regional Technical Support Office (RTSC) acquired aerial photography of **Harpers Ferry National Historical Park** with emphasis on seven areas where the park needed to monitor and document development adjacent to the park boundary. The photos were converted into orthophotography for incorporation into the park’s GIS system for comparison with other GIS data and photography.
- NCR RTSC funding was used to support Global Positioning System (GPS) work at **George Washington Memorial Parkway**. This project used GPS to document the locations of populations of rare, threatened and endangered state listed plant species at two locations in the park. Along with the coordinate information, data about the plants’ population extent, health, and status were also collected. This data was incorporated into the park’s GIS system and will be used to help protect these populations from any potential future disturbances.
- NCR RTSC funding was used to purchase historic aerial photography for **George Washington Memorial Parkway**. Digital imagery was acquired for 1937, 1959, 1996 and 2000 for the entire park. This photography will be used in the parks GIS to look at change and condition



In the National Capital Region seven seasonal employees used GPS to document the location of assets in six parks. This data will be used in park planning and to ensure visitor safety through the creation of a Search and Rescue Atlas for the Potomac Gorge.

Ida Cunningham waits for an optimal GPS signal before navigating to an accuracy assessment point during an evaluation of Olympic National Park's existing vegetation map.

of various features over time.

- NCR RTSC funds were leveraged, along with funds from NCR Facilities Management Program, to hire seven seasonal employees. The seasonals were tasked with using GPS to document the location of assets in six parks. As a result of their work, parking lots, bridges, trails and features on the List of Classified Structures (LCS) were mapped and coordinates entered into the Facility Management Software System and LCS for use by Facilities and Cultural Resource staff. This data was also put into the park GIS system which will add to the parks in other projects. Additional funding was procured from NCR Planning Office to support GPS and GIS projects in the region. This funding was used to enhance, maintain, and purchase GPS and GIS equipment that support planning projects in the region. RTSC funding along with a grant from REI and the Potomac Conservancy was used to create a Search and Rescue Atlas for the Potomac Gorge. This Atlas will be used by law enforcement and emergency responders during search and rescue operations on the Potomac River.
- In the Pacific West Region, GIS program funds were provided to Oregon Caves National Monument to assess cumulative impacts to the cave occurring along the primary tour routes. To better assess the magnitude of these impacts, the park undertook a project in 2006 to map soil compaction and locations of damaged features. Park managers are storing this information in a GIS data layer that will aid in determining carrying capacity for the cave.
- The Southeast Region GIS Program provided a Student Conservation Association (SCA) intern to the Chickamauga and Chattanooga National Military Park to complete the mapping of the park's monuments and markers. Over 800 markers and monuments were photographed and their locations recorded using GPS as well as approximately one half of the park's Civil War earthworks. These data provide the park with critical information for managing resources and visitor needs. The data was also provided to the NPS Cultural Resource GIS program for inclusion in their national database. In addition, cave locations, building footprints and approximately half of the park's trails were also mapped.
- An SCA Intern was funded by the Southeast Region to provide critical water quality and watershed assessment work at Chattahoochee River National Recreation Area. The Chattahoochee River NRA provides rare green space to the more than 4 million residents of the Atlanta Metro Area and is under continual threat from numerous industrial, agricultural, and suburban pollution sources. This position

will enable the park to identify and respond to these threats and protect visitors and natural resources.

- The Alaska Region developed an Avian Observation Database to record sick and dead birds as reported through the statewide Avian Influenza Hotline, managed by the National Park Service. This database allows the hotline operator to record detailed information about each observation including location of bird(s) and type or species of bird(s). The hotline operator follows the workflow protocols developed by an interagency committee and also records within the database the people who were contacted and all actions taken in response to the observation. The database is disseminated to the involved agencies where stored information can be searched and retrieved for further analysis and reporting. For the year 2006, 290 bird observations were recorded with 41 of those being priority observations. Over half of the observations have been recorded spatially in a corresponding GIS layer.
- The Alaska Region GIS Team assisted the Bureau of Land Management National Training Center (Phoenix, Arizona) in developing a mapping grade Trimble GPS course. Two 4-day training events were held in Arcata, California and Anchorage, Alaska during fiscal year 2006. Trainees learned the fundamentals for advanced sub-meter GPS use, thereby reducing field and post-processing errors. During these two events, 45 students from the NPS, BLM and partnering municipal government agencies were trained. This course and the cadre of NPS/BLM instructors will be provided throughout DOI at several locations on an annual basis.

INVENTORY AND MONITORING PROGRAM (I&M) FY 2006 Allocation: \$43,124,000

This program provides park managers with information about what they manage (inventories) and the condition of the resources they manage (monitoring) so that science-based informed decisions can be made about actions that affect natural resources. The program, which began in the early 1990s, has expanded greatly as a result of Natural Resource Challenge increases. In FY 2000, the National Park Service organized 270 natural resource parks into a system of 32 networks to provide an efficient means of carrying out expanded inventory and monitoring (I&M) activities. In FY 2006, the program received a net increase of \$3,602,000 as a result of reprogramming from the Natural Resource Preservation Program (NRPP).

Through this program, each of the parks involved is to obtain 12 basic inventory products

and park networks are to develop and implement programs to monitor the most critical vital signs (indicators of park ecosystem health) in all parks with significant natural resources. The vital signs monitoring component of the program began in FY 2001. Earlier designed prototype monitoring programs which began in 1992 to evaluate alternative monitoring designs and strategies continue although most of the prototypes are now closely integrated with their respective networks.

As of FY 2006, 1,939 park data sets have been completed. This resulted in essentially completing seven inventory data sets for all natural resource parks (natural resource bibliographies, vertebrate and vascular plant species lists, base cartography data, baseline water quality data, water body location and classification, air quality data, and meteorological data) in addition to making progress on the remaining five inventories. Additionally, 30 networks encompassing 251 parks have been funded to monitor vital signs. The 30 networks are involved in a three-phase planning process to develop quality, peer-reviewed monitoring program designs that will provide the best possible information for management use. The first 30 networks have completed the vital signs identification phase (phase 2 of 3). In these networks, the categories of vital signs that predominated include landscape dynamics, weather and climate, water chemistry, bird distribution and abundance, and invasive/exotic plants.

The I&M program directly achieves goals of the National Park Service strategic plan. The Service's inventory goal met its target in FY 2006 to complete 1,942 (70.2 percent) of the 2,767 outstanding data sets. The Service's FY 2006 goal that 90 percent (243) of the 270 parks with sig-

nificant natural resources identify their vital signs was exceeded. As a direct result of the strategy of organizing parks into 32 vital signs monitoring networks, 250 parks (93 percent) had identified their vital signs, compared to the annual goal of 243 parks. In the new strategic plan, the NPS will focus on implementing the measurement of park vital signs, rather than identifying them; this is a direct result of new funding under the Natural Resource Challenge.

Universities, other non-governmental entities, and non-NPS government agencies produced inventory and monitoring products totaling more than \$10 million during the year. Efficiencies and leveraging was obtained by partnering. For example, in FY 2006, I&M funding was combined with funding from USGS to further accelerate vegetation mapping. Alaska land cover mapping combined I&M funding in a variety of cooperative projects, including those with the U.S. Geological Survey, Ducks Unlimited, National Wetlands Inventory, and the University of Alaska.

Activities administered and funded through the Inventory and Monitoring Program are as follows:

Inventories

Natural resource inventories being conducted as part of the Natural Resource Challenge are revealing many new and exciting insights into the natural resources contained in parks. Not only are the investigations increasing our knowledge and understanding about park resources, but the information being provided is also being used to address a wide variety of resource management issues and activities.

The Inventory component of the National Park

Basic Data Sets	End of FY 2006	End Of FY 2007	End Of FY 2008	FY 2009-10 ¹
	Completed	Completed	Completed	To be Completed
Natural Resource Bibliographies	270	270	270	Completed
Base Cartographic Data	270	270	270	Completed
Species Lists	270	270	270	Completed
Species Surveys	100	200	270	Completed
Vegetation Maps	80	116	146	124
Soils Maps	100	140	160	110
Geology Maps	92	146	204	66
Water Body Locations	270	270	270	Completed
Baseline Water Quality Data	270	270	270	Completed
Air Quality Data	270	270	270	Completed
Air Quality-Related Values	150	175	200	70
Meteorological Data	270	270	270	Completed

¹ The Servicewide program acquires basic inventory data sets for about 270 parks with significant natural resources. However, some parks have acquired some of these data sets and a few parks may not need all 12 sets. The parks to be completed reflects the number of parks Servicewide with outstanding needs.



Biologist Brenda Wells enters water quality data into NPStoret for the Cumberland Piedmont Network. Over 27,000 record entries were made in FY 2006.

Service Inventory and Monitoring Program reports to the strategic planning goal on Natural Resource Inventories that states that by September 30, 2006, acquisition or development of 70.2 percent (1,942) of the 2,767 outstanding data sets identified in 2002 of basic natural resource inventories for all parks will be complete. The number of outstanding datasets was increased to 2,767 in FY 2002 when vegetation maps were added to the baseline inventories.

The Service completed an additional 178 datasets in FY 2006, bringing the total to 1,939 (70.1 percent) of the outstanding datasets. Some parks will require additional time to certify the accuracy of their biological (vertebrates and vascular plants) field inventories, even though most of those field inventories were completed and data sets available by the end of FY 2005.

The increased funding for natural resource inventories received through the Natural Resource Challenge since FY 2000 is allowing the National Park Service to significantly increase the rate at which the basic natural resource inventories are completed. By combining Challenge funding, with funds previously available for inventories, the Service now estimates that it will complete the basic resource inventories for all 270 natural

resource parks over a period of approximately 10–12 years, rather than the 20–25 years projected to complete the inventories prior to receiving the additional Natural Resource Challenge funding.

The national I&M office has worked closely with park resource managers and others to obtain information about which of the 12 basic natural resource inventories are of highest priority to the parks for addressing various resource management and protection issues, as updating resource management plans and developing management actions to respond to a particular threat to park resources. Those priorities were revised in fiscal 1997 and are currently being used to establish the service-wide strategies for completing the inventories.

In FY 2006, inventory funding was devoted primarily to seven of the basic inventories: base cartography, vegetation mapping, soils mapping, geologic resource inventories, baseline water quality data inventories, meteorology, and Air Quality Related Values (AQRV's). Profiled below are examples of how inventory results during FY 2006 were used to better understand, manage, and protect park resources.

- **New Fish Species Discovered in American Samoa.** A new fish species in the genus of *Ostorhinchus* was discovered by a Department of Marine and Wildlife Resources biologist in American Samoa. The Senior Ichthyologist at the Bishop Museum is in the process of writing the description to name this newly discovered species. The fish has subsequently been observed in waters in the Tutuila unit of the **National Park of American Samoa** during a routine dive by park marine ecologists. This fish lives in deep areas of the reef usually below depths of 90 feet.
- **Giant Sequoia Tree Inventory Maps.** All giant sequoia trees, logs, and reproduction (seedlings) were historically mapped during the 1930s in **Yosemite National Park** and during the 1960s and 1970s in **Sequoia and Kings Canyon National Parks**. These maps and associated data were identified as an important baseline dataset for long-term monitoring and management of this species, however most of these data were not in digital format. These historic maps were recently converted into digital formats, and over 73,000 trees, logs, snags, and seedlings were digitized and georeferenced. Analysis of these data will improve the park's understanding and preservation of the complexity and ecology of these majestic trees.
- **Four-toed Salamander Inventory, Year One of Two Completed.** The four-toed salamander (*Hemidactylium scutatum*) is a Massachusetts Species of Special Concern whose distribution and abundance at **Cape Cod National Sea-**

shore is poorly known. The limited information available suggested it occurred in some of the park's tidally restricted wetlands proposed for tidal restoration. To assist in planning for these restorations, and to facilitate a more informed evaluation of alternatives, a breeding season inventory of four-toed salamanders was initiated in FY 2006. This first of two year's effort found that four-toed salamanders occur in both tidally restricted wetlands and isolated wetlands (e.g. vernal ponds). However, both frequency of occurrence and abundance was greater in tidally-restricted wetlands, although the difference in frequency was not statistically significant. Additional sampling in 2007 will provide a more definitive sense of this species distribution, abundance, and breeding-habitat use.

- **Mercury Contamination Documented in Fish Populations.** Preliminary results of inventorying atmospheric contaminants in aquatic ecosystems found that fish in high elevation lakes at **North Cascades and Mount Rainier National Parks** had mercury concentrations at 17 to 262 ($\mu\text{g/kg}$) and total PCB's and DDE, two organochlorines, at <25 ($\mu\text{g/kg}$), measured as wet weight. These contaminants were not found in fish from lakes inventoried from Olympic National Park, a park near the Pacific Ocean buffered from urban areas. Although the final report has not been completed, interim data suggest that urban areas may be the primary source of atmospheric contaminants affecting lake ecosystems in North Cascades and Mount Rainier.

Tapto #2 Lake in North Cascades National Park had an acid neutralizing capacity of less than 10 $\mu\text{eq/L}$, making it extremely sensitive to air quality impacts.



- **Prairie Rattlesnake / Western Rattlesnake Hybrid Found.** Through a cooperative agreement between the Northern Colorado Plateau Network and the Utah Division of Wildlife, state zoologist George Oliver documented the first hybrid rattlesnake known from the state of Utah. The hybrid rattlesnake is a cross between the green prairie rattlesnake (*Crotalus viridis viridis*) and the Great Basin rattlesnake (*Crotalus oreganus lutosus*). It is well known that in captivity almost all species of rattlesnakes are capable of producing hybrid offspring, but hybridization in rattlesnakes in nature seldom occurs.
- **Vascular Plant Inventories Document Rare Orchid Species.** The field work for vascular plant inventories has been completed for all five Appalachian Highland Network parks. To date, 453 species of previously-undocumented vascular plants have been added to park species lists for Blue Ridge Parkway, Big South Fork National River & Recreation Area, and Obed Wild & Scenic River. This represents a significant accomplishment in parks that have each had extensive botanical surveys done in the past. The most significant find for FY 2006 was a white fringeless orchid (*Platanthera integrilabia*), a candidate for federal threatened/endangered listing; found for the first time at Big South Fork during network inventories. Further searches in 2006, refined with predictive GIS habitat models developed from characteristics of the originally discovered populations, resulted in the discovery of what is either the largest or the second largest population of white fringeless orchid known to exist.
- **Chytrid Fungus Inventories.** The Southeast Coast Inventory and Monitoring Network (SECN) has partnered with the USFWS, The Atlanta Zoo, Georgia Department of Natural Resources, and others to further understand the distribution of a chytrid fungus, an amphibian pathogen related to large-scale amphibian population declines. The SECN staff sampled and tested several frog and salamander species at five parks in the Southeast Region (Cumberland Island National Seashore, Horseshoe Bend National Military Park, Timucuan Ecological and Historic Preserve, Ocmulgee National Monument, and Kennesaw Mountain National Military Park) in spring and fall 2006 as part of an ongoing Cooperative Agreement with researchers at the University of Georgia. Preliminary results have shown that the fungus is present in frog and salamander species at Horseshoe Bend. Sampling efforts will be expanded this fall at Horseshoe Bend, Kennesaw Mountain, and Ocmulgee to more adequately address the presence of this disease in SECN parks.
- **Eight New Fish and Eighteen New Plants Detected at Bent's Old Fort National Historic Site.** Southern Plains Network conducted biological inventories at Bent's Old Fort in 2001 and 2002. However, the Network has determined that the original biological inventories did not sufficiently cover the aquatic resources at the park. Filling this gap was a priority because aquatic resources were determined to be instrumental in vital signs monitoring. The Southern Plains Network developed an inter-agency agreement with the Bureau of Reclamation to conduct further plant and fish inventories in the park's largest wetland and along the Arkansas River which bisects the park. This project detected 8 new species of fish and 18 new plant species for the park. The invasion of cattail (*Typha latifolia*) and the exotic Canada thistle (*Cirsium arvense*) into the Arch wetland were identified as severe problems that could restrict plant diversity and bulrush habitat.
- **Biscayne National Park Cryptic Reef Fish Inventory.** The cryptic reef fish inventory completed field work in September 2006, and analysis is in progress. Network staff participated in the third field expedition of the Biscayne National Park cryptic fish inventory conducted with REEF (Reef Environment Education Foundation). To date, over 50 new species have been added to the park's list of marine fish from this endeavor with close to 200 sites sampled stratified across multiple habitats.

Monitoring

Natural resource monitoring provides site-specific information needed to understand and identify change in complex, variable, and imperfectly understood natural systems and to determine whether observed changes are within natural levels of variability or may be indicators of unwanted human influences. Thus, monitoring provides a basis for understanding and identifying meaningful change in natural systems characterized by complexity, variability, and surprises. Monitoring data help to define the normal limits of natural variation in park resources and provide a basis for understanding observed changes. Monitoring results may be used to determine what constitutes impairment and to identify the need to initiate or change management practices.

The intent of park vital signs monitoring is to track a subset of physical, chemical, and biological elements and processes of park ecosystems that are selected to represent the overall health or condition of park resources, known or hypothesized effects of stressors, or elements that have important human values.

During the development of the vision for park vi-

Common Types of Identified Vital Signs

Level 1 Category	Level 2 Category	Level 3 Category	Example Measures	Net-works	Parks
Air and Climate	Air Quality	Ozone	Atmospheric ozone concentration, damage to sensitive vegetation	17	118
		Wet and Dry Deposition	Wet deposition chemistry (pH, NO ₃ ⁻ , SO ₄ ⁻²), continuous sulfur (SO ₂) dioxide concentrations	18	93
		Visibility and Particulate Matter	IMPROVE network; visibility and fine particles	18	83
		Air Contaminants	Concentrations of mercury, benzene, toluene, ethylene chloride), atrazine	13	72
	Weather and Climate	Weather and Climate	Temperature, precipitation, wind speed, ice on/off	25	204
Geology and Soils	Geomorphology	Stream Channel Characteristics	Erosion/sedimentation, channel change, rate of scouring, stream profiles, coarse woody debris	12	81
	Soil Quality	Soil Function and Dynamics	Biological soil crusts, aggregate stability, soil surface condition, nutrients, organic matter	12	71
Water	Hydrology	Surface water dynamics	Discharge/flow rates (cfs), gauge/stage height, lake elevation, spring/seep volume, sea level rise	22	137
	Water Quality	Water Chemistry	pH, temperature, dissolved oxygen, conductivity	24	183
		Aquatic Macroinvertebrates	Species richness, diversity, IBI of stream macroinvertebrates, relative abundance	13	81
Biological Integrity	Invasive Species	Invasive/Exotic Plants	Early detection (predictive search models); presence/absence, area covered by exotic species	23	184
		Vegetation Communities	Species richness and diversity, rates of mortality and regeneration, stand structural dynamics	12	80
		Forest Vegetation	Species composition, % cover by species & layer, tree growth & mortality, regeneration	13	83
	Focal Species & Communities	Birds	Species composition, distribution, abundance	24	138
		Mammals	Species composition, distribution, abundance	18	95
		Fishes	Species composition, distribution, abundance	13	77
		Amphibians	Species composition, distribution, abundance	17	86
	At-risk Biota	T&E species and communities	Distribution,abundance, age and sex composition	16	112
	Human Use	Visitor & Recreation Use	Visitor Usage	Numbers of visitors by location, activity, season	12
Ecosystem Pattern and Processes	Land Cover and Use	Land Cover and Use	Area in each land cover and use type; patch size and pattern (from satellite and aerial imagery)	25	197

tal signs monitoring, it was clear that a “one size fits all” approach to monitoring design would not be effective in the National Park Service considering the tremendous variability among parks in ecological conditions, sizes, and management capabilities. A primary purpose of vital signs monitoring is to provide park managers with the data they need to understand and manage park resources, and the data most relevant to different types of park systems should be expected to be very different. Furthermore, partnerships with federal and state agencies and adjacent landowners are critical to effectively understand and manage the many resources and threats that extend beyond park boundaries, but these partnerships (and the appropriate ecological indicators and methodologies involved) differ for parks throughout the national park system.

Twenty-six networks (255 parks) have completed the process of determining which vital signs will be monitored in which parks based on available funding, and the most common categories of vital signs selected are summarized in the following table. The list of vital signs will not be finalized until each network has completed the protocol design phase and its negotiations with partners on options for implementation are completed. The most common park vital signs and the number of parks identified by 24 networks as a top priority are summarized in the following table.

As of the end of FY 2006, 30 of the 32 networks had been funded for condition monitoring, and the remaining 2 networks received initial planning funds. The first 17 networks have now implemented monitoring after completing the planning and design of the program. The resulting scientifically sound information is critical for designing strategies to protect and restore natural resources, for working with others whose actions influence resource conditions, and for measuring the condition of park resources.

As of September 30, 2006, 250 parks (93 percent, compared to the goal of 90 percent) had identified their vital signs and 157 parks (58 percent) had implemented vital signs monitoring. Because of the strategy of building on existing monitoring efforts by parks, other programs, and other agencies, and by involving the superintendents and park staff in the planning and design of long-term monitoring efforts, the I&M networks have played a key strategic role in the National Park System as a unifying program that has catalyzed collaboration among parks and programs, and developed new cost-sharing opportunities with other programs and agencies.

Profiled below are examples of how monitoring results during FY 2006 were used to better understand, manage, and protect park resources.

- Landscape changes as revealed by repeat photography. During 2004–2006, scenes from a total of 214 historic photographs were re-taken in three Southwest Alaska network parks and organized into a database. The primary subjects of the photographs are glaciers, ocean shorelines, floodplains, volcanic features, landslides, avalanche chutes, plant succession including shrub and tree expansion, and human disturbance. In comparing the old and recent photographs, it is evident that a variety of changes associated with vegetation succession and geomorphic processes have occurred within the parks. Volcanism in **Katmai National Park and Preserve** and **Aniakchak National Monument and Preserve** has created extensive barren landscapes that for the most part have been slowly colonized except in favorable microsites. Most glaciers have shown dramatic retreat since the early 1900s, with newly exposed surfaces becoming rapidly vegetated by tall shrubs and trees at low elevations but remaining sparsely vegetated at higher elevations. Expansion of trees and shrubs was observed in western Katmai, and altitudinal increase in treeline was observed at many locations in Katmai and **Lake Clark National Park and Preserve**.
- State-of-the-art coral reef monitoring detects interaction between coral bleaching and coral disease outbreaks. Increased temperatures detected by coral reef monitoring at three Caribbean parks triggered episodic monitoring that began in September 2005 and continued throughout FY 2006. October 2005 saw the Caribbean park reefs suffering through the most severe coral bleaching ever documented in **Virgin Islands National Park** and **Buck Island Reef National Monument** with 90 percent of coral bleached at South Florida/Caribbean Network study sites. A three-fold increase in monitoring frequency triggered by the bleaching episode produced the “discovery” that tremendous levels of coral mortality (currently an average 47 percent decrease in live coral cover for Caribbean park sites in FY 2006) was caused by coral disease outbreak (primarily “white plague”) that occurred as the corals were recovering from bleaching.
- Hemorrhagic disease may be responsible for significant declines in white-tailed deer at three parks in Missouri and Arkansas. Annual monitoring of white-tailed deer densities using state-of-the-art procedures detected significant declines in deer density at **Arkansas Post National Monument** (45 percent decline)

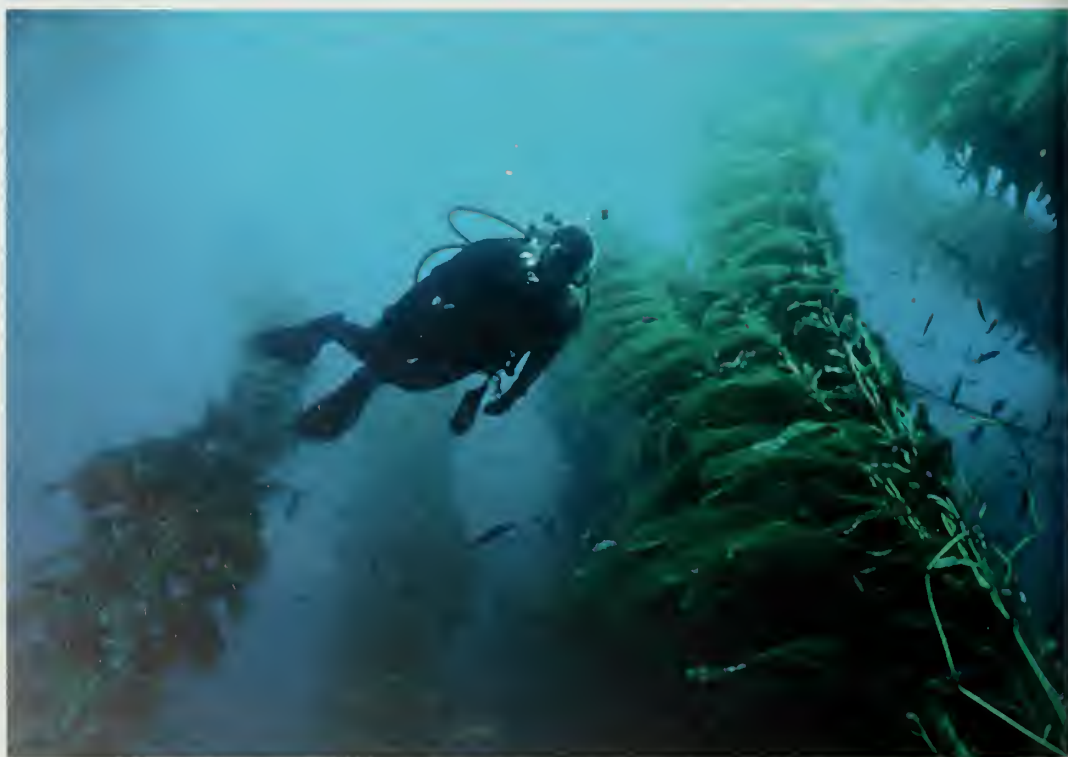
and Wilson's Creek National Battlefield (greater than 53 percent decline), while some decline occurred also at Pea Ridge National Battlefield. Population declines on the three parks may be attributable to hemorrhagic disease, which was detected in the deer herd at Wilson's Creek in the fall of 2005. This viral disease is acute, infectious, and often fatal and has been reported in southern Missouri and Arkansas. Park staff found 11 dead deer in September and expect that many others died undetected.

- Changes in land cover and use at Sierra Nevada parks determined through analysis of historic vegetation maps. The Sierra Nevada Network partnered with the University of California at Davis to digitize vegetation maps for Sequoia and Kings Canyon National Parks using historic information compiled in the 1920s and 1930s. Yosemite National Park's map had previously been digitized. The original data consists of photos, species inventories, plot maps, and vegetation maps covering much of California. The data provide a snapshot of the state's vegetation in the early 20th century, making the collection an invaluable resource for examining changes in land cover and use, and for informing our knowledge of habitat restoration.
- Effectiveness of marine protected areas determined at Channel Islands National Park. Sixteen additional monitoring sites were added to the kelp forest monitoring program in FY 2006 to assess the effectiveness of newly established marine protected areas in the park at stabiliz-

ing kelp forest community structure.

- Spadefoot toad monitoring at Cape Cod National Seashore leads to enhanced protection. Data collected during development of the amphibian monitoring protocol indicated that Cape Cod National Seashore's Province Lands support perhaps the largest concentration of Eastern spadefoot toads in the northeastern United States. Unfortunately many are killed on park roads during rainy nights, particularly on Province Lands Road, which bisects an area of temporary wetlands used by spadefoots. Monitoring results led to a program of road closures on rainy nights to protect spadefoots and are being used to refine and determine the effectiveness of this management action.
- Restoration of the cultural landscape at Wilson's Creek National Battlefield benefits rare plant species. An increase in the population size of the federally threatened Missouri bladderpod at the park in 2005 and its stability in 2006 has been attributed to restoration of the cultural landscape on Bloody Hill. The resulting open savanna provides habitat for the Missouri bladderpod, where it can increase in abundance and distribution. Monitoring by the network will continue to provide trend information to help guide management decisions.
- Parks and their importance in a fragmented landscape. The National Capital Region Network, as part of its Landscape Dynamics Monitoring, has developed a method to determine the importance of national park units to the dispersal of wildlife in surrounding land. With the help of satellite photos, the network

At Channel Islands National Park resource managers established 16 new kelp forest monitoring sites. The program provides data on the effectiveness of the newly established marine protected areas.



can identify patches of suitable habitat, such as forests or fields, both within and around the parks. Using a geographic information system, the distances between the suitable habitat patches are calculated. The measures are then compared to the maximum distance that particular animal species are willing to travel. This method, which examines connectivity of patches, can highlight vital habitat patches in the parks that are important in allowing wild-life species to travel throughout their entire range. In some cases relatively small patches of habitat can be important in that they serve as “bridges” allowing animals to move through parks to reach other locations. This technique can emphasize the importance of the parks as wildlife movement corridors and can help resource managers to identify patches within parks that require management attention.

NATURAL RESOURCE DATA AND INFORMATION PROGRAM

FY 2006 Allocation: \$1,510,000

The purpose of the Natural Resource Data and Information Program is to develop guidelines, technical solutions, and procedures for using and managing natural resource data in parks. This program operates and maintains a variety of relational database solutions that support efficient and consistent programmatic workflow, document and track resource inventories and assessments, and provide the analyses needed to effectively plan, manage, and track a broad range of natural resource stewardship activities. Funds also support production of the annual edition of *Natural Resource Year in Review* and the journal *Park Science*. The development and dissemination of information for the public, NPS managers and interpreters, students, teachers, and the media, including administration of the NPS Nature and Science website and the Natural Resources Intranet is also handled through this program. The infusion of funds from the Natural Resource Challenge initiative, combined with the periodic allocation of project funding, provides the means for this program to maintain and refine Internet-based information technology solutions to successfully and efficiently gather and share data and information with a vast internal and external audience.

Highlights of FY 2006 activities include the following:

- Views of the National Parks (Views) is a multi-media educational program designed to teach school children and the public about national park resources. The program is available on the Internet and DVD. In FY 2006 the Views team and its partners completed modules on:

Whiskeytown National Recreation Area, Devils Tower National Monument, Grand Canyon-Parashant National Monument, Petersburg National Battlefield, Badlands National Park, and the Petroglyphs National Monument volcanism case study. The Wilderness module was translated into Spanish (by partners) and will be implemented in 2007. Educators working with the Views team wrote lesson plans for “Coastal Geology” and educational curriculum guides for “Caves and Karst” (comprehensive, 1-week, and 2-week versions). Partnerships were initiated or expanded with the: University of Colorado-Denver School of Education, NASA Mission Mars and Mission Landsat, and the Denver Museum of Nature and Science. Nearly 20,000 copies of the Views DVD were distributed, most significantly as part of the American Geological Institute’s “Earth Science Week” toolkit.

- e-Authentication pilot project-In collaboration with the Office of Management and Budget and General Services Administration, modifications to the NPS Research Permit and Reporting System software were implemented to accommodate e-Authentication pilot project requirements. The Department of The Interior uses this e-Authentication pilot project to help the federal government progressively respond to the President’s E-Government Initiative. The Internet-based NPS Research Permit and Reporting System receives more than 10,000 new electronic records from the public annually (comprised of permit applications, issued permits, and annual accomplishment reports).
- Pesticide and Herbicide Tracking. More than 2,000 pesticide and herbicide use proposals were approved and tracked during FY 2006 using the Internet-based Integrated Pest Management (IPM) system. The IPM system efficiently and consistently facilitates the proposal, review and approval, and tracking of applied pest control agents within the National Park Service. The data obtained through the continued use of this system is conveyed to the National Archives every two years.

RESEARCH LEARNING CENTERS

Cumulative Increases: 2,698,000 (FY 2001 and FY 2002)

Seventeen Research Learning Centers (RLCs) were created beginning FY2001 to promote new knowledge about park resources through research, education, and public engagement. Twelve RLCs have been funded through the Natural Resource Challenge (NRC) and five through a combination of existing park base and partner support. The two newest RLCs, Crater Lake Science and Learning Center and Greater Yellowstone Science Learning Center, were es-

established in FY 2006. The mission of the RLCs is to increase the effectiveness and communication of research and science results in the national parks by:

- Facilitating use of parks for scientific inquiry
- Supporting science-informed decision making
- Communicating relevance of and providing access to research knowledge
- Promoting resource stewardship through partnerships

RLC staffs include research and education coordinators and, in some cases, other technical and administrative support personnel. While staffs are located at a host park, most RLCs serve multiple park units; over 100 of the existing 390 National Park System (NPS) units are served by RLCs. Basic facilities for research and education vary widely from one RLC to the next, but nearly all provide housing, office and meeting space, computer use with internet access, and a range of products and services that communicate science and research results. In addition, some RLCs provide project funding and grant writing assistance as well as the following logistical support: wet and dry analytical labs (e.g. refractometers, microscopes, sieves, sample bottles, etc); field equipment (e.g., spotting scopes, binoculars, GPS units, data loggers, digital cameras, inflatable raft, radio telemetry receivers, waders, canoes, coolers, etc.); access to libraries, park data, and archives; transportation (including use of boats and research vessels for aquatic and marine research); and field assistants (students interns and citizen science volunteers).

Through the efforts of RLCs, the National Park Service is effectively meeting managers' needs for quality scientific information. In FY 2006, RLC research coordinators helped to establish and implement over 800 research permits, nearly 500 of which met park back-logged needs for resource information. RLC housing accommodated 16,968 people-nights, saving researchers \$922,663 in lodging expenses. RLC staffs worked with 346 college students that were involved in park research, many of which were graduate students conducting independent research. About one-third of the RLCs now offer internship or fellowship programs, often in collaboration with other Natural Resource Challenge programs such as Cooperative Ecosystems Studies Units (CESUs) or nonprofit park partners. Seed money from these programs helps promote park research while providing modest stipends for future scientists.

Science communication and educational activities are integrated into many research projects

to promote science literacy, science-informed decision making, and resource stewardship. RLC education coordinators created over 90 science communication products used by teachers, students, park staff, and the general public. These include on-line multi-media approaches such as digital video, audio recordings and electronic field trips along with more traditional products such as project summaries, newsletters, brochures, resource and site bulletins, wayside and visitor center exhibits, and nature trail guides. Sixty public workshops and seminars were held on specific topics such as coastal erosion and restoration, avian ecology, saltmarsh loss, as well as conferences highlighting a range of park research projects. Through RLCs, more than 2,000 teachers and 7,000 students were engaged in hands-on science activities in and about parks. Internally, RLC staffs provided nearly 8,000 hours of training for park resource managers, interpreters, and concessionaires on climate change, wetland health, grassland restoration, invasive plant mapping and eradication, wildlife and vegetation monitoring, air quality, forest pathogens and pests, and a host of other topics. Because science communication is an important component to a Natural Resource Challenge programs, RLCs are currently involved in efforts to collaborate with other programs, such as Inventory and Monitoring (I&M) and CESUs, to identify products we might jointly produce to consistently convey high quality resource information to managers and the public.

Partnerships are the key to RLC success. In FY 2006, RLCs engaged more than 330 partners including universities, schools, non-profit organizations, community groups, federal, state, and tribal agencies and a range of NPS programs. By involving partners in park research, scholarship, and educational activities, RLCs logged over 25,000 volunteer hours and leveraged \$7 million in direct match and in-kind support, plus millions more in research supported solely by outside funding agencies. Among the most successful volunteer efforts were citizen science programs. Some of these were "bioblitzes" (one or two day events to inventory one taxa or habitat such as aquatic invertebrates, moths, or beetles) while others represent longer-term programs to monitor the health of a species, such as the Common Loon, or a group of species such as butterflies.

Highlights of RLC supported activities for FY 2006 include the following:

- The Ivory-billed Woodpecker (*Campephilus principalis*) is the largest woodpecker in North America, and the second largest in the world. Thought to be extinct, it was recently rediscovered

ered in the Cache River National Wildlife Refuge in Arkansas. The Old-Growth Bottomland Forest Research and Education Center has taken a lead role in working with a wide range of stakeholders, including federal and state agencies, non-governmental organizations, and private entities, to evaluate the possible presence of the species in South Carolina. Efforts include facilitating workshops, training citizen scientists to conduct field surveys, compiling and entering data, and a host of other recovery support and science communication activities.

- Mount Rainier is a steep, glaciated volcano, and it naturally sheds copious amounts of sediment. This dirt fills the river channels, makes flooding worse, and destroys increasing amounts of park infrastructure. The North Coast and Cascades Research Learning Network is facilitating research to survey river channel beds, compare them to historic maps and data from 1910, and evaluate the rate of historic channel filling. Results suggest the river has risen an astounding 38 feet since 1910, and 6 feet in the last year alone. This information is critical for park planning.
- The study of factors affecting the marine mammal decline in the North Pacific remained a high priority for the Ocean Alaska Science Learning Center, which contributed \$70,000 to harbor seal and Steller sea lion projects that was matched by more than \$975,000 in external funding. Results suggest that Steller sea lion and harbor seal populations declines may have slowed or ceased and that populations have stabilized somewhat at levels approximately

85 percent less than in 1980.

- Big Egg Marsh, Jamaica Bay was selected as one of four national sites featured in "Estuary Live," a live internet broadcast for classrooms around the country. The Jamaica Bay Institute developed the tour, which took place on National Estuaries Day, September 29, 2006. More than 250 schools from 35 states, representing at least 15,000 students, participated in this virtual exploration of the estuary with scientists, resource managers, educators and community members. During the hour-long broadcast, students submitted more than 300 questions to on-site field trip.
- The Appalachian Highlands Science Learning Center collaborated with numerous partners to offer nine bioblitzes in 2006. These were focused citizen science volunteer efforts to help researchers conduct field inventories of specific taxa or habitats such as water mites, ferns, moths and butterflies, beetles, slime molds and species found in the unique habitats of tree canopies and karst areas. The thrill of discovery, the newspaper articles that accompany the bioblitz and direct public involvement, all lead to greater stewardship and an increased sense of place that is changing the way the public values national parks.
- Discover Denali, a public education program developed by the Murie Science and Learning Center and the Denali Foundation, reached 3000 participants this year. The program includes a presentation by Center staff of film and historic photographs, a hands-on "skins and skulls" session, and a ranger-led hike to

Citizen Scientists in search of the elusive Ivory-billed Woodpecker at Congaree National Park. The Ivory-billed Woodpecker (*Campephilus principalis*) is the largest woodpecker in North America, and the second largest in the world. Thought to be extinct, it was recently rediscovered in the Cache River National Wildlife Refuge in Arkansas.



the site of Morino's roadhouse. A portion of the proceeds from the program supports the Discover Denali Research Fellowship Program, which can in turn provide grants up to \$5,000 for high priority park research projects. This extraordinary program is a wonderful example of how research and education objectives can be integrated with a RLC.

- A cyber infrastructure, remote sensor arrays, and a dynamic website are being used to provide access to real-time and historic information on southern California coastal ecosystems. The California Mediterranean RLC has developed multiple partnerships to serve real-time or close to real-time visual, climatic, and acoustical components of the environment on the internet, along with links to raw climate and ecological data, long term data series (including Vital Signs monitoring), and digitized photographs. The effort will expand public and student awareness of the Mediterranean ecosystem in this urban area.
- The Continental Divide RLC sponsored a nine-week interpretive series called "Science Behind the Scenery" allowing scientists to present their research to public audiences. The most popular talks were on bears (90 in attendance) and mountain lions (102 in attendance). The volunteer citizen science hummingbird project was presented three times over the season to a packed house of 75-90 people. Other topics included historic trails, glaciers, archeology, and air quality.



Chapter Five: Financial Details

This chapter presents financial details for Service-wide natural resource programs. Information in Chapters Three and Four describe program accomplishments and highlight which of the programs have benefited from the Natural Resource Challenge funding provided between FY 2000 and FY 2006, and how the programs were affected.

The Natural Resource funding is requested as a series of discrete programs, including 14 Service-wide programs, Everglades restoration elements, and the Glen Canyon Adaptive Management Program. Funding for the set of actions that make up the Natural Resource Challenge in some cases was requested as new programs, but also was requested under appropriate program budgets. Since many Challenge increases resulted in expansions of existing programs, only some of the Challenge budget increases are easily identifiable separate line items. In other cases, the

Challenge funds are mixed with previous park or program bases. Therefore, the Challenge funding cannot be distinguished in most of the program-by-program financial information. Details of the history of Challenge funding are included in Appendix A.

Likewise, parks receive a single allocation for their operations funding and neither Challenge funding, nor natural resource management generally, are separately identified. For parks, funding is shown only for parks that received Natural Resource Challenge funding; funding for their entire natural resource programs is as reported by the parks.

Below are details of funding changes by program between FY 2005 and FY 2006. In addition, where appropriate, additional detail is provided regarding how funding within these programs has been allocated.

Natural Resource (NR) Funding of Parks Receiving NR Challenge Increases

Park	FY 01 or FY 02 Challenge Increase	FY 2002 NR Total	FY 2003 NR Total	FY 2004 NR Total	FY 2005 NR Total	FY 2006 NR Total
Acadia NP	345,000	849,827	794,395	755,087	752,395	695,273
Antietam NB	150,000	319,965	316,723	314,900	353,000	350,000
Appalachian National Scenic Trail	142,000	263,638	256,603	258,337	298,642	299,453
Big Cypress NPr ¹	399,000	1,033,640	1,010,000	1,108,140	1,108,140	1,085,907
Buck Island Reef NM ²	100,000	270,000	216,450	216,000	216,000	216,000
Catoctin Mountain Park ³	89,000	254,400	231,900	232,200	272,414	174,867
Channel Islands NP ⁴	498,000	1,406,622	1,406,622	1,440,607	1,891,222	1,891,222
Coronado NMem	60,000	94,993	105,231	95,236	108,000	60,000
Curecanti NRA	141,000	657,500	690,600	719,300	724,000	731,700
Dinosaur NM	189,000	501,800	559,375	568,874	571,152	524,200
Gates of the Arctic NP&Pr	148,000	362,401	363,039	349,164	377,345	357,517
Great Basin NP	126,000	331,450	315,756	375,939	367,080	382,600
Great Sand Dunes NP	180,000	291,700	287,500	281,300	281,300	323,400
Great Smoky Mountains NP	402,000	1,245,100	1,152,700	1,003,200	1,231,700	476,000
Haleakala NP	480,000	1,561,660	1,372,200	1,196,400	1,196,400	1,404,882
Homestead NM of America	82,000	104,500	104,500	81,198	82,460	82,353
Hopewell Culture NHP ³	105,000	95,000	79,322	103,047	99,953	109,519
Jewel Cave NM	50,000	168,500	168,500	167,140	159,203	153,330
John Day Fossil Beds NM	95,000	129,000	130,000	115,000	127,101	119,000

¹ Part of increase to another program for contract support; part of balance of change from pre-Challenge increase due to realigned position.

² Also received \$65,000 Coral Reef Initiative increase in FY 2001.

³ Information provided by parks for FY 2003 report included discrepancies with previously provided information or did not add or subtract correctly; attempts to resolve were unsuccessful.

⁴ Received NRC money in FY2002 (\$498k for Santa Cruz Island restoration) and a non-NRC increase in FY2005 (\$477k for island fox recovery).

At Haleakala National Park Feral Animal Bio-Tech Gale Plana (with white hard hat) leads two Americorps volunteers and emergency hire Bio-Tech Jon Han (camo hat) in adding aproning to the east Kaupo Gap fence. The fence is a key element of the park's efforts to control non-native feral animals.

Natural Resource (NR) Funding of Parks Receiving NR Challenge Increases

Park	FY 01 or FY 02 Challenge Increase	FY 2002 NR Total	FY 2003 NR Total	FY 2004 NR Total	FY 2005 NR Total	FY 2006 NR Total
Kalaupapa NHP	211,000	549,000	549,000	549,000	499,000	534,000
Lake Clark NP&Pr	147,000	321,500	319,810	250,000	262,600	245,800
Little River Canyon NPR ⁵	85,000	182,426	174,027	112,900	171,275	95,898
Mojave NPR ³	470,000	1,264,000	1,219,073	1,177,488	1,178,297	1,165,193
Monocacy NB ³	118,000	120,000	116,000	116,000	116,000	116,000
Obed W&SR	195,000	245,000	193,318	188,775	188,775	188,775
Padre Island NS	95,000	408,000	403,825	543,000	471,896	600,200
Pictured Rocks NL	55,000	194,650	207,000	211,000	237,000	238,832
Rock Creek Park ³	163,000	436,522	393,168	359,104	299,000	376,300
San Juan Island NHP	95,000	124,600	125,050	124,600	124,600	116,837
Saugus Iron Works NHS	58,000	58,000	58,000	69,900	58,000	58,000
Sequoia & Kings Canyon NPs ⁶	112,000	1,446,000	1,424,400	1,424,400	1,457,400	1,563,600
Stones River NB	132,000	132,000	137,100	127,924	132,000	208,277
Sunset Crater, Walnut Can- yon, & Wupatki NMs	100,000	166,762	171,227	186,341	191,683	196,426
Theodore Roosevelt NP	133,000	302,500	292,500	282,500	281,500	264,660
Virgin Islands NP ⁷	399,000	1,077,234	1,002,726	941,500	877,234	877,234
Zion NP	246,000	536,300	515,872	518,774	485,274	518,774
Totals	6,595,000	17,506,190	16,863,512	16,564,275	15,047,667	16,802,029

Air Quality Program

FY 2005 allocation	8,890,000
Classified Pay Increase	11,000
Net FY 2005 Decrease ⁸	-128,000
Total available in FY 2005	8,773,000
FY 2006 allocation	8,773,000
Classified Pay Increase	58,000
Net FY 2006 Decrease ⁹	-139,000
Total available in FY 2006	8,692,000
Change from FY 2005	-81,000

Air Quality Program Funding by Categories

Program Management & Implementation	1,620,000
Air quality monitoring, projects, and analysis	3,420,000
Collaboration & Outreach	1,352,000
Technical assistance	2,300,000
Total available in FY 2006	8,692,000

Figures shown for FY 2001 and 2002 reflect a correction to those reported in last year's report.

Also received a non-Challenge \$367,000 base increase in FY 2001.

Also received Coral Reef Initiative base increase of \$300,000 and Prototype Monitoring increase of \$230,000 in FY 2001.

The FY 2005 net decrease is the sum of funding changes in response to both a bureau-determined information technology (IT) assessment and travel reduction adjustment.

The FY 2006 net decrease is the sum of across-the-board reductions.



At Mojave National Preserve, observing juvenile desert tortoises develops interest and respect for the desert in local students. Survival of juveniles to adulthood is also essential for species recovery. Photo: Debra Hughson

Threatened Cumberland rosemary (*Conradina verticillata*), is the subject of long-term monitoring at Obed Wild and Scenic River.

Biological Resource Management Program

FY 2005 allocation	8,575,000
Classified Pay Increase	23,000
Net FY 2005 Decrease ⁸	-123,000
Total available in FY 2005	8,475,000
FY 2006 allocation	8,475,000
Classified Pay Increase	60,000
Net FY 2006 Decrease ⁹	-134,000
Total available in FY 2006	8,401,000
Change from FY 2005	-74,000
Emergency Supplemental—Highly Pathogenic Avian Influenza	375,000

Biological Resource Management Program Funding by Categories

Biological Resource Projects-National Level Support	700,500
Ecological Restoration	275,000
Endangered Species Program	410,000
Exotic Plant Management Program	5,149,000
Integrated Pest Management Program	280,000
Invasive Animal Program	255,000
Invasive Plant Program	255,000
Migratory Bird Program	175,000
Wildlife Management and Health Program	1,276,500
Total available in FY 2006 ¹⁰	8,776,000

Cave and Karst Research Institute

FY 2005 allocation	344,000
Base change ¹¹	-6,000
Net FY 2005 Decrease ⁸	-5,000
Total available in FY 2005	333,000
FY 2006 allocation	333,000
Net FY 2006 Decrease ⁹	-5,000
Total available in FY 2006	328,000
Change from FY 2005	-5,000

Cooperative Ecosystem Studies Units

Funding available in FY 2005 ¹²	\$129,000
Net FY 2005 Decrease ⁸	-2,000
Total allocation/available in FY 2006	127,000

¹⁰ Includes emergency Supplemental Budget for Highly Pathogenic Avian Influenza.

¹¹ The base change noted represents the correction to reflect prior year travel reductions properly in various Natural Resources accounts, it is not an actual change in available operating funds over FY 2005.

¹² In FY 2001, the CESU program received \$1,596,000 with \$1,550,000 transferred to regions. In FY 2003, \$310,000 transferred to the region for use during FY 2003. In FY 2004, the same amount less an across-the-board decrease, or \$306,000, was permanently transferred to regions.



Electrofishing crew sampling the spring *Moxostoma* run within Gills Creek at Booker T. Washington National Monument.

A Rufous hummingbird at North Cascades National Park.

Cooperative Ecosystem Studies Units Funding Distribution¹³

Californian CESU	no Challenge funding
Chesapeake Watershed CESU	155,000
Colorado Plateau CESU	155,000
Desert Southwest CESU	155,000
Great Basin CESU	155,000
Great Lakes-Northern Forest CESU	153,000
Great Plains CESU	155,000
Gulf Coast CESU	153,000
Hawaii-Pacific Islands	no Challenge funding
North and West Alaska CESU	no Challenge funding
North Atlantic Coast CESU	155,000
Pacific Northwest CESU	155,000
Piedmont-South Atlantic Coast CESU	no Challenge funding
Rocky Mountains CESU	155,000
South Florida-Caribbean CESU	155,000
Southern Appalachian Mountains CESU	155,000
Upper and Middle Mississippi Valley CESU	no Challenge funding

Geographic Information System Program

FY 2005 allocation	1,291,000
Net FY 2005 Decrease ⁸	-18,000
Total available in FY 2005	1,273,000
FY 2006 allocation	1,273,000
Classified Pay Increase	2,000
Net FY 2006 Decrease ⁹	-20,000
Total available in FY 2006	1,255,000
Change from FY 2005	-18,000

Geologic Resources Program

FY 2005 allocation	2,651,000
Base Change ¹¹	25,000
Classified Pay Increase	11,000
Net FY 2005 Decrease ⁸	-40,000
Total available in FY 2005	2,647,000
FY 2006 allocation	2,647,000
Classified Pay Increase	68,000
Net FY 2006 Decrease ⁹	-43,000
Total available in FY 2006	2,672,000
Change from FY 2005	+25,000

¹³ Distribution of initial funding from Natural Resource Challenge increases for CESUs shown. Does not show changes to base that may have occurred to funds transferred to regions.

Geologic Resources Program Funding by Categories

Cave & Karst	267,000
Coastal Geology	273,000
Disturbed Lands/AML	517,000
Geologic Hazards	126,000
Geologic Resource Evaluation	596,000
Minerals Management	626,000
Paleontology	120,000
Soil Resources	147,000
FY 2006 Total	2,672,000

Inventory and Monitoring Program

FY 2005 allocation	36,932,000
FY 2005 increase	3,111,000
Classified Pay Increase	41,000
Net FY 2005 Decrease ⁸	-562,000
Total available in FY 2005	39,522,000
FY 2006 allocation	39,527,000
Base Change	319,000
Program Change ¹⁴	3,931,000
Classified Pay Increase	29,000
Net FY 2006 Decrease ⁹	-682,000
Total available in FY 2006	43,124,000
Change from FY 2005	+3,602,000

Inventory and Monitoring Program Funding by Categories

Database Development	1,868,200
Monitoring Projects	165,000
Program Administration	2,922,900
Prototype Monitoring	1,000,000
Regional Coordinators	859,000
Resource Inventory Projects	11,389,200
Vital Signs Monitoring	24,919,700
Total available in FY 2006	43,124,000

Allocation of Funding among Basic Natural Resource Inventories

Air Quality Related Values (AQRVs)	325,000
Base Cartography Data	798,160
Biological Inventories	0
Geology Inventories	1,750,000
Meteorological Data	218,130
Soil Mapping	2,250,000
Species Lists	45,000
Vegetation Mapping	
Alaska	500,000
Outside of Alaska	4,250,000
Water Resource Data	760,000
Other Natural Resource Inventories	452,910
Total	11,349,200

¹⁴ Reprogramming of funds from Natural Resource Preservation Program.

Inventory and Monitoring Expenditures by Non-NPS Performers

Inventories	Universities	Other Non-Fed	USGS	Other Fed	Total
AQRV's	125.6	49.9	0.0	7.0	182.5
Base Cartography	0.0	100.0	100.0	698.2	898.2
Biology	120.2	0.0	62.0	45.0	227.2
Geology	833.2	200.0	234.2	0.0	1,267.4
Landcover (Alaska)	35.7	299.3	0.0	0.0	335.0
Meteorology	118.1	0.0	0.0	100.0	218.1
Monitoring	6,602.7	5,233.7	1,354.0	761.7	13,952.1
Soils	0.0	90.0	0.0	2,160.0	2,250.0
Veg. Mapping	717.7	1,684.6	853.6	487.4	3,743.3
Water Resources	211.0	0.0	548.9	0.0	759.9
Totals	8,764.2	7,657.5	3,152.7	4,259.3	23,833.7

Allocation of Monitoring Funding among Networks and Prototypes

North Coast and Cascades ¹⁵	748,700
Northeast Coastal and Barrier	779,500
Heartland	702,000
Sonoran Desert	672,600
Cumberland/Piedmont ¹⁵	678,700
Central Alaska	1,215,100
National Capital	747,000
Northern Colorado Plateau	967,000
San Francisco Bay Area	751,600
Greater Yellowstone	728,700
Appalachian Highland	418,400
Mediterranean Coast	304,400
Southwest Alaska	1,449,700
Northeast Temperate	782,800
Southern Colorado Plateau	1,209,000
Pacific Island	1,576,100
Great Lakes	1,292,500
Gulf Coast	929,800
Rocky Mountain	634,800
Sierra Nevada	657,900
Eastern Rivers and Mountains	657,100
Klamath	796,200
Arctic	1,564,700
Southeast Coast	1,267,800
Upper Columbia Basin	524,400
Southern Plains	390,400
Mojave Desert	850,400
Southeast Alaska	440,500
South Florida/Caribbean	1,277,300
Mid-Atlantic	301,200
Chihuahuan Desert	376,400
Northern Great Plains	377,000
Total	27,078,700

¹⁵ Additional funding for prototypes funded by the Natural Resource Challenge but now fully integrated with their respective networks has been permanently transferred to park base: \$200K to Olympic NP, \$200K to North Cascades NP, and \$261K to Mammoth Cave NP.

National Natural Landmarks Program		
FY 2005 allocation		986,000
Classified Pay Increase		9,000
Net FY 2005 Decrease ⁸		-14,000
Total available in FY 2005		981,000
FY 2006 allocation		981,000
Program Change		-495,000
Classified Pay Increase		17,000
Net FY 2006 Decrease ⁹		-7,000
Total available in FY 2006		496,000
Change from FY 2005		-485,000

Natural Resource Data and Information Program		
FY 2005 allocation		1,521,000
Classified Pay Increase		5,000
Net FY 2005 Decrease ⁸		-21,000
Total available in FY 2005		1,505,000
FY 2006 allocation		1,500,000
Classified Pay Increase		33,000
Net FY 2006 Decrease ⁹		-23,000
Total available in FY 2006		1,510,000
Change from FY 2005		+5,000

Natural Resource Preservation Program (NRPP)		
FY 2005 allocation		12,484,000
Base Change		-16,000
Net FY 2005 Decrease ⁸		-173,000
Total available in FY 2005		12,295,000
FY 2006 allocation		12,295,000
Inventory and Monitoring reduction		-3,931,000
Net FY 2006 Decrease ⁹		-135,000
Total available in FY 2006		8,229,000
Change from FY 2005		-4,066,000

Allocation of NRPP Among Project Categories and Projects Funded		
	Allocation	Projects
Alaska Projects	474,000	6
Disturbed Land Restoration	803,000	13
Natural Resource Management	3,190,000	27
Regional Block Allocation	1,324,000	75
Service-wide	776,000	23
Small Park	948,000	57
Threatened & Endangered Species	474,000	11
USGS/BRD Technical Assistance	240,000	

Natural Sound Program

FY 2005 allocation	921,000
Classified Pay Increase	2,000
Net FY 2005 Decrease ⁸	-14,000
Total available in FY 2005	909,000
FY 2006 allocation ¹⁶	909,000
Program Change	500,000
Classified Pay Increase	12,000
Net FY 2006 Decrease ⁹	-22,000
Total available in FY 2006	1,399,000
Change from FY 2005	+490,000

Resource Damage Assessment and Restoration Program¹⁷

FY 2005 allocation	1,264,000
Reallocation of Funds ¹⁸	94,000
Classified Pay Increase	4,000
Net FY 2005 Decrease ⁸	-21,000
Total available in FY 2005	1,341,000
FY 2006 allocation	1,341,000
Classified Pay Increase	25,000
Net FY 2006 Decrease ⁹	-22,000
Total available in FY 2006	1,344,000
Change from FY 2005	+3,000

Resource Protection Fund

FY 2005 allocation	294,000
Net FY 2005 Decrease ⁸	-4,000
Total allocation/available in FY 2005	290,000
FY 2006 allocation	290,000
Net FY 2006 Decrease ⁹	-4,000
Total available in FY 2006	286,000
Change from FY 2005	-4,000

Water Resources Program

FY 2005 allocation	12,071,000
Classified Pay Increase	19,000
FY 2005 increase	528,000
Net FY 2005 Decrease ⁸	-182,000
Total available in FY 2005	12,436,000
FY 2006 allocation	12,436,000
Classified Pay Increase	85,000
Net FY 2006 Decrease ⁹	-196,000
Total available in FY 2006	12,325,000
Change from FY 2005	-111,000

¹⁶ Includes \$500,000 dedicated for Air Tour Management Plans.

¹⁷ Combines two former line items: Oil Pollution Act and Resource Protection Act

¹⁸ Base funding reprogrammed from Visitor and Resource Protection to Natural Resource Stewardship & Science.



The red bat (*Lasiurus borealis*), a species of special concern in Maine and federally, was found during a survey of mammals along the Appalachian National Scenic Trail in Maine by researchers from the BioDiversity Research Institute, but has not been well documented in Maine. Photo: Dave Yates.

Water Resources Program Funding by Categories

Water Resource Projects	
Water Resource Protection	989,100
Competitive Projects	161,500
Other Projects	14,500
Water Quality Monitoring	2,781,300
Water Resource Protection—Aquatic Resource Professionals	1,205,000
Watershed Condition Assessment Program	
Competitive Projects	834,700
Critical Projects	220,400
Coastal Projects	362,300
Natural Resource and Watershed Condition Assessments	827,900
Marine Science Advisor	141,000
Other Projects	263,000
Water Resource Technical Assistance	4,524,300
Total	12,325,000

Allocation of Water Quality Monitoring Funding

Network

Central Alaska	95,700
Heartland	80,000
Northeast Coastal and Barrier	87,900
National Capital	69,300
Cumberland/Piedmont	57,600
Appalachian Highlands	68,300
Northern Colorado Plateau	105,400
Greater Yellowstone	69,300
Sonoran Desert	62,500
North Coast and Cascades	80,000
San Francisco Bay	68,300
Mediterranean Coast	74,200
Southwest Alaska	135,700
Northeast Temperate	58,600
Southern Colorado Plateau	121,000
Pacific Island	147,400
Great Lakes	120,100
Gulf Coast	86,900
Rocky Mountain	59,500
Sierra Nevada	61,500
Eastern Rivers and Mountains	61,500
Arctic	147,400
Klamath	74,200
Southeast Coast	118,100
Upper Columbia Basin	48,800
Southern Plains	28,300
Mojave Desert	78,100
Southeast Alaska	41,000
South Florida/Caribbean	143,500
Mid-Atlantic	43,000
Chihuahuan	71,300
Northern Great Plains	79,100
Servicewide Data Management	137,800
Total	2,781,300



Botanists with the Heartland Network collect vegetation community data at Pipestone National Monument

Appendix A: Natural Resource Challenge Funding History

Challenge Elements	Increase FY 2000	Increase FY 2001	Increase FY 2002	Increase FY 2003	Increase FY 2004	Increase FY 2005	Increase FY 2006	Request FY 2007	Total through FY 2007
Inventory and Monitor Resources									
Basic inventories (except vegetation mapping)	7,309			1,987					9,296
Vegetation mapping (with USGS)		1,746		2,235					3,981
Park air emissions inventory		200							200
Monitor vital signs in park networks		4,191	4,200	6,855	4,939	3,068	3,931*	1,000	28,184
Monitor water quality in park networks		1,272		497	592	521			2,882
Watershed assessment				3,080					3,080
Expand air quality monitoring and related activities			2,600						2,600
Make natural resources data useable		1,098							1,098
Fix Critical Problems									
NRPP project funding	2,875		4,000				-3,931*		2,944
Alaska Natural Resource Projects				497					497
Establish resource protection fund			300						300
Water resource protection & restoration/project funds		823							823
Water resource protection & restoration/field specialists			1,000	200					1,200
Native/nonnative species mgt & Exotic Plant Mgt Teams	3,449		2,400	2,136					7,985
Implement Resource Protection Act/restore resources			500						500
Protect geologic resources	696								696
Park invasive species control/T&E species recovery		3,395	3,200						6,595
Attract Scientists									
Establish learning centers		898	1,800						2,698
Establish Cooperative Ecosystem Studies Units		1,596		397					1,993
Annual Increase	14,329	15,219	20,000	17,884	5,531	3,589	0	1,000	77,552
Total Annual Funding	14,329	29,548	49,548	67,432	72,963	76,552	76,552	77,552	77,552

* Reflects reprogramming of \$3,931,000 from Natural Resource Preservation Program to Vital Signs Monitoring in I&M networks.



Appendix B: NRPP Projects FY 2006

NRPP Natural Resource Management Fully Funded Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2006 FUNDING
Boston Harbor Islands National Recreation Area	Boat Wake Impacts and their Role in Shore Erosion Processes	411,000	129,000
Capitol Reef National Park	Construct Fence to Keep Bison out of Park	135,000	135,000
Carlsbad Caverns National Park	Assess Mexican Free-tailed Bat Population at CAVE	368,000	78,000
Mesa Verde National Park	Investigate Paleoecological Fire History	108,000	40,000
Pacific West Regional Office	NPS Western Airborne Contaminant Assessment Project	642,000	231,000
Pinnacles National Monument	Eradicate Feral Pigs	767,000	61,000
Point Reyes National Seashore	Cape Ivy Removal in GOGA and PORE	770,000	309,000
Shenandoah National Park	Assess Hydrology for Sensitive Wetland System at Big Meadows	132,000	44,000
Voyageurs National Park	Assess Impacts of Forest Fires on Levels of Mercury in Lake and Forest Environments	150,000	50,000
Western Arctic National Parklands	Assess the potential for heavy metal bioaccumulation in terrestrial biota in Cape Krusenstern NM	235,000	36,000
TOTAL		\$3,718,000	\$1,113,000

NRPP Natural Resource Management New and Ongoing Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2006 FUNDING
Acadia National Park	Characterize Rocky Intertidal Shorelines at Newly Acquired Navy Base Lands	122,000	111,000
Black Canyon of the Gunnison National Park	Survey Boundary to Protect Park Resources	180,000	36,000
Buck Island Reef National Monument	Test Effectiveness of Buck Island Reef NM Expanded Marine Reserve	300,000	101,000
Canyonlands National Park	Acoustic Monitoring of Natural Soundscape	206,000	94,000
Channel Islands National Park	Establish Baseline of Newly Established Marine Reserves	564,700	258,000
Cumberland Island National Seashore	Establish Exotic Plant Management Program for Southeast Coast Network Parks	661,000	204,000
Gateway National Recreation Area	Efficient Surveillance, Targeted Management, Natural Transmission Dynamics of West Nile Virus	292,000	107,000
Glacier National Park	Evaluate the Prey Base for Lynx: Snowshoe Hare Abundance, Habitat Use, and Population Dynamics	433,000	131,000
Great Sand Dunes National Park & Preserve	Determine Grazing Ecology and Management Of Elk and Bison In Great Sand Dunes National Park and Preserve	450,000	75,000
Great Smoky Mountains National Park	Support for Predator Beetle Facility Needed to Control Exotic Hemlock Woolly Adelgids	396,000	87,000
Olympic National Park	Atmospheric Pollutant Loading: Link to Trans-Pacific Airmass	287,000	89,000
Padre Island National Seashore	Protecting Endangered Kemp's Ridley Sea Turtle Nests from Vehicular Traffic	295,000	93,000
Petrified Forest National Park	Excavation of Threatened Fossil Bone-bed	82,000	48,000
Saguaro National Park	Remove Invasive Exotic Plants from Critical Habitats at Saguaro National Park	196,000	11,000

Great Basin National Park successfully reintroduced three native fish species into two park streams, Strawberry creek and South Fork Big Wash. These three species, speckled dace (*Rhinichthys osculus*), mottled sculpin (*Cottus bairdi*), and redbelly shiner (*Richardsonius balteatus*) are small native non-game fish in the streams of the Bonneville Basin, and previously occupied park streams.

NRPP Natural Resource Management New and Ongoing Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2006 FUNDING
Shenandoah National Park	Identify and Assess Cliff Resources and Visitor Use, Develop and Implement Cliff Management Planning	520,000	118,000
St. Croix/Lower St. Croix National Scenic River	Document Habitat Requirements of the Winged Mapleleaf Mussel: Potential Habitat Degradation and Decline	219,000	73,000
Voyageurs National Park	Assess the Impacts of International Lake Level Management by Using an interdisciplinary Approach	899,000	207,000
Yellowstone National Park	Conserve Declining Yellowstone Pronghorn Population	376,000	125,000
Natural Resource Program Center	Support for Biological Projects	77,000	77,000
TOTAL		\$6,555,700	\$2,045,000

NRPP Threatened and Endangered Species Fully Funded Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2006 FUNDING
Chiricahua National Monument	Develop recovery prescriptions for listed plants of Santa Cruz Island	150,000	57,000
Grand Canyon National Park	Foraging Ecology of Threatened Mexican Spotted Owls	150,000	50,000
Hawaii Volcanoes National Park	Reintroduce Nine Extirpated Plant Species	64,000	32,000
National Capital Region	Discovery of Remnant Populations of the Endangered Dwarf Wedge Mussel Using GIS Habitat Analysis	70,000	29,200
TOTAL		\$434,000	\$168,200

NRPP Threatened and Endangered Species New and Ongoing Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2006 FUNDING
Ebey's Landing National Historical Reserve	Implement Recovery Plan for Threatened Golden Paintbrush	96,397	27,200
Mojave National Preserve	Lake Ecology and Population Dynamics of Mohave Tui Chub	149,947	54,300
Organ Pipe Cactus National Monument	Sonoran Pronghorn Captive Breeding	150,000	42,300
Padre Island National Seashore	Determining Seasonal Movements, Habitat Use, and Abundance of Piping Plovers at Padre Island NS	144,000	35,500
Point Reyes National Seashore	Threatened Western Snowy Plover Recovery	150,000	25,000
Presidio of San Francisco	Restore Habitat for Two Federally Listed Plant Species	149,070	73,700
Wind Cave National Park	Reintroduction of Black-footed Ferrets to Wind Cave National Park - Phase II	146,000	42,000
Natural Resource Program Center	Support for Resource Protection	1,060	1,060
TOTAL		\$986,474	\$301,060

NRPP Disturbed Lands Restoration Fully Funded Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2006 FUNDING
Buffalo National River	Stream Corridor Restoration within Newly Acquired Properties	157,800	98,500
Olympic National Monument	Restore Hydrologic Function, Fish, Wildlife, Veg - Upper Hoh River	250,000	63,980
Pacific West Region	Disturbed Land Restoration of the Bradford Tract	107,600	4,000
Pinnacles National Monument	Old Pinnacles Road Removal (Final Phase)	174,700	16,400
Point Reyes National Seashore	Glenbrook Quarry Supplemental Funding	110,320	110,320
Presidio of San Francisco	Restore Disturbed Coastal Areas Following Remediation	250,000	114,400
St. Croix/Lower St. Croix National Scenic River	Protecting Genetic Diversity Through Prairie Restoration	57,800	25,000
Yosemite National Park	Ecological Restoration of Gaylor Pit	167,200.00	36,000.00
TOTAL		\$1,275,420	\$468,600

NRPP Disturbed Lands Restoration New and Ongoing Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2006 FUNDING
Glen Canyon National Recreation Area	Restoration of Springs on Navajo Point	66,000	15,000
Golden Gate National Recreation Area	Complete Restoration of Salmonid Habitat at the Banducci site on Redwood Creek	244,000	56,000
Great Basin National Park	Reclamation of the Lincoln Cirque Mining Exploration Area	90,000	45,300
Indiana Dunes National Lakeshore	Complete Restoration of 500 Acres of Wetland at Derby Ditch-Great Marsh	223,700	88,600
New River Gorge National River	Reclaim Abandoned Ames Mine	70,200	39,700
Zion National Park	Test Riparian Revegetation Methods along the Virgin River	157,800	81,800
TOTAL		\$851,700	\$326,400

NRPP Alaska Special Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2006 FUNDING
Alaska Regional Office	Resource Baseline Update for Alaska Parks Using High Resolution Satellite Imagery	1,706,900	100,000
Alaska Regional Office	Mapping and Scientific Management of Off-Highway Vehicle Trails in Alaska -Implementing Best Management Practices	200,790	71,400
Denali National and Preserve	Stratified Random Sampling for Baseline Soundscape Conditions in Large Alaskan Parks	69,972	35,000
Katmai National Park and Preserve	Genetic, Phenotypic, and Life History Analysis of Sockeye Origins in Katmai National Park and Preserve	155,000	77,000
Kenai Fjords National Park	Estimating the Brown Bear Population on the Kenai Peninsula	261,000	51,000
Western Arctic Park Lands	Identify Levels and Dynamics of Subsistence Resources Harvests for Kiana	90,000	90,000
Wrangell - St Elias National Park and Preserve	Evaluate Effects of International Caribou Recovery Program	148,950	49,600
TOTAL		\$2,632,612	\$474,000

NRPP Small Park Block Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2006 FUNDING
Abraham Lincoln Birthplace National Historic Site	Restore American Elm (Phase I)	24,892	12,000
Bent's Old Fort National Historic Site	Complete the Legal Boundary Survey on the Final Six Miles of Park Boundary	20,000	20,000
Big Hole National Battlefield	Big Solutions for Big Weeds	13,697	13,697
Boston Harbor Islands National Recreation Area	Restore Natural Biodiversity	29,110	4,610
Capulin Volcano National Monument	Propagate Native Vegetation for Restoration of Disturbed Areas	32,800	16,400
Carl Sandburg Home National Historic Site	Prepare an Inventory and Management Plan for Low Elevation Granitic Domes	25,000	9,500
Carl Sandburg Home National Historic Site	Treat Hemlock Trees for Infestations of Hemlock Woolly Adelgid and Elongate Hemlock Scale	11,340	9,600
Chattahoochee River National Recreation Area	Manage Exotic Kudzu (<i>Pueraria montana</i>) Populations	28,000	4,500
Chattahoochee River National Recreation Area	Chattahoochee River Restoration Initiative: RiverRescue	24,750	23,700
Craters of the Moon National Monument	Survey for Rare Insects on New NPS Lands	14,890	14,890
Devils Tower National Monument	Control/Eliminate Non-native Invasive Plant Species-Next Phase	39,500	20,000
Effigy Mounds National Monument	Control and Monitor Garlic Mustard Multi-year	30,000	9,000
Fort Bowie National Historic Site	Analyze and Rehabilitate Apache Spring Watershed	35,213	9,500
Fort Pulaski National Monument	Baseline Monitoring & Analysis of Health of the Salt Marsh Ecosystem	20,000	11,500
George Washington Carver National Monument	Implement Vegetation Management Plan	19,600	6,127
Gettysburg National Military Park	Taxonomic assessment of invertebrates	85,690	54,410
Grant-Kohrs Ranch National Historic Site	Construction of a Recreationist-friendly and Cattle-proof Floating Gate for Resource Protection	3,200	3,200
Guilford Courthouse National Military Park	Develop Vegetation Management Plan	25,000	20,000
Herbert Hoover National Historic Site	Develop 10-year Replacement Plan for Trees in the Cultural Landscape	9,125	6,413
Homestead National Monument of America	Control Invasive Species and Increase Species Diversity on Newly Acquired Property	15,000	13,500
Hovenweep National Monument	Acoustic Monitoring	26,750	6,800
Jewel Cave National Monument	Evaluate Cave Airflow Mass Balance and Microclimate Effects	5,000	4,500
John Day Fossil Beds National Monument	Distribution and Status of the Plants Endemic to the Paleosols of the Painted Hills Unit	27,142	22,443
John Muir National Historic Site	Develop Soil/watershed Model for Mt. Wanda and Vicinity	5,000	1,300
John Muir National Historic Site	Non-native Plant Removal – Yellow Star Thistle	30,000	15,600
Kaloko-Honokohau National Historic Park	Assessing Potential Impacts on Marine and Terrestrial Resources from Boat Harbor Expansion	35,705	20,941
Kings Mountain National Military Park	Provide Term Resource Management Assistance for Kings Mountain NMP and Cowpens NB	253,000	41,000
Klondike Gold Rush National Historical Park	Provide GIS Support for Dyea VERP and Social Science Survey	30,000	9,405
Lava Beds National Monument	Complete Cave Reconnaissance at Lava Beds National Monument	25,677	25,677

NRPP Small Park Block Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2006 FUNDING
Lewis and Clark National Historical Park	Noxious Weed Control on Newly Acquired Lands	21,368	10,000
Lyndon B. Johnson National Historical Park	Evaluate Invasive Plant Response to Alternative Treatments	6,500	3,000
Lyndon B. Johnson National Historical Park	Install Hydromet River Monitoring System for Pedernales River	20,000	20,000
Manassas National Battlefield Park	Habitat Preferences of Birds Wintering in Restored Grasslands of the Mid-Atlantic Region	18,505	9,900
Marsh-Billings-Rockefeller National Historical Park	Develop Silvicultural Inventory System for Forest Management	45,800	28,800
Mesa Verde National Park	Investigate Paleoecological Fire History	173,899	900
Midwest Regional Office	Development of Park Natural Resource Programs	98,600	28,464
Natural Bridges National Monument	Acoustic Monitoring	24,600	4,200
Obed Wild & Scenic River	Investigate the Potential Reserve of Threatened or Endangered Aquatic Insect Species	25,000	23,400
Pipe Spring National Monument	Geophysical Investigations of the Groundwater System Feeding Pipe Spring	39,700	19,800
Pipestone National Monument	Sioux Quartzite Prairie Mangement and Invasive Weed Control	18,496	16,646
Prince William Forest Park	Develop Management Plan for Isotria Medeoloides	29,700	9,800
San Juan Island National Historical Park	Implement Native Prairie Restoration at EBLA and SAJH	60,000	1,000
San Juan Island National Historical Park	Conduct Rabbit Removal Feasibility Study and Produce EA to Evaluate Treatment Options	26,000	26,000
Sand Creek Massacre National Historic Site	Study 1864 Environmental Conditions	20,000	20,000
Sand Creek Massacre National Historic Site	Inventory Rare and Listed Species at Sand Creek Massacre National Historic Site	36,372	29,800
Saratoga National Historical Park	Landscape-level Habitat Use by Woodfrog	25,000	25,000
Sitka National Historical Park	Complete a Non-vascular Plant Survey	30,000	9,405
Stones River National Battlefield	Privet Removal And Replanting At A Significant Civil War Battlefield Site	40,167	14,300
Timpanogos Cave National Monument	Restoring Cave Resources	38,500	18,500
Timucuan Ecological and Historic Preserve	Control Exotic Plants on Recently Harvested Timberlands	19,000	19,000
Tonto National Monument	Determine Lion Distribution in Southern Arizona Parks with High Potential for Conflicts	39,996	28,100
Tumacacori National Monument	Fence New Park Lands	40,000	20,000
Valley Forge National Historical Park	Assess Sediment Pollution in Valley Creek	89,562	4,000
Vicksburg National Military Park	Delineate Wetlands at Vicksburg National Military Park	19,955	19,000
Whitman Mission National Historic Site	Revegetate Restored Doan Creek Streambanks	43,883	12,452
Wilson's Creek National Battlefield	Savanna Tree Rehabilitation	32,998	13,500
Wind Cave National Park	Protection of Night Sky at WICA, HOME, DETO, JECA (Multi-Park)	25,000	17,100
TOTAL		\$2,053,681	\$882,280

NRPP Regional Block Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2006 FUNDING
Alaska Regional Office	Natural Resource Employees Professionalization and Technical Competency Enhancement	67,900	20,000
Alaska Regional Office	Alaska Park Science Conference 2006	50,000	40,000
Alaska Regional Office	Alaska Park Cooperative and Technical Assistance Projects	134,150	25,000
Alaska Regional Office	Produce Alaska Park Science Journal	216,885	15,000
Alaska Regional Office	Alaska Scientific and Technical Reports	60,000	10,000
Alaska Regional Office	Vascular Plant Flora of Southwestern Alaska: A Comparative Analysis of Five National Park Units	14,212	14,210
Antietam National Battlefield	Characterization of Precipitation and Water Quality at Mumma Spring	20,000	10,000
Apostle Islands National Lakeshore	Determine Appropriate Harvest Levels of Deer to Protect Unique Vegetation from Overbrowsing	45,000	24,075
Apostle Islands National Lakeshore	Develop Natural and Cultural Disturbance History using GIS to Identify Restoration Sites	33,450	24,381
Assateague Island National Seashore	Upgrade Water Quality Monitoring Stations	24,900	24,900
Bandelier National Monument	Measure Effects of Fire and Browsing on Vegetation	40,000	20,000
Big Cypress National Preserve	Prepare Addition Lands Off-Road Vehicle Management Plan	730,000	16,200
Big South Fork National River and Recreation Area	Establishing Native Grasslands and Restoring Sandstone Glade Habitats	25,000	22,900
Bryce Canyon National Park	Repeat 50 Year Old Forest Succession Research Study	40,000	40,000
Buffalo National River	River Use Monitoring Program	24,200	5,518
Canaveral National Seashore	Identify Critical Nursery Habitat for Larval and Juvenile Horseshoe Crabs	25,000	22,900
Cape Cod National Seashore	20th Century Dune Migration, Wetland Formation and Hydrologic Change at Cape Cod National Seashore	31,111	31,311
Cape Hatteras National Seashore	Prepare Environmental Assessment for Predator Management	25,000	21,200
Catoctin Mountain Park	Monitor Vegetation in Enclosures and Open Plots in Storm Damaged Areas	26,440	9,800
Channel Islands National Park	Develop Fecal Genotyping Methods to Monitor Island Fox Populations	88,012	37,582
Chattahoochee River National Recreation Area	Manage Exotic Kudzu (<i>Pueraria montana</i>) Populations	28,000	8,900
Chesapeake and Ohio Canal National Historical Park	Protect State Rare, Threatened and Endangered Plants During Exotics Removal	6,000	2,000
Crater Lake National Park	Complete Stream Restoration Designs and Implementation Plan for Recovery of Bull Trout in Sun Creek	94,000	19,941
Cumberland Island National Seashore	Continue Hog Eradication Program for Cumberland Island	25,000	22,900
Delaware Water Gap National Recreation Area	Develop Coordinated Regional Management Goals for Black Bears (<i>Ursus americana</i>)	10,109	10,110
Denali National Park & Preserve	Implement Regional Integrated Pest Management Program to Insure Health of Natural Resources	29,500	9,250
Devils Tower National Monument	Control/Eliminate Exotic Invasive Plant Species - Year One Costs	40,000	20,000
Fire Island National Seashore	Support Humain Society of the US winter/fall darting and community information	140,440	18,000
Fire Island National Seashore	Beach Scraping Impacts-Site Investigations	38,232	38,232
Gates of the Arctic National Park & Preserve	Assess Moose Population Health in Areas of High Human Controversy and Harvest	57,040	28,520

NRPP Regional Block Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2006 FUNDING
Gates of the Arctic National Park & Preserve	Course-Scale Wolverine Distribution and Habitat in Interior Alaska	18,500	9,250
Gateway National Recreation Area	Develop a Habitat Plan for the Park's Flora and Fauna: A Vision of What Should Be	48,000	6,012
George Washington Memorial Parkway	Assess Impacts of Deer and Invasive Plants on Native Vegetation in Potomac Gorge	59,600	19,600
George Washington Memorial Parkway	Obtain GPS Coordinates for RTE Plant Populations in Turkey Run and Great Falls Parks	2,500	2,500
George Washington Memorial Parkway	Determine Pollination Biology of Three Rare Plants in Turkey Run and Great Falls Parks	20,000	10,000
George Washington Memorial Parkway	Inventory Seven Groups of Insects in Turkey Run and Great Falls Parks, Virginia	29,800	9,900
George Washington Memorial Parkway	Create Digital Bird Atlas of Wood Warblers of Great Falls and Turkey Run Parks	19,500	9,900
Gettysburg National Military Park	Taxonomic Assessment of Invertebrates	85,690	2,280
Glacier National Park	Establish Baseline Survey of Priority Rare Plant Populations and Communities	30,000	20,000
Great Basin National Park	Reintroduction of Extirpated Non-Salmonid Fish Species	73,639	24,100
Great Smoky Mountains National Park	Develop Baseline for Mycorrhizal Populations and Potential Microbial Control Agents for HWA	18,000	18,000
Harpers Ferry National Historical Park	Deer Population and Vegetation Impact Monitoring	18,000	9,000
Harpers Ferry National Historical Park	Conduct Resource Inventory of Rare Limestone Glade Habitat	15,000	6,500
Isle Royale National Park	Conduct a Survey of Forest Mustelid Populations Inhabiting Isle Royale National Park	49,203	22,191
Jean Lafitte National Historical Park and Preserve	Quantify Rate of Change in Bottomland Hardwood Forest Composition at the Barataria Preserve	22,900	20,300
Kaloko-Honokohau National Historical Park	Assessing Potential Impacts on Marine and Terrestrial Resources From Boat Harbor Expansion	35,705	14,764
Lake Meredith National Recreation Area	Protect Natural and Cultural Resources by Constructing Boundary Fence	39,516	19,800
Mammoth Cave National Park	Restoration of American Butternut in Four National Park Service Units	50,000	22,800
Manassas National Battlefield Park	Funding for Deer Exclosure Data Collection and Natural Resource Interpretation	28,200	9,400
Manassas National Battlefield Park	Prepare Natural Resource Planning Documents	9,600	9,600
Manassas National Battlefield Park	Shrub Planting for Establishment of Riparian Buffers	6,000	6,000
Midwest Regional Office	Integrated Planning with Fire Management, Planning, and Cultural Resources Division	162,112	5,593
Missouri National Recreational River	Funding Breakdown for Assessment of Habitat use During Early Life Stages of Sauger	24,885	24,875
National Capital Parks-East	Survey of Butterflies for Northern Sites Within National Capital Parks-East	5,000	5,000
National Capital Regional Office	Augmenting and Enhancing Effective Park Management of Natural Resources	51,100	1,100
National Capital Regional Office	Demonstrating Leadership: Providing Opportunities for Profession Development of Natural Resource	38,170	8,850
National Capital Regional Office	Finalizing Vegetation Classification in the National Capital Region	122,180	28,950
Northeast Regional Director's Staff	Chronic Wasting Disease Plan and Environmental Assessment	3,000	3,000

NRPP Regional Block Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2006 FUNDING
Padre Island National Seashore	Assessment of Impacts from Oil and Gas Activities on Grassland Birds at Padre Island National Seashore	37,000	19,700
Pictured Rocks National Lakeshore	Mercury Levels in Otters from Upper Great Lakes Parks	25,000	19,250
Pinnacles National Monument	Re-introduce Foothill Yellow-legged Frogs to Chalone Creek Drainage	132,277	43,700
Prince William Forest Park	Funding Needed to Revegetate Barren Areas on Hillslope at Cabin Branch Pyrite Mine	9,700	9,700
Prince William Forest Park	Determine Community Structure, Movement Patterns, and Conservation Concerns for Carnivores	29,900	9,900
Prince William Forest Park	Restore Habitat at Taylor Farm	8,500	8,500
Saint Croix National Scenic River	Investigate Oxygen Depletion Episodes in the Lower St. Croix River Using Sediment Core Insects	24,896	22,157
San Juan Island National Historical Park	Implement Native Prairie Restoration	60,000	2,195
Santa Monica Mountains National Recreation Area	Implementation of a Three-Phase Containment, Eradication and Restoration Program for Harding Grass	88,017	27,089
Sequoia and Kings Canyon National Parks	Restoration of Mountain Yellow-legged Frogs in Upper Bubbs Creek	77,941	20,629
Shenandoah National Park	Document and Mitigate Deer Impacts on an Endemic Wetland Plant Community in the Big Meadows Area	15,000	15,000
Shenandoah National Park	Deploy SCA Volunteers to Control Mile-a-Minute at Shenandoah National Park	66,362	19,500
Shenandoah National Park	Control Non-native Plants, Monitor Rare Plants	43,500	14,000
Tonto National Monument	Research Ecology and Resource Requirements of Reptiles for Critical Resource Protection	39,992	20,000
Valley Forge National Historical Park	Assess Sediment Pollution in Valley Creek	89,562	4,765
Voyageurs National Park	Control Exotic Smallmouth Bass and Census Native Pike	5,750	5,118
Wind Cave National Park	Inventory Wind Cave Biota	47,000	21,525
Wrangell-Saint Elias National Park & Preserve	Wrangell-St. Elias Access to Inholdings Programmatic Plan and Environmental Assessment	81,105	6,105
Yellowstone National Park	Is Extirpation of the Yellowstone Trumpeter Swan in our Immediate Future?	37,000	11,100
Zion National Park	End Wildlife Access to Human Foods to Resolve Visitor Safety Issues-Education and Waste Management	39,586	19,800
Total		\$4,233,469	\$1,281,828

FY 2006 NRPP Servicewide Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2006 FUNDING
AD, Natural Resource Stewardship & Science	Cannon Scholars Program	598,400	50,000
AD, Natural Resource Stewardship & Science	Director's Annual Natural Resource Awards	65,000	30,000
AD, Natural Resource Stewardship & Science	Conserving Birds in Human Dominated Landscapes Symposium	5,000	5,000
AD, Natural Resource Stewardship & Science	Co-sponsor Natural Areas Conference	5,000	5,000
AD, Natural Resource Stewardship & Science	World Heritage Experts Meeting on Climate Change	1,900	1,900

FY 2006 NRPP Servicewide Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2006 FUNDING
Environmental Quality Division - Washington Office	Emergency Response Function Implementation, Environmental Response, Damage Assessment and Restoration	133,000	133,000
Environmental Quality Division - Washington Office	Administrative Study of Legal Issues	12,000	12,000
Geologic Resources Division - Washington Office	Geologic Resources Management Technical Support for Parks	150,000	50,000
Geologic Resources Division - Washington Office	HR Assistance to NRSS Core Operations Analysis	10,000	10,000
Geologic Resources Division - Washington Office	Coastal Disaster Assessments	50,000	50,000
Natural Resource Program Center OCD, WASO	Park Science (FY2006)	82,700	82,700
Natural Resource Program Center OCD, WASO	Natural Resource Year in Review--2005 (FY2006)	71,000	71,000
Natural Resource Program Center OCD, WASO	Expansion and Enhancement of the "Views of the National Parks"	50,000	50,000
Natural Resource Program Center OCD, WASO	IT Management Assistance - NPRC Academy Place FY06	17,000	17,000
Natural Resource Program Center OCD, WASO	Cert/Accred. IT Systems and RPRS Development - NPRC FY06	40,000	40,000
Natural Resource Program Center OCD, WASO	NPS Nature and Science Website Support	20,000	20,000
Natural Resource Program Center OCD, WASO	RLC Support	28,000	28,000
Natural Resource Program Center OCD, WASO	Support for National Council Science and The Environment	10,000	5,000
NRSS Biological Resource Management Division	5th National IPM Symposium 2006	2,000	2,000
NRSS Biological Resource Management Division	Livestock and Grazing Management Workshop and Assistance	7,500	7,100
NRSS Biological Resource Management Division	Science Advisor - Eastern Forest Health	35,000	35,000
NRSS Biological Resource Management Division	Communicating Complex Natural Resource Issues with the Media	10,000	10,000
Social Science Division - Washington Office	Comprehensive Survey of the American Public to Assist in Park Management Planning	62,600	31,300
	Buy Out	30,000	30,000
TOTAL		\$1,496,100	\$776,000



Appendix C: Biological Resource Projects—National Level Support

Park	Project Title	2006 Funding
Acadia NP	Winter Site Fidelity of Purple Sandpiper	\$33,400
Big Bend NP	Maximize Effectiveness of Volunteers and Partnerships in Exotic Plant Management	\$20,000
Big South Fork NR	Exotic Plant Control in Biologically Sensitive Big South Fork Riparian Habitat	\$16,200
Biscayne NP	Conserving Threatened and Endangered Sea Turtles in Biscayne NP	\$11,700
Canaveral NS	Identify Watercraft Use Patterns in Canaveral National Seashore	\$41,500
Cape Cod NS	Characterization of Breeding Habitat and Impacts of Road Kill for the Eastern Spadefoot Toad	\$24,000
Catoctin Mountain Park	Protecting Resources: Sustaining Wild Mushroom Populations in Four National Capitol Region Parks	\$25,000
Cowpens NB	Inventory and Plan for Threatened Dwarf-Flowering Heartleaf at Cowpens National Battlefield	\$30,000
Glacier NP	Effects of 2003 Fires on Fire-Dependent Bird Species	\$25,000
Grand Canyon NP	Inventory Small Vertebrates in Selected Habitats of North and South Rim of Grand Canyon	\$25,000
Great Basin NP	Survey Invertebrate Cave Endemics	\$26,900
Haleakala NP	Restore Native Plant Diversity in Dry Ohia Woodland	\$49,500
Indiana Dunes NL	Enhance State Listed Species Through Habitat Modifications and Introductions	\$27,700
Jean Lafitte NHP& PRES	Characterize Changes in the Fisheries Population at the Barataria Preserve	\$24,000
Katmai NP	Assess the Abundance of Distribution of Moose Subject to Harvest on the North Alaska Peninsula	\$48,000
Lassen Volcanic NP	Determine Distribution of California Spotted Owl in Lassen Volcanic National Park	\$26,000
Mount Rainier NP	Assess Status of Native Bull Trout and Cutthroat Populations	\$26,000
Petrified Forest NP	Inventory and Assess Milk Snake Populations	\$26,000
Pictured Rocks NL	Determine Black Bear Harvest Mortality at Pictured Rocks NL	\$22,000
Prince William Forest Park	Investigate Pollution-sensitive Subterranean Fauna of Vulnerable Habitats in National Capitol Region	\$25,000
Redwoods NP	Ground Survey for Causal Agent of Sudden Oak Death Disease	\$34,700
Santa Monica Mountains NRA	Restore Riparian and Wetland Habitat: Eradicate Pepperweed	\$23,000
Wrangell-St. Elias NP& PRES	Stock Status and Population Biology of the Copper River Steelhead	\$18,000
Yosemite NP	Eradication of Bullfrogs from Yosemite Valley	\$25,000
Zion NP	Determine Lion Distribution in Northern Colorado Plateau Parks with High Potential for Human-Lion Conflict	\$22,000
Zion NP	Fire Management Effects on Native Bee Diversity and Abundance in Relation to Rare Plant Conservation	\$24,900

At Redwoods National Park, park managers instituted a Sudden Oak Death (SOD) monitoring program to protect native tanoaks. SOD is a forest disease caused by a fungus-like pathogen *Phytophthora ramorum*. Tanoak trees are highly susceptible to this disease and typically die after being infected. Early detection of SOD may allow managers the best chance of managing the disease through sanitizing infected sites, or closing/re-routing public access.



Appendix D: Water Resource Protection Projects— FY 2006

Water Resource Protection Projects—FY 2006

Park	Region	Project Title(s)	FY2006 Funding \$(000s)
ALL	ALL	Support to the Office of the Solicitor	202.0
CHIC	IMR	Hydrologic Data Collection	12.6
GRCA	IMR	Groundwater Study, Spring Protection	39.6
CRLA	PWR	Supplemental Water Source	30.0
MOCA	IMR	Hydrologic Data Collection in Support of the Adjudication of the Verde River Basin in Arizona	58.7
MT Parks	IMR	Implementation of the Montana-NPS Compact	16.4
SAGU	IMR	Investigation of Hydrology and Water Related Values	17.3
ARCH	IMR	Hydrologic Data Collection	12.6
BUFF	MWR	Investigation of Hydrology and Water Related Values	42.0
GRSA	IMR	Hydrogeologic Data Analysis	112.4
THRO	MWR	Investigation of Hydrology and Water Related Values	10.2
DEVA	PWR	Devils Hole and Spring Flow Monitoring, Groundwater Study, Participation in Groundwater Model Development	134.0
GRBA	PWR	Assessment of Hydrologic Conditions and Vulnerability of Park Streams to Groundwater Development	18.0
LAME	PWR	Spring Flow Monitoring, Participation in Cooperative Aquifer Stress Test, Groundwater Model Development	70.5
BLCA	IMR	Monitoring of Riparian System	36.8
ALL	ALL	Technical Support to All Projects and Technical Assistances	92.6
ALL	ALL	Administrative Support to All Projects and Technical Assistances	83.4
TOTAL FOR WATER RESOURCE PROTECTION PROJECTS			989.1

Competitive Projects Final-Year Funded Projects—FY 2006

Park	Region	Project Title	FY2006 Funding \$(000s)
BUFF	MWR	Delineate and Characterize the Karst Groundwater Recharge Zone of Tomahawk Creek at BUFF	30.0
GRTE	IMR	Hydrology and Geomorphology of the Snake River	33.0
SACN	MWR	Using Wetland Environmental Histories to Develop Management Strategies for the St. Croix Riverway	40.8
MULTI	PWR	Reference Site Data for Monitoring Biointegrity & Water Quality of Streams	73.2
JELA	SER	Assess and Map the Distribution of Submerged Aquatic Vegetation Communities at JELA	40.2
MORA	PWR	Assess Water Quality/biological Integrity with Invertebrates	35.0
DEVA	PWR	Develop Water Resource Management Plan; Phase II	46.9
CAVE	IMR	Delineate Watershed & Subsurface Channels Feeding Rattlesnake Springs Aquifer	35.8
WRST	AKR	Map Wetlands Along the McCarthy & Nabesna Roads	97.5
ROMO	IMR	Ecological Restoration of a Willow Carr that was Destroyed in the 1982 Lawn Lake Flood	40.0
TOTAL			472.4

Biological technician, Laura Sorenson, seining for humpback whitefish in Iliamna Bay, Lake Clark, Lake Clark National Park and Preserve, Alaska. Photo: Jared Irvine



Appendix E: USGS—Biological Resources

Title of Project	FY 06 Report
Development of a model to evaluate impacts of fuels-reduction/prescribed fire in Pinyon-Juniper habitats on avian communities within Colorado Plateau National Parks	<p>This project examined potential impacts of prescribed fire and fuels reduction on avian communities within pinyon/juniper habitat of 19 southern Colorado Plateau parks (e.g., Montezuma Castle National Monument, Petrified Forest National Park, Sunset Crater Volcano National Monument, Walnut Canyon National Monument, Wupatki National Monument, Mesa Verde National Park, Navajo National Monument, Zion National Park). Zion served as a pilot area, where information on avian communities can be collected prior to, and then subsequent to prescribed burning and/or mechanical removal of fuels. The research information collected during this study will allow development of a model for predicting avian community responses to pinyon/juniper fuels reduction efforts. This GIS model can then be applied to other NPS and partner areas over the Colorado Plateau.</p> <p>During 2003–2006 the project dealt provided: a complete literature review of published and non-published works associated with breeding birds from Zion National Park, focused on all birds that have been reported within mature, mid- and young-aged Juniper/ Juniper habitat in the park; a list of resident, migrant, and vagrant non-breeding species; detailed historical accounts of information on population dynamics of breeding species within the park; permanent transects stratified by mature and young vegetation types established in Pinyon-Juniper vegetation scheduled for fuels reduction to permit future correlation of other biotic and abiotic parameters with data obtained on the vegetation and avian population transects; initial avian surveys carried out at permanently marked, geo-referenced target areas in 2005 to provide pre-treatment baseline data; Geographic Information data themes of Pinyon-Juniper habitat for FLAG, WACA, WUPA and ZION; geographic information data themes of Pinyon-Juniper habitat for FLAG, WACA, WUPA and ZION; and initial oral reports to park staffs during 2003, annual progress reports in 2005 and 2006; meetings involving BLM; and permits from FLAG, WACA and ZION parks for this study. Zion was unable to conduct prescribed burns in Pinyon Juniper during 2006, so project focus moved to BLM lands in the adjacent Grand Paraschant National Monument, where the project examined hand-cleared and machine-cleared Pinyon habitat with control areas in the Monument. Resulting information will be submitted as a MA thesis and then to the Natural Areas Journal for publication.</p> <p>In 2006–2007, the project will complete the last year of this 3-year study, continuing to establish a baseline for the comparison of avian communities in prescribed burned areas and mechanically thinned areas as compared to control sites that were not treated. A model will be developed for Zion and then be refined for 32 other Colorado Plateau parks. At the end of the study, parks will have available findings to better assess a priori potential impacts on avian community structure throughout prescribed burning management activities in Pinyon-Juniper habitats over the southern Colorado Plateau. Each of the Colorado plateau parks with significant Pinyon-Juniper habitat will receive a copy of the GIS data theme and the model for avian habitat responses to prescribed fire in differing Pinyon-Juniper habitat types.</p>
Testing and evaluation of remote sensing methods for estimating refuge characteristics of karst wetlands	Research completed and journal manuscript in preparation.

Title of Project	FY 06 Report
Distribution, population dynamics, and herbivory impacts of a pioneering elk herd on Chaco Culture National Historical Park	<p>Elk were captured, radio-collared, and evaluated for physiological condition each April and November 2003–2006 and were monitored monthly for movements, home ranges, behavior, and survival. Calf elk were captured and radio-tagged during June and July 2004–2006. Vegetation surveys, grazing surveys, browse surveys, and pellet group surveys were completed, summer 2004–6. Since colonization, elk have increased from approximately 20 to > 53 in December 2005, an average annual rate of increase of approximately 18% per year. For 2003–2005, adult cow survival was 0.94–1.00; survival of radio-collared calves was 0.86–1.00. Pregnancy rates of > 2.5-year-old cows were 0.69–1.00 and pregnancy rates for yearling cows were 0.00–0.50, 2003–2005, respectively. Calf/cow ratios in November were 55/100 and 44/100 for 2004–2005, respectively, indicating high calf production for 2004 and moderate for 2005. Fat levels of lactating cows in late autumn (November) were 10.6%–13.2% in 2003–2004, but dropped to 5.6% in 2005. Expressed as a percent of potential ecological carrying capacity (ECC), elk were at 20% and 51% in 2003 and 2004; habitat decline resulted in the elk population moving to 95% of ECC in 2005. Reasons for the decrease in ECC in 2005 likely reflect patterns in precipitation. Accrual of body fat in elk was positively related to the amount of Low Sagebrush Shrublands and Mixed Salt Desert Scrub habitat types in their home range. Browse utilization was < 25% for both key species (willow and saltbush), rates much lower than observed in other national parks (> 70–90%) and well below maximum levels of sustainability (50–60%). Both elk and mule deer relative use was related to observed levels of browse utilization. However, in both 2004 (21%) and 2005 (63%) mule deer use accounted for the majority of the variation in use of browse in CCNHP, indicating the mule deer use was primarily responsible for observed levels of browsing.</p>
Effect of groundwater withdrawal on avian abundance and species richness in riparian areas of National Parks in the desert southwest	<p>Riparian woodlands in the desert southwest constitute <1% of the landscape, yet these woodlands typically support >50% of the breeding birds. Increasing use of limited groundwater (and subsequent loss of surface water) to support urban development in the desert southwest has the potential to degrade riparian woodlands and threaten associated breeding bird communities in the region. This project sought to quantify the extent to which surface water influences the health of the riparian bird community along Rincon Creek in Saguaro National Park, Arizona. During the 2006 breeding bird season (March–July), the project collected data on abundance, diversity, and breeding status of riparian birds, presence and extent of surface water, and availability of important avian food resources (e.g., insects) at Rincon Creek. Data collected at Rincon Creek compared with similar data collected at another riparian site (Cienega Creek) located 12 km from Rincon Creek, and with data collected during a previous bird study conducted along Rincon Creek in the spring of 2004 (a year when surface water was abundant at this site) revealed several differences. The amount of surface water differed dramatically between Rincon Creek and Cienega Creek during the spring of 2006, with Rincon Creek remaining essentially dry and Cienega Creek retaining flowing surface water throughout the breeding bird season. Compared to Cienega Creek, the work at Rincon Creek detected fewer bird species, fewer individuals of many migratory and riparian breeding bird species, fewer nests of a riparian obligate bird species (e.g., Bell's vireo, <i>Vireo Bellii</i>), and fewer potential avian food resources. Compared to data collected during the previous (2004) bird study at Rincon Creek, the 2006 Rincon Creek work detected fewer riparian obligate bird species such as yellow warbler (<i>Dendroica petechia</i>) and Bell's vireo during bird surveys, and unlike in previous years, found little or no evidence of breeding by yellow warblers, Bell's vireos, and summer tanagers (<i>Piranga rubra</i>). The results suggest a possible link between ground water reduction, surface water depletion, and a decline in the health of the riparian bird community along Rincon Creek in Saguaro National Park.</p>

Title of Project	FY 06 Report
<p>Documenting current stream productivity and fish populations prior to dam removal in the Elwha River: Setting the stage for long-term monitoring of ecosystem responses.</p>	<p>Restoration of the Elwha River in Olympic National Park through removal of two long standing dams is an historic opportunity for ecosystem restoration of a large river system. For over 90 years, the dams have disrupted the natural processes- such as sediment transport, large woody debris input, and salmon migration- important for structuring aquatic and terrestrial communities. Documenting the status of key biological, geological, and fluvial elements prior to dam removal is critical for ascertaining the ecosystem effects of restoration and the recovery of salmon populations. In locations below, between, and above the dams, 56 sites were sampled for dissolved and total nutrients, macroinvertebrate community composition, periphyton biomass and composition, fish populations and salmon genetics during a three year period. Over 250 different taxa were identified from macroinvertebrate communities that were structured along elevational gradients. Patterns of nitrogen stable isotopes, commonly used to gauge levels of marine-derived nutrients, were significantly higher in resident trout and some species of macroinvertebrates sampled from areas where salmon still spawn compared with areas sampled between and above the dams where salmon do not spawn. A final report for the park will be completed in FY 2007 and two peer-reviewed manuscripts will be submitted to a forthcoming special issue of the journal Northwest Science devoted to Elwha River research and monitoring. Also, a fish sampling protocol that was developed and tested in the Elwha River has been incorporated into the large river Long Term Inventory and Monitoring Program at the park. Development of these baseline data will be invaluable for assessing the short and long term changes associated with dam removal and salmon recovery.</p>
<p>Monitoring avian community changes and habitat use in the Giacomini Wetland Restoration Project in the Golden Gate National Recreation Area and reference wetlands along Tomales Bay</p>	<p>The Giacomini Wetland Restoration Project, a large tidal marsh wetland restoration in coastal California, will provide significant changes in the Tomales Bay watershed. This study used a Before After Control Impact (BACI) design based on 250 x 250 m grid cells to identify unique locations within habitat types and provide spatially explicit area and point count surveys of the avian community on the Giacomini Ranch site and on three reference wetlands along Tomales Bay to permit determining whether changes in the avian community can be attributed to the restoration. Tomales Bay represents a wide variety of habitat types for resident and migratory waterbirds. The greatest number of birds was observed on mudflats, followed by pasture, marsh, and open water habitat types. The greatest density of birds was at Walker Creek, followed by Giacomini East, Giacomini West, Inverness, and Olema Marsh; average species richness per point count station was greatest at Olema Marsh, followed by Giacomini West, Inverness, Walker Creek, and Giacomini East. Giacomini East currently is pasture with high densities of blackbirds, but low average species richness. Restoration of this site would create a fringe of mudflat and a mosaic of marsh habitat that would increase avian species diversity. Few birds were consistently observed on disturbed and ruderal areas across sites. The project has completed all field surveys and is preparing a final report that will provide baseline information on the avian community on the Giacomini Ranch restoration site and reference sites prior to restoration action. Monitoring based on the results of this project will help assess habitat changes and the response of the avian community as the Giacomini Ranch restoration proceeds. These baseline data will be an integral part of assessing progress and providing a basis for adaptive management.</p>

Title of Project	FY 06 Report
Estimating distribution and amphibian occupancy of vernal pool breeding habitat	<p>Habitat destruction and degradation are thought to be primary stressors of amphibian populations throughout the Northeast U.S., where habitat modifications include changes in both the local breeding habitat (e.g., pond water quality, area, hydroperiod) and the broader landscape (e.g., forest and wetland density). Amphibian populations on protected federal lands (e.g. national parks and wildlife refuges) are of particular interest as these lands may be isolated areas of natural habitat in a rapidly changing landscape. Vernal pools which provide essential breeding and larval habitat for amphibians such as wood frogs (<i>Rana sylvatica</i>) and mole salamanders (<i>Ambystoma species</i>) currently are poorly mapped and are not reliably detected via remote sensing methods. This project used an adaptive sampling design to estimate the number of vernal pools within 14 National Parks and Refuges in the Northeast U.S. Combining this sampling with sampling in 4 other National Parks with known vernal pools, we explored whether local (pool) or landscape characteristics influenced the probability that amphibians occupied vernal pools within these federal lands. We found that occupancy by both wood frogs and spotted salamanders had a strong, positive relationship with proportion of forest cover within the park or refuge and was influenced by pond permanency (or hydrology) and size. Consistent with previous laboratory studies, project results showed spotted salamanders apparently more sensitive to low pH than wood frogs. Findings about wood frogs showed a negative effect with road proximity. Spotted salamander populations within these protected lands may be influenced by surrounding land use: this study revealed a strong negative relationship between pool occupancy and proportion of development within a 5 km buffer around these federal lands. This study is the first large scale assessment of the status of two presumably sensitive amphibian species on protected areas that are embedded in a changing landscape. In addition to providing an invaluable baseline of amphibian occupancy within these protected areas, the information from national parks and wildlife refuges can serve as a reference for comparisons with more manipulated landscapes (e.g., those in agricultural, urban or semi-urban areas). Information from continued monitoring will permit distinguishing among those factors influencing current species distributions and population processes that are likely to contribute to changes in the distribution over time and space.</p>
Impact of recreational and invasive species on resident aquatic species: Whiskeytown National Recreation Area	<p>This study investigated presence and abundance of the Foothill yellow-legged frog (<i>Rana boylei</i>) and Western pond turtle (<i>Emys marmorata</i>) in the presence of invasive species. For frogs, the study sampled 8 streams twice per season (late spring for egg masses; early fall for young of the year) in 2004 and 2005. In 2004, 38 egg masses occurred at half of the streams surveyed as well as larvae at 7 sites. The only stream where they did not occur was also the only site with the invasive bullfrog present. In 2005, the study found yellow-legged frogs at all 10 streams, only 5 egg masses in 3 streams (spring flooding made eggs difficult to observe), and larvae in 7 of 10 streams. Foothill yellow-legged frogs were present in 6 creeks where no American bullfrogs (<i>Rana catesbeiana</i>) were found. Some bullfrogs were in 4 streams, mostly in lower portions of streams near Whiskeytown Reservoir. Overall, there appeared to be a healthy population of Foothill yellow-legged frogs in the park unit, unlike elsewhere where populations of this species are declining. Capture of 125 Western pond turtles and 2 introduced Red-eared sliders (<i>Trachemys scripta</i>) at 6 sites in and around Whiskeytown Reservoir suggest native turtles appear to be stable in the presence of invasive bullfrogs and a few introduced turtles. However, these exotic sliders can increase rapidly once they become established and so need to be removed whenever located. The paucity of information on the effects of invasive fish in the park is of concern as about 20 fish species have been introduced. There are other invasive species (e.g., crayfish) that have received no attention. Further monitoring of invasive species is warranted and specific studies are needed on effects of introduced species on native biota. This project has produced 3 news items (two in NPS outlets), a draft report, and 1 small chapter to a book and is drafting two papers for scientific journals and a final report.</p>

Title of Project	FY 06 Report
Distribution of black bears in the Elwha Valley, Olympic National Park: Environmental baseline for assessing ecosystem effects of salmon restoration	Beginning in 2009, the dismantling of two hydroelectric dams on the Elwha River in Olympic National Park to restore anadromous fish to this pristine watershed will be the second largest ecological restoration project undertaken in national parks. Investigation during 2004 through September 2006 of seasonal distribution and movements of the American black bear (<i>Ursus americanus</i>) in the Elwha Valley sought to document the distribution of black bears and, specifically, their use of the riparian corridor as a basis for determining long-term effects of salmon restoration on this top carnivore. Work during 2004 and 2005 placed GPS radio collars on 7 black bears to supplement a sample of 8 bears collared in a previous study. Due to failure of some GPS collars, gathering of location data declined from 6 bears throughout 2005, 3 bears through spring 2006, to only 1 bear through fall 2006. Analysis of data retrieved from the GPS collars that functioned during this period and preparation of manuscripts for publication are in progress, with an expected completion of all analysis and reporting by June 2007. The project to date has published 1 manuscript that describes biases and bias corrections of GPS data obtained from GPS-collared black bears in mature forests of Olympic National Park. A second manuscript summarizing the seasonal distribution and movements of black bears from 2002–2006 will be submitted in March for publication in a special issue of Northwest Science that will compile the diverse ecological studies completed to date to characterize the aquatic and terrestrial ecosystems of the Elwha Valley prior to dam removal. Information gathered during this study allowed development of a protocol for long-term monitoring of black bear use of the riparian corridor of the Elwha River after dam removal. The method uses barbed-wire sampling stations distributed the length of the river to collect bear hairs, which provide DNA useful for determining the minimum number of individual bears using the riparian corridor and stable isotopes of nitrogen, carbon, and sulfur useful for monitoring dietary shifts over time.
Evaluating vertebrate monitoring indicators for sound decision making: Technical assistance to the Sonoran Desert Network inventory and monitoring program	Consultation with the NPS Sonoran Desert Network, determined that this project would concentrate on avifauna. The 11 parks in the network were finished with the inventory phase and ready to begin monitoring. Monitoring land changes in landbird population and community parameters was considered to be a highly important step to take in the transition into the long-term ecosystem monitoring program. The study has finished, monitoring indicators have been chosen, and the project has delivered to the Sonoran Desert Network a Land Bird Monitoring Protocol that is now being implemented.
Augmentation and expansion of endangered freshwater mussel populations in the Big South Fork National River and Recreation Areas	Three of the five federally endangered mussel species in this national park were propagated in 2006. Collections of gravid females were made in spring, host fishes were infested with their glochidia at the Freshwater Mollusk Conservation Center at Virginia Tech, and 36,844 juveniles were released in May and June to augment the existing populations at the release site. Juveniles released into the Big South Fork Cumberland River included 31,482 Cumberland combshells, 5,352 tan riffleshells, and 10 Cumberland beans. Juveniles were cultured for several weeks in the laboratory and were 1-2 mm in length at time of release. Because 2004 was a bad year for propagation, due to high water and inability to collect gravid females from the river, a no-cost time extension was granted to allow propagation in 2007. Propagation of multiple species in 2007 will make up for the lack of juveniles produced in 2004. Therefore this project, originally scheduled to terminate in August 2006, now will continue until August 2007.

Title of Project	FY 06 Report
Assessing the relationship between acid precipitation, calcium depletion, and avian productivity in Great Smoky Mountains National Park	<p data-bbox="722 126 1415 814">This project studied the breeding biology of the Black-capped Chickadee (<i>Parus atricapillus</i>) in GRSM to assess its suitability for a future study examining effects of acid precipitation on high elevation bird communities. The park's high elevations experience high levels of air pollution deposition as acid rain, acid snow, acidic dry particles, fog, and cloudwater. The bedrock of the high elevation forest soils makes it naturally poor in calcium with low native soil pH. Calcium cation is stripped from the environment by acid precipitation; reductions in environmental calcium have been tied to reductions in populations of aquatic invertebrates, terrestrial snails, and more recently to reproductive problems in birds. Increased acidification of soils by acid precipitation in high elevation environments could push bird populations beyond their limits. Chickadees are year-round residents in the spruce-fir forests, their specialization on this high elevation forest type suggests they might be a good bioindicator of calcium depletion in this ecosystem. Chickadees are also close taxonomic relatives to the Great Tit (<i>Parus major</i>), a forest passerine that is the focal species of studies in the Netherlands that linked effects of acidic deposition to reductions in snail populations, thinner avian egg shells, and lower reproductive success. Because acidification has a greater effect on the abundance of calcium rich prey than it does on individual prey chemistry, food sources high in calcium may become rare and perhaps limiting for birds breeding on acidified sites. Having very little physiological storage capacity, many passerine females collect nearly all of the calcium they need in the weeks prior to egg laying.</p> <p data-bbox="722 841 1415 1931">This project conducted field research during spring and summer of 2003–2005 at high elevations (1524–2024m) using primarily observations but also experimental calcium supplement platform feeders and nest boxes or nest poles. The project monitored 25 Chickadee nests over three years. Although the field work detected no use of nest boxes or nest poles by any bird species, including Chickadees, it did find some use of supplemental calcium platforms by Dark-eyed Juncos (<i>Junco hyemalis</i>) and red squirrels (<i>Tamiasciurus hudsonicus</i>) but not by Chickadees. Conclusions suggest Chickadees offer theoretical advantages for testing hypotheses related to calcium deficiency in high elevation forests in the southern Appalachians: 1) Chickadees have a close taxonomic relationship to the Great Tit, about which biology is known, 2) Chickadees will exploit novel sources of calcium, including from a platform feeder, thus permitting experimental manipulation of the availability of environmental calcium, 3) female Chickadees lay a relatively large clutch and so may show signs of calcium deficiency before other bird species nesting at high elevations, 4) Chickadees are common resident breeders at high elevation sites in GRSM, and detailed data are available on patterns of avian distribution and abundance in the park. However, multiple limitations to using this species as a model for high elevation bird populations include: 1) accessibility to the nests is limited, 2) methods for using artificial nesting substrates require additional testing, and 3) the relatively low density of Chickadees in the area coupled with frequency of high winds during late winter and early spring that limit bird activity and detectability when birds are most active in establishing territories and excavating nest cavities. Because Chickadees provide a good model theoretically, work with this species in 2006 involved moving nest boxes to more suitable locations to determine their utility. If Chickadees will not use nest boxes, then logistics of accessing nest contents may prove too challenging and future work may switch to other common high elevation species, such as Dark-eyed Juncos, Winter Wrens (<i>Troglodytes troglodytes</i>), and Ruffed Grouse (<i>Bonasa umbellus</i>). Dark-eyed Juncos may be advantageous because they are ground nesters, abundant in the area, often double-brood, have been heavily studied in the Appalachians, calcium limitation may be another confounding factor that reduces nesting success, especially for a second brood, and working with a passerine would allow for greater application and inference of this research to those other common species nesting in high elevations that might be facing similar calcium limitation.</p>

Title of Project	FY 06 Report
Riparian vegetation response to tamarisk invasion and flow regulation in Dinosaur National Monument	<p>This research assessed the status of riparian and aquatic ecosystems along the Green and Yampa Rivers in Dinosaur National Monument, which have experienced different magnitudes of alteration of stream and sediment flux and more than 50 years presence of non-native riparian plant species. The results will help inform NPS decisions about whether or not to attempt restoration of these rivers. The study utilized a tamarisk removal experiment, including control and treatment (tamarisk removal) reaches and 32 permanently monumented channel cross-sections designed to integrate measures of riparian vegetation with driving physical variables, including river stage-discharge relationships and changes in channel and flood plain geometry related to erosional and depositional processes. The experimental design allows inference of results from this site to a wider set of streams in similar geomorphic settings across the region. Measurements of riparian vegetation to date include woody riparian vegetation composition and cover; vertical vegetation volume of woody vegetation; and herbaceous cover by species. Physical measurements of channel geometry, sediment dynamics and river stage-discharge relationships have been made at these sites for over a decade, and integration with measurements of riparian vegetation provides valuable baseline information upon which to design and test the efficiency of riparian monitoring protocols. Preliminary results from four study sites in Lodore Canyon reveal that two geomorphic surfaces formed following completion of Flaming Gorge Dam. These surfaces are dominated by the exotic plant, tamarisk, and their formation correlates with rare post-dam floods, and average flood peaks associated with power- generation activity at Flaming Gorge Dam. At present, the non-native tamarisk is approximately equal in cover to the native box-elder, in all size classes, except seedlings, where tamarisk is significantly more important. In the absence of large pre-dam floods, tree-sized box-elder stems are projected to be lost from high, pre-dam surfaces. Comparing tamarisk cover in removal versus non-removal sites indicates that physical removal significantly reduces cover of tamarisk but complete elimination has not been possible in the smaller size-classes because of re-sprouting from existing root crowns and establishment of new seedlings. Moreover, non-native herbaceous weeds like white-top and Canada thistle are establishing in greater abundance on tamarisk removal sites. Statistical tests for differences in overall community composition between the treatments, months (pre- and post-flood), and sites indicated that there are differences between the treatment and control plots and that flooding had no overall effect on species composition in the flooded plots. These results indicate that physical removal of tamarisk in Lodore Canyon has been successful, with the exception of the establishment of new seedlings in some locations and the appearance of a few re-sprouts. Whereas species diversity has not been significantly changed, there is indication that some non-native weeds are becoming more important in removal sites, a finding that suggests need for further monitoring and perhaps additional management intervention. The established permanent monitoring plots could form the basis for a long-term monitoring program in the monument and future investigations could examine historical channel narrowing in Lodore Canyon, using stratigraphic and recently developed dendrogeomorphic techniques. Results of this work were presented at two scientific meetings in 2006 and the data are being prepared for publication in a scientific journal.</p>

Title of Project	FY 06 Report
Effects of road mortality on native anuran populations at Saguaro National Park	<p>Previous studies of mortality at Saguaro National Park conservatively estimated that 17,000 amphibians were killed by vehicles annually on roads in and near the Park. This study sought to assess park anuran breeding sites to see what effect this mortality might be having on those populations. During the 2006 monsoon season, the study located 15 amphibian breeding sites on the Tucson Mountain District by returning to sites found in 2005 and by conducting visual surveys of pools and streams for eggs, larvae, or recent metamorphs during the day and call surveys at night. The study conducted single-night Lincoln-Petersen population estimates and collected demographic information on seven of these sites for three species: Red-spotted Toads, Couch's Spadefoots, and Colorado River Toads. Study efforts found four native species of anurans during road surveys at both the Tucson Mountain and Rincon Mountain districts of the park in 2006: Red-spotted Toad, Colorado River Toad, Great Plains Toad, and Couch's Spadefoot and at the Tucson Mountain District in 2006, found 26% of 166 anurans dead on the road and at the Rincon Mountain District in 2006, 38 of 71 (53.5%) anurans were dead on the road. During FY 2007 we will complete analyses of the data and provide a final report to Saguaro National Park, including detailed maps of all anuran breeding sites and locations and numbers of live and dead anurans seen during road surveys. This information will provide baseline data for monitoring the status of these desert-breeding anurans on the park in the future and will allow for informed adaptive management of these species within the park.</p>
Population status and ecology of ashy storm petrel in Channel Islands National Park assessing one of the most vulnerable endemic seabirds in the California Current	<p>Islands within Channel Islands National Park provide essential nesting habitat for Ashy Storm-Petrel. This species also depends upon marine prey resources throughout surrounding waters including several west coast National Marine Sanctuaries. Basic information regarding storm-petrels in the park, including current population sizes, diet, and quantitative information necessary to identify important oceanographic habitats, is lacking. Such information, however, is required for effective monitoring and management. In 2006, the third year (not supported by POBS) of the ongoing population study of Ashy Storm-Petrel in Channel Islands National Park was successfully completed, focusing effort at Scorpion Rock (SR): 8 nights capturing, measuring, and banding. One hundred-sixty-six (166) storm-petrels were captured; 5 of which had previously been banded (3%). Standardized Catch Per Unit Effort (CPUE) was 0.074 ± 0.040 SD birds min⁻¹ (35.3 net hours). A report of results from 2004–2005 radio telemetry work is forthcoming and the park will be provided with a Final Report tentatively by 31 December 2006. Results of this study show storm-petrels (215 valid locations from 57 individuals) were aggregated over the continental shelf-break from Pt. Conception to Pt. Buchon, within the western Santa Barbara Channel, and over the deep basin separating Santa Cruz, San Nicolas, and Santa Barbara Islands. Individuals ranged as far north as Gulf of the Farallones National Marine Sanctuary. Researchers believe this is the first study to use radiotelemetry to document at-sea distribution and habitat association for any of the world's storm-petrels.</p>

Title of Project	FY 06 Report
Does food availability impede bird restoration in Hawaii Volcanoes National Park?	<p>Restoration of Hawaiian forest bird populations requires information about the availability of food resources in addition to understanding threats posed by disease, predators, and habitat modifiers. Identifying threats to arthropod prey of birds also informs inventory and monitoring programs. A method was developed to assess the suitability of habitats for native bird restoration at a landscape scale by sampling arthropod distribution in habitats along gradients of elevation and moisture. Results indicated that arthropods generally, and caterpillars, spiders, and other major prey types in particular, tended to be more available in terms of numbers of individuals and biomass per unit of foliage at higher elevation sites. Study of distribution patterns of parasitoid wasps and ants to evaluate potential threats to important arthropod prey of forest birds indicated that ant and parasitoid threats were greater at lower elevations and that native parasitoids were more abundant at higher elevations and alien parasitoid species were more abundant at lower elevations. Bird surveys revealed that generalist foragers, which exploit a wide range of nectar and arthropods, were relatively common and widespread, whereas specialist insectivores were restricted to high elevations. Final analyses in FY 2007 will determine whether bird density estimates are sufficiently fine-grained to permit constructing a model that can help managers predict bird abundance and distribution based on arthropod availability. In addition, this research will help managers appreciate some of the complexity involved in protecting and restoring forest bird communities, and will provide detailed information about the composition of arboreal forest arthropod communities, which are little known.</p>
The role of hybridization in cattail (<i>Typha</i> spp.) invasions of freshwater wetlands in Great Lakes National Parks	<p>The invasive spread of cattails in the Great Lakes Region may be partially due to hybridization between native broad-leaved cattail (<i>Typha latifolia</i>) and European narrow-leaved cattail (<i>T. angustifolia</i>). This study examined the prevalence of hybrids in three Great Lakes national parks representing multiple habitat types, and the relationship between clone size and hybrid status in newly invaded areas. Samples were also collected from nine East Coast sites from Virginia to Connecticut. Intensive sampling of 150 individuals from each of 5 sites was conducted during 2004, with a less intensive, broader survey of 20–40 individuals from each of 20 sites (including Isle Royale National Park) conducted during 2005. Species-diagnostic RAPD (randomly amplified polymorphic DNA) markers were used to identify pure <i>T. latifolia</i> and <i>T. angustifolia</i> so that these individuals could, in turn, be used to identify diagnostic microsatellite markers for a subsequent analysis of genetic admixture within individuals exhibiting hybrid ancestry. Results from the 2004 samples showed a history of hybridization among all but a few pure <i>T. angustifolia</i> at St. Croix National Scenic River and Voyageurs National Park. Individuals sampled at Indiana Dunes National Lakeshore and St. Croix showed evidence of backcrossing to <i>T. angustifolia</i>, whereas those at Voyageurs were more similar to <i>T. latifolia</i>. A higher incidence of first-generation hybrids was also apparent at Voyageurs, suggesting that <i>T. angustifolia</i> has reached this park most recently. Results from the 2005 samples have revealed the existence of several pure populations of <i>T. latifolia</i> among several of the small, isolated lakes at Voyageurs, and at least one population of pure <i>T. angustifolia</i> on the East Coast at the mouth of the Connecticut River. The development of species-diagnostic markers from these pure samples is ongoing, and will be concluded during fiscal year 2007, ultimately resulting in recommendations concerning the removal or protection of cattail populations at each affected park.</p>

Title of Project	FY 06 Report
Importance of small wetlands to the diversity of amphibian assemblages in the Delaware Water Gap Recreation Area	<p>In the spring and summer of 2005 this study used a combination of visual encounter surveys, larval dipnet surveys, and adult anuran call surveys to assess the use of lentic bodies of water by pond-breeding amphibians throughout the New Jersey portion of the Delaware Water Gap National Recreation Area. A total of 44 wetlands that were stratified among small (< 0.1 ha), medium (0.15 – 0.66 ha), and large (> 1.0 ha) size classes were surveyed. Twelve species of amphibians were found to reproduce in these wetlands. Nine of these wetlands were re-sampled in 2006 to assess temporal variability in species presence (i.e. species turnover). The data is currently being analyzed using species occupancy models (MacKenzie et al. 2006) to estimate species occupancy, extinction, and colonization probabilities as functions of wetland size, hydroperiod, and isolation from nearby wetlands. In addition to estimating important population parameters, these models will be used to identify the most efficient mean of sampling pond breeding amphibians in the New Jersey portion of the park by modeling species detection probabilities as functions of survey method, time of year, and environmental variables. As a result of this research, approximately 350 potential amphibian breeding wetlands have also been identified and mapped throughout the park and detailed information on amphibian species occurrence, predator occurrence, and hydrologic regimes has been linked to site locations using GIS. The final report in FY 2007 will evaluate the importance of small wetlands to the overall maintenance of amphibian biodiversity throughout New Jersey portion of the Delaware Water Gap National Recreation Area and will present predictive models of amphibian species presence as a function of wetland size, hydroperiod, connectivity, and isolation.</p>
Producing wolf-elk population model for Yellowstone National Park	<p>This project obtained information from 151 radio-collared calves and 95 radio-collared cows to assess elk calf and cow survival rates and amount of calf and cow mortality caused by wolves in Yellowstone National Park. Annual calf survival was 24% and cow survival 80%. Wolves killed 11% of calves annually and 7% of cows. Initial use of these figures in developing a model of the Yellowstone elk population dynamics that accounts for the effects of wolves on the wolf-elk system will involve exploring the usefulness of both White and Lubow (2002) and Cooper et al. (2003) approaches.</p>
The development of a quantitative decision model for evaluating the effects of river regulation and water use on native fishes in the Chattahoochee River National Recreation Area	<p>Identifying and quantifying the effects of river regulation and water development on native fish communities in the Chattahoochee River National Recreation Area are crucial for evaluating potential conservation and restoration strategies. During 2006, researchers used GPS and electronic depth recorder to map stream habitats at three flows, representing low, moderate, and high discharge conditions; developed models for estimating habitat availability at two study reaches representing impact and recovery from hydropower generation; and sampled fishes using a quadrat sample design to estimate native fish community structure at each study reach. To assess effects of thermal and habitat characteristics on fish distribution and community structure, the study compiled existing data on native fish communities in similar SE riverine ecosystems. During FY 2007, researchers will complete data analyses and model building. The models will allow NPS to evaluate the influence of various water management scenarios on the abundance and distribution native biota in the River.</p>
Development of methods to improve trapping of free-roaming cats in national parks	<p>The investigator's health problems prevented conduct of the project in FY 2006. Plans for the study in 2007 include testing and using a camera to monitor cat activity.</p>

Title of Project	FY 06 Report
Fishes and riverine habitat of Badlands National Park, with emphasis on the sturgeon chub and other imperiled species	<p>The purpose of the project is to inventory the fish fauna and aquatic habitat of the park and update information on the presence and ecology of rare fishes. Survey of ponds, streams, and river habitats within Badlands National Park found 19 species of fish, amphibians, and aquatic reptiles. Several sites sampled on the White River and tributaries within Pine Ridge Oglala Sioux Reservation represent the first revisits to sites previously sampled as part of the former Environmental Protection Agency project Environmental Monitoring and Assessment Program—West. Collection and measurement of 75 sturgeon chubs (<i>Macrhybopsis gelida</i>, a state listed threatened species) contributed information to an understanding of population dynamics, natural history characteristics, and anatomy of this rare species. Almost 40,000m² of seining effort among all sites collected about 2,000 individuals of about 27 other fish species. Drought hampered sampling because some sites were dry and the White River became intermittent in mid-July. Data entry and analysis are in progress; similar fieldwork will resume in the spring of 2007. The information to date is preliminary and offers no significant management application at this time.</p>
Assessment of upland ecosystem conditions in the Salt Creek Watershed, Canyonlands National Park	<p>This project is assessing the condition of upland ecosystems in the Salt Creek watershed and surrounding portions of Canyonlands National Park using a suite of quantitative and qualitative indicators of functioning of key ecosystem processes. Salt Creek is the only perennial stream in Canyonlands other than the Colorado River itself, and riparian and aquatic ecosystems associated with the Salt Creek drainage may be affected by upland watershed conditions impacted by past land-use practices (e.g., livestock grazing), recent visitor-use activities, or on-going drought. Preliminary analyses from approximately 100 assessments conducted in the lower, middle, and upper Salt Creek watersheds during 2006 suggest that approximately 17 percent of sites show indications of diminished soil stability and accelerated wind- and/or water-driven erosion, relative to reference conditions. Approximately 23 percent of sites show indications of accelerated run-off, and 15 percent of sites have diminished "biotic integrity"—as indicated by relative dominance by invasive exotic plants and/or by shifts in relative abundances of plant functional types. Within the Salt Creek watershed, most (but not all) sites with diminished soil stability occur on Bureau of Land Management lands adjacent to the Park. Emerging patterns suggest that particular soils and types of ecosystems are highly susceptible to experiencing long-term dominance by invasive exotic plants. Information collected to date will allow NPS to evaluate current conditions in relation to management objectives and "desired future conditions" and to begin establishing priorities for restoration or other management actions. These data also will enable USGS and NPS to work together to form hypotheses concerning the resistance and resilience of particular soils/ecological sites to effects of land-use activities. Field work in 2007 will conduct approximately 100 additional assessments.</p>

Title of Project	FY 06 Report
Development and validation of a potentially non-lethal sampling strategy for environmental contaminants of concern in the NPS Ozark National Scenic Riverways	Trace metals emanating from mining and other sources are a high priority concern of the Ozark National Scenic Riverways of southeastern Missouri. Ongoing and proposed mining represent possible sources of lead, cadmium, and other metals to park waters. Predatory fishes within the park contain comparatively high concentrations of mercury. The source or sources of mercury in these fish has not been conclusively identified, but may include atmospheric emissions from coal-fired power plants, other anthropogenic sources, and natural sources. Monitoring for contaminants in fish as presently conducted by most agencies requires the periodic sacrifice of large numbers of fish to obtain fillet size tissue samples, which is becoming increasingly unpopular among natural resource managers and their constituents. This study is evaluating methods that may reduce or eliminate the need to sacrifice fish for determining contaminant burdens as estimators of health risks associated with fish consumption by humans. Two species of fish commonly sought by anglers (northern hog sucker and smallmouth bass) were collected by electrofishing at four sites in the Ozark National Scenic Riverways in September 2005. Additional fish were obtained from sites outside the park for comparison. Fillet size tissue samples and small samples of blood and muscle tissue collected with biopsy instruments (punch and needle) were obtained from each smallmouth bass. Blood and fillet size tissue samples were obtained from the hog sucker. To date, the mercury analyses have been completed and show that concentrations in the biopsy size samples were directly comparable to the fillet size values whereas the blood mercury concentrations were substantially lower. These results show that the evaluated sub-lethal (biopsy) methods yielded accurate and precise estimates of fillet mercury concentrations in smallmouth bass. Chemical analyses of the hog sucker samples for mining-related metals are underway and should be completed in 2006.
Baseline Analysis of Floodplain Soils Prior to Dam Removal, Elwha River, Olympic National Park	This project completed approximately 25% of the study plan in its first year, with the remaining work planned for FY 2007. In FY 2006, 83 quadrats from a previous study were selected for detailed soils work, which included collecting and combining four samples of the soil matrix (top 15 cm) from the mid-points of the sides of a 10 x 10 quadrat and collecting one composite sample from each aggregation for future analysis. Analytical work will involve partners to assess soil microbial communities and marine derived nutrients. In addition, samples of roots from approximately three individuals of the dominant tree within a sub-set of the quadrats were collected and are being analyzed for mycorrhizal fungi. The same quadrats will be revisited in summer 2007 to collect soil samples for analysis for physical and chemical properties and to conduct additional mycorrhizal fungi work.

Title of Project	FY 06 Report
Effects of Invasive Exotic Plants on Habitat Conditions and Performance of the Federally Endangered <i>Astragalus Ampullarioides</i> (Shivwits Milkvetch), Zion National Park	<p>This project seeks to provide Zion National Park with information regarding management of the federally endangered plant <i>Astragalus ampullarioides</i> (Shivwits milk-vetch)—an edaphically restricted species that is endemic to southwestern Utah. In 2006, we conducted descriptive habitat studies to develop a deeper understanding of plant occurrence patterns in relation to soil properties, geologic/geomorphic setting, and plant community composition (emphasizing occurrence patterns in relation to invasive exotic plants). This work documented occurrences of the milk-vetch on a new geologic substrate—an important finding which improves understanding of the species' potential habitat, may lead to the discovery of new populations, and could potentially impact the listing status of the species. This work also resulted in a 50 percent increase in the estimated number of individuals for the species—most of which occur at two small sites in Zion. This work examined plant-herbivore relations and found that vertebrate herbivory was responsible for a 90 percent reduction in fruit production at a high-density site in the park, the first documentation of a significant role of herbivory for this species and a finding that may have implications for management activities regarding distribution and abundance of herbivores and their predators. In fall 2006, researchers installed an automated precipitation gage and soil-moisture probes at a high-density site in Zion, and initiated field experiments to evaluate effects of the exotic grass <i>Bromus rubens</i> (red brome) on growth, reproductive output, and mycorrhizal status of Shivwits milk-vetch. These experimental studies will continue through 2007. In 2007 researchers also plan to use the improved understanding of milk-vetch—environment relations to develop a GIS-based predictive habitat model that will aid in the design of future plant surveys and recovery efforts conducted by the park, the Bureau of Land Management, the U.S. Fish and Wildlife Service, and the Shivwits Band of the Paiute Indian Tribe.</p>
Experimental control of invasive ant species in Hawaii Volcanoes National Park.	<p>Mitigating the impacts of invasive ants on Hawaiian ecosystems and arthropod communities is challenging because ants are not native to Hawaii and are notoriously difficult to suppress. Two especially destructive ant species, the big-headed ant (<i>Pheidole megacephala</i>) and the Argentine ant (<i>Linepithema humile</i>), are found along with other alien ant species in Hawaii Volcanoes National Park. This assemblage of ant species affords excellent opportunities to experimentally test emerging methods of control that show promise in some other habitats (e.g., Australia, New Zealand). Our study evaluates the impacts of ants on Hawaiian arthropod communities and tests a variety of baits, toxicants, and physiological inhibitors under natural conditions. Preliminary results of field trials indicate that Argentine ants may be more susceptible to the neurotoxin fipronil (Xstinguish®), than to either the metabolic inhibitor hydramethylnon (Maxforce®) or the insect growth regulator (IGR) pyriproxyfen, at least within the formulations tested. Fipronil may also be relatively effective at achieving local extermination of ant colonies. Pitfall trapping and vegetation beating before and after treatment of ant infested plots will allow an assessment of the impact of these invasive ants on native arthropod community structure and composition. In 2007, the project will focus upon refining methods for suppressing Argentine ants and will begin testing baits and growth regulators for controlling big-headed ants. This study seeks to provide information about management tools will help resource managers protect areas of special ecological value against the impacts of invasive ant species.</p>

Title of Project	FY 06 Report
Movements and activities of cougars in high visitor use areas of Zion National Park, Utah	<p>Issues arising from unanswered questions about cougars (<i>Puma concolor</i>) in and near Zion National Park in southwestern Utah include whether the park functions as a source for lions dispersing into neighboring jurisdictions, whether increasing sightings of cougars and cougar sign near park visitor facilities suggest need for concern about human safety, and whether a dearth of cougars in parts of Zion National Park has resulted in a cascade of effects resulting in deleterious changes to riparian areas. This study began during 2005 to provide information on cougar movements and behaviors, including use of riparian areas, habitat selection, response to human facilities, and use of areas outside NPS jurisdictions. Global positioning system collars were deployed on three cougars in and near Zion National Park during 2005–2006, with a fourth collar to be deployed during the remaining months of 2006. One collar has delivered locational data daily via Argos satellites and was deployed to test performance of this technology in the precipitous terrain of Zion National Park. The near real-time delivery of data provided by this collar has allowed for timely investigation of kill sites for the cougar fitted with the Argos collar. Researchers plan to deploy two more collars during 2007, including an additional collar with capacity for Argos data delivery. Preliminary results suggest that collared cougars using Zion National Park also use extensive areas beyond park boundaries.</p>
Using Acoustic Sampling of Bat Assemblages to Monitor Ecosystem Trends	<p>Acoustic detection systems used to identify bats and document their presence can operate unattended for months, offering a very cost effective way to implement long-term monitoring to document both spatial and temporal changes in species composition of bat assemblages. Because bats fly and can effectively track the distribution and abundance of the aerial stages of aquatic insects, changes in the species composition of bat assemblages may reflect the productivity of aquatic ecosystems and thus offer the potential for effectively monitoring ecosystem trends. This project will develop a sampling design, analytical methods, data management tools, and software for a long-term bat monitoring protocol with relatively affordable labor and equipment costs. Such an acoustic detection system will enable use of acoustic monitoring of bats as a metric for detecting ecosystem change. Project activities in 2006 largely focused on such tasks as refining the study plan, equipment purchases, construction of field housings for the bat monitoring stations, analysis of existing data to determine the intensity and duration of sampling that will be needed to assess variability between individual detectors and the probability of detection for each bat species, and rewriting the DOS-based Anabat software to a Windows version. The Windows version provides a much more functional interface that will allow individuals lacking extensive experience with bat vocalizations to distinguish between different species. In addition, six bat detectors were purchased and are currently being modified with hardware and software upgrades to allow them to operate unattended for up to six months. In 2007, the project anticipates having 12 acoustic detectors in the field, collecting data, and being checked at monthly intervals to download data and monitor their function. Additional tasks include investigating intra- and inter-habitat variability in detection probabilities for each species of bat in the park, developing analytical methods for detecting statistically significant changes in species composition over different temporal and spatial scales, refining exiting software algorithms for identification of bat vocalizations, and creating database applications for storing, managing, and analyzing acoustic data files.</p>

Title of Project	FY 06 Report
Assessing the Distribution and Effects of Chytrid Fungus on Amphibians in Grand Teton National Park	<p>This study seeks to determine effects of the fungus <i>Batrachochytrium dendrobatidis</i> on health and survival of Boreal Toads (<i>Bufo boreas</i>) and Columbia Spotted Frogs (<i>Rana luteiventris</i>), pathogenicity of <i>B. dendrobatidis</i> isolated from amphibian populations in Grand Teton National Park, Wyoming, and susceptibility of 2 amphibian species to a known virulent North American strain of <i>B. dendrobatidis</i> and to document and map the distribution of <i>B. dendrobatidis</i> and prevalence of chytridiomycosis in and near Grand Teton National Park. In 2006, the project collected 300 <i>B. boreas</i> tadpoles from Black Rock pond, just east of the park, and no <i>R. luteiventris</i> tadpoles. Mortality of tadpoles up to metamorphosis was < 2%. <i>Batrachochytrium dendrobatidis</i> was cultured from two, 2-yr-old toads from Black Rock, which had succumbed to chytridiomycosis. In one experiment, 60 juvenile toads from the Native Aquatic Species Restoration Facility in Colorado (control group) and from Black Rock were exposed to isolates of <i>B. dendrobatidis</i> from Black Rock and a strain from Colorado known to be pathogenic (provided by Joyce Longcore, Univ. Maine). No toads from either group succumbed to <i>B. dendrobatidis</i> and the study was terminated at 40 days, because several of the control toads died of a bacterial infection. After the first experiment was unsuccessful at initiating chytridiomycosis in any of the exposed animals, a small scale study evaluated potential exposure methods. Methods similar to published methods, which used high exposure doses, were tested on the toads from Colorado using the known pathogenic strain of <i>B. dendrobatidis</i>. This experiment resulted in toads developing chytridiomycosis. Follow-up study will repeat this experiment using Colorado and Wyoming <i>B. boreas</i> and the chytrid isolate from Black Rock. Although more data are required to confirm our preliminary observations, it appears that <i>B. boreas</i> from Black Rock pond (and toads from the Aquatic Species Restoration Facility in Colorado) can succumb to chytrid fungus when exposed to a high concentration of fungal zoospores. Stress may also be required for the manifestation of disease (evident from the 2 wild toadlets collected from Black Rock pond). Follow-up study will test these findings.</p>
Human/black bear interactions in Canyon de Chelly National Monument, AZ: development of a cooperative management strategy with the Navajo Nation	<p>A delay in transfer of funds to Virginia Tech delayed project initiation until late June 2006. Project work in 2006 included a site visit to the park to tour the study area, discuss the planned research, and explore additional sources of funding for the research. Following the site visit and receipt of funds, a PhD student joined the study and currently is conducting course work and literature review and developing a dissertation working plan. Following an early 2007 field trip to the park to finalize plans for data collection, project field work will begin in May 2007.</p>
The sugar pine dilemma: prescription burning and the management of a declining species	<p>Although prescribed fire is a primary tool for forest restoration, changing forest conditions may create circumstances where simple use of fire may not achieve restoration goals. This condition may be true for sugar pine (<i>Pinus lambertiana</i> Douglas) in the Sierra Nevada of California, where high post-fire mortality coupled with the ongoing effects of an introduced pathogen (white pine blister rust) could contribute to local extirpations. This project will determine whether post-fire survivorship can be enhanced by removal of fuels in the immediate neighborhood of individual tree stems. Field data collection is exactly on schedule as of fall 2006. Working with park fire managers, the project installed plots and applied treatments at three locations (Redwood Canyon, Wall Spring and Cabin Creek), marked and measured nearly 1000 trees, and, on one site (Redwood Canyon), conducted a burn and completed post-fire data collection. The project has presented its rationale and initial results to three audiences: the park's Natural Resources annual orientation day, the park's Division of Interpretation, and a volunteer high school group.</p>

Title of Project	FY 06 Report
National Park Service Wildlife Disease Reporting Technical Assistance	<p>This project will provide the National Park Service with a Web-based platform for NPS units to report observations of wildlife disease or mortality. The platform will permit information to be entered and visualized by way of interactive text and geospatial interfaces and to be easily shared and integrated into other systems. NPS wildlife disease specialists and regional public health coordinators will be able to analyze these reports to gain better understanding of disease dynamics and emergence on NPS lands and to be enabled to more quickly respond to potential health threats. NPS managers will gain a useful tool to recognize the appearance of exotic microorganisms, institute effective management strategies and protect human health. In 2006 the project staff met with NPS Wildlife Health staff, developed an avian influenza reporting web application (HEDDS) as a prototype for the NPS application, and initiated a partner relationship with the Wildlife Conservation Society which will provide expanded capacities for development of NPS application. In 2007 the project will complete and test the application.</p>
Snowy Plovers at Point Reyes National Seashore: Unraveling the Mystery of Mercury	<p>Mercury concentrations in addled eggs from federally listed Snowy Plovers at Point Reyes National Seashore in northern California were found to be elevated relative to eggs from southern California. To understand potential vectors of mercury availability to Snowy Plovers and habitat cycling of mercury, this project collected invertebrate prey samples early and late in the Snowy Plover breeding season in 2006 at nesting sites, and from marine mammal carcasses that washed ashore at Point Reyes. Reference samples were collected at the Coal Oil Point Marine Reserve near Santa Barbara, California. Addled plover eggs also were collected for analyses. Preliminary results showed that mercury concentrations in marine species of invertebrates (e.g., amphipods, isopods) at Point Reyes were relatively uniform among the four sites sampled but that invertebrates collected from or around marine mammal carcasses had 2–4 times higher mercury levels. Point Reyes invertebrates had 7–10 times higher mercury concentrations than invertebrates collected from southern California. Moreover, the few addled eggs collected at Point Reyes in 2006 had higher concentrations of mercury than eggs collected in previous years. Notably, Point Reyes plover egg concentrations were several time higher than those detected in shorebird eggs from the more urbanized San Francisco Bay, emphasizing the importance of understanding potential impacts on Snowy Plovers at Pt. Reyes National Seashore. Studies planned for 2007 will determine the extent of mercury contamination at gradients away from Point Reyes, and replicate the 2006 sampling design.</p>
Developing a coral conservation strategy for the global warming era in the National Park of American Samoa	<p>This project seeks to identify physical and biological factors that increase coral resilience to elevated seawater temperatures. The findings of the project will inform development of a coral conservation strategy in preparation for potential seawater warming with future climate change in The National Park of American Samoa. The first part of the project was completed as planned in 2006 by conducting an experiment testing the effects of water motion on survival and growth of coral transplants and by collecting coral samples from 400 Pocillopora eydouxi coral colonies from various reef habitats in American Samoa. The samples will be used for an allozyme study to determine if colonies found in warm, shallow areas are genetically distinct from other colonies and thus likely adapted to the warmer seawater of these habitats.</p>

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Spring aspect of Coastal Plain/Piedmont Swamp Forest, Richmond National Battlefield Park, Chickahominy Bluffs Unit. Photo: Gary P. Fleming, Virginia DCR



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