



Funding the Natural Resource Challenge Report to Congress, Fiscal Year 2008



Cover: Hawksbill turtle hatchlings head into the surf. Hatchlings are believed to ride currents of marine gyre systems, where they feed in rafts of seaweed while growing to approximately "dinner plate size." Perhaps one in 1,000 survive to adulthood. Photo: Lahela Burgess.

Funding the Natural Resource Challenge

Report to Congress, Fiscal Year 2008

Natural Resource Stewardship and Science
Washington, DC

U.S. Department of the Interior
National Park Service
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At Carl Sandburg Home National Historic Site (NC) crews used NRPP-Small Park Allocation funding to repair erosion damage and improve drainage on the Big Glassy Trail.



Executive Summary

For nearly a century, the National Park Service (NPS) has been charged with managing the parks within the breadth and complexity of the NPS mission mandated by the Organic Act in 1916: “to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.” Since its early days, the NPS has faced daunting challenges to effective natural resource management and today, park managers face an increasing array of dynamic and complex issues and unprecedented challenges, seemingly more than any encountered in the history of the NPS.

The best hope to restore and retain the rich natural heritage found in the National Park System is to be fully informed about park plants, animals, ecosystems and their interrelationships. Accordingly, the NPS introduced the Natural Resource Challenge (NRC) in 1999, with the full support of Congress. Originally envisaged as a five-year, \$100 million program to strengthen natural resource management, the Challenge has realized a total of \$77,552,000 in funding and has reinforced the natural resource stewardship and science legacy for the NPS. NRC programs have influenced every aspect of natural resource management in the NPS for most of this decade by increasing the capacity and professional expertise of natural resource managers, initiating and expanding research, protection, and restoration projects, enhancing natural resource education efforts and supporting cooperative programs that engage partners in the shared study and protection of park’s natural resources.

Although the 100 million dollar vision for the Challenge has yet to be met, natural resource programs established at all levels of the NPS continue to provide far-reaching benefits. Individual park base increases and the expanded Natural Resource Preservation Program have improved park capacity to address critical natural resource projects and enhanced air, water, geologic and biological resource programs that provide technical assistance to parks. Inventory and Monitoring

Networks have developed and implemented peer reviewed protocols to monitor “vital signs” and synthesize data to better understand the dynamic nature and condition of park ecosystems and to provide reference points for comparisons with other, altered environments. Exotic Plant Management Teams have treated acres of invasive plant infestations and Cooperative Park Ecosystem Studies Units have expanded our research portfolio through partnerships with academia, other agencies and non-profit organizations. Research Learning Centers have facilitated research efforts, provided educational opportunities and shared research results with researchers, local communities, students, educators, and the public.

NRC funded programs have produced tangible results in parks over the last nine years. One of the first projects initiated with NRC funding was an effort to restore Bonneville cutthroat trout to streams in **Great Basin National Park** in Nevada. Great Basin received a park-base increase to support its efforts to restore trout and other threatened or endangered species. In October 2008, the U.S. Fish and Wildlife Service found that the Bonneville cutthroat trout was not warranted for listing under the Endangered Species Act, citing the work at Great Basin as a significant factor in the decision.

Another notable project includes the endangered island fox and breeding bald eagle recovery programs at **Channel Islands National Park** in California. This highly successful restoration effort and the myriad of collaborators have forged significant relationships between the park, other federal agencies, the state and NGOs and continue to produce models for park stewardship.

The ongoing project to monitor the status of the panther population in **Big Cypress National Preserve** in Florida has been highly successful. It has provided information for management decisions that support and enhance panther recovery, and provided insight into the panthers’ behavioral and/or demographic responses to natural events, management actions, and human impacts in

Natural Resource Challenge funding supported the restoration of the endangered Channel Islands fox.

south Florida. The many projects identified in this 2008 Annual Report were successful largely in part due to NRC funding that enhanced natural resource programs throughout the Service.

The availability of sustained funding for natural resource work continues to be a challenge and the gains in natural resource stewardship over the life of the Natural Resource Challenge have proved significant. Advancing a conservation agenda while simultaneously protecting our past natural resource investments against rapidly changing conditions in parks and surrounding areas will benefit from applying new strategies, effective engagement with others and a greater effort within the National Park Service to coordinate across parks, regions and the Natural Resource Stewardship and Science Directorate. The Natural Resource Challenge will continue to enhance the National Park Service's ability to address complex and changing natural resource issues to ensure that our nation's natural heritage has the capacity to endure the challenges ahead, and in doing so, will remain unimpaired for our future generations.



Members of the Big Cypress Panther family, kittens K-274, K-275, and K-276 were born in July 2008. Their mother is FP-153. Photo: Ralph Arwood Inside-Out Photography, Inc.



Chapter I: Funding and Measuring Progress

The National Park Service (NPS) is a caretaker of America's special places. Congress mandated this in 1916 with the passage of the Organic Act, which established the National Park Service and tasked the agency with the management of parks, monuments, and other federal lands. The act also defined the purpose of the newly created agency: "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

Park managers have worked hard to fulfill this mandate for almost a century. It has not always been easy. Since the early days of the National Park Service, park managers have faced issues that put pressure on public lands and natural resources. These issues have grown more complex as the nation—and its population—grew. Today's natural resource managers face dynamic, complex issues that challenge their ability to meet the original mandate. The issues are both local, such as development or invasive species on park lands, and international, such as climate change.

Conservation of our natural resources in light of these issues requires informed action. Every action the National Park Service takes toward managing its natural resources is part of the natural resource stewardship cycle—a process of discovery, learning, understanding, sharing, resource protection/restoration, and evaluation.

- **Discovery** is the process of finding something new, whether it comes from basic research, baseline inventories, or observation.
- **Learning** is tactical research, monitoring, or study that gathers data in a scientifically sound manner to allow for the examination of causes, effects, and implications.
- **Understanding** is the process of analysis, synthesis, summarization, and critical review of data that creates information and then knowledge.
- **Sharing** is information disseminated to peers, partners, and the public.
- **Resource protection/restoration** is action,

based in sound science, taken by managers to meet mission goals.

- **Evaluation** is the act of determining the effectiveness of the action—and can lead back to any other step in the cycle.

Since FY 2000, park managers have had assistance—in the form of the Natural Resource Challenge—in carrying out this natural resource stewardship cycle.

Natural Resource Challenge

The National Park Service announced the Natural Resource Challenge, a program to strengthen natural resources management in the National Park System, in 1999. With the support of Congress, the Natural Resource Challenge was launched in FY 2000. Originally envisioned as a five-year, \$100 million effort, the Natural Resource Challenge spanned FY 2000–2007 and received a total of \$77,552,000 in funding (see Appendix A for a detailed funding history).

Natural Resource Challenge funding has increased the professional expertise of natural resource managers; introduced and expanded research, protection, and restoration projects; improved education efforts; and supported cooperative programs that engage partners in studying natural resources. While the funding increases have ended, the natural resources in the National Park Service continue to benefit from Natural Resource Challenge funds.

Funding

The Natural Resource Challenge included funding for park-level and Servicewide programs. Some of this funding augmented existing programs; the rest added important, but missing, components.

The Natural Resource Challenge included a series of requests for new funding that were developed by park superintendents and subject matter experts as necessary to meet future natural resources management needs. The Natural Resource Challenge provided base increases to 36 parks and enhanced eleven Servicewide natural resource stewardship programs, which benefitted additional NPS sites. Table 1.1 shows the funding for Service-

Field verification of wetlands mapping with St. Mary's University on the Copper Lake trail in Wrangell-St. Elias National Park and Preserve, 2008.
Photo: Bruce Rogers

wide natural resource stewardship programs, distinguishing programs that received funding from the Natural Resource Challenge; it also identifies the funding level for FY 1999, the year before the first Challenge increases, and FY 2008.

Table 1.1

NPS Natural Resource Stewardship Programs ¹			
Program Components	1999	2008	Change
<i>Natural Resource Challenge-Affected Programs</i>			
Air Quality Program	6,285	8,673	2,388
Biological Resource Management Program ^{2 & 3}	0	9,765	9,765
Cooperative Ecosystem Studies Units ⁴	0	125	125
Geologic Resources Program	1,918	2,901	983
Inventory and Monitoring Program ⁴	5,787	43,836	38,049
Natural Resource Data and Information Program ³	1,424	1,871	447
Natural Resource Preservation Program	5,432	8,100	2,668
Research Learning Centers (20 centers established, 12 Natural Resource Challenge funded) ⁴			0
Resource Damage Assessment & Restoration Program (includes Oil Pollution Act)	873	1,373	500
Resource Protection Fund	0	282	282
Water Resources Program	4,754	12,316	7,562
Subtotal	26,473	89,242	62,769
<i>Programs Not Affected by Natural Resource Challenge</i>			
Cave and Karst Research Institute	0	323	323
Everglades—Comprehensive Restoration Plan (CERP)	0	4,657	4,657
Everglades—Critical Ecosystem Studies Initiative	1,200	3,849	2,649
Everglades Task Force Support	800	1,303	503
Geographic Information System (GIS) Program	1,336	1,235	-101
Glen Canyon Adaptive Management Program ⁴	0	96	96
Natural Sounds Program (formerly Overflight Program) ³	200	3,527	3,327
Subtotal Non Natural Resource Challenge Programs	3,536	14,990	11,454
Subtotal—Servicewide Natural Resource Programs	30,009	104,232	74,223
National Park System Units, Other Field Units, and Central Office Natural Resource Stewardship Programs	64,408	117,263	52,855
Total Natural Resource Stewardship	94,417	221,495	127,078

¹ All numbers shown in thousands of dollars/Years in fiscal years

² Includes \$375,000 for Emergency Supplemental - Highly Pathogenic Avian Influenza

³ Reflects FY 2008 base transfer of \$414,000 to Natural Resource Data and Information Program from Social Science (\$67,000), Natural Sounds (\$236,000), and Biological Resource Management Programs (\$111,000).

⁴ Reflects program funding after transfers to parks or regions



Katrina Park of Northern Rocky Mountain Exotic Plant Management Team treats houndstongue (*Cynoglossum officinale*) at the "R Lazy S Hayfield" riparian area in Grand Teton National Park. Photo: Chris Overbaugh

Measuring Progress

The National Park Service, as with other government agencies, is tasked with reporting performance in a measurable way. The National Park Service measures the effectiveness of its natural resource and other programs using the performance goals identified in the Department of the Interior 2007–2012 Strategic Plan, which was established according to the guidelines in the Government Performance and Results Act (GPRA) of 1993. The desired outcome for natural resources in the National Park System is resources in good condition as defined by the desired condition identified in the Servicewide Strategic Plan, Annual Performance Plan, Annual Performance Report, and operational plans to standards in GPRA and Office of Management and Budget (OMB) Directive A11—Preparation, Submission and Execution of the Budget.

The strategic plan targets, results for FY 2008, and Servicewide natural resource programs supporting park performance are listed in Table 1.2. The eleven natural resources goals listed are in two categories: goals relating to

strategies to restore, maintain, sustain, and protect resources, and goals relating to strategies to improve information base, resource management, and technical assistance. The table compares FY 2008 actual performance to projected planned performance as set forth in the National Park Service's FY 2009 Budget Justification for all GPRA goals reported to Congress.

Reporting

The *Natural Resource Challenge Report to Congress* responds to a request in House Report 106-22 to provide information to Congress about the expenditures and related accomplishments and results derived from Natural Resource Challenge funding. This report details expenditures and accomplishments for FY 2008, as well as achievements that parks and Servicewide programs have made due to cumulative funding provided during the eight-year span of the Natural Resource Challenge increases. To provide a more complete picture of the state of natural resources in the parks, this report also includes information about expenditures for

Table 1.2

NPS Goal Targets for FY 2008 (NPS number/DOI number)	SERVICEWIDE NATURAL RESOURCE PROGRAM Supporting Park Performance
Goals relating to strategies to restore, maintain, sustain, and protect resources:	
BUR Ia3A Visibility: 96% of NPS reporting parks has remained stable or improved. Actual: 97% (113 of 116 parks) remained stable or improved. (Exceeded) BUR Ia3B Ozone:- % of NPS reporting parks has remained stable or improved. Actual: 92% (135 of 146 parks) remained stable or improved. (Exceeded) BUR Ia3C Atmospheric deposition: 76% of NPS reporting parks has remained stable or improved. Actual: 85% (46 of 54 parks) remained stable or improved. (Exceeded)	Air Quality
BUR Ia1B Invasive Plants Controlled: 0.44% of acres (7,050 of 1,607,231 acres) infested with invasive plants being maintained as free of invasive plants and 2.1% of acres (34,519 of 1,607,231 acres) treated. Actual: 0.50% of acres (8,021 acres) controlled and 4.1% of acres (66,069 acres) treated. (Exceeded) BUR Ia2A T&E Species: 33.9% (337 of 993) of federally listed species in parks making progress toward recovery. Actual: 33.0% of park populations (328 of 993) making progress toward recovery. (Not met) ¹ BUR Ia2B Species of Management Concern: 12.7% (605 of 4,765) of park populations of native species of management concern that are managed to desired condition. Actual 11.9% (566 of 4,765). (Not met) BUR Ia2C Invasive Animals Controlled: 12.9% (104 of 806) of park populations of exotic (i.e. non-native) invasive animal species are effectively controlled. Actual: 13.6% (110 of 806) of park populations of exotic invasive animal species effectively controlled. (Exceeded)	Biological Resources Management
BUR Ia9 Paleo Sites in Good Condition: 37.6% (1,595 of 4,243) of paleontological localities in good condition. Actual 38.7% (1,643). (Exceeded)	Geologic Resources
BUR Ia4A Water Quality Miles: 98.4% (136,775 of 139,000) of surface water stream miles in parks that meet state and federal water quality standards as defined by the Clean Water Act. Actual 98.9% (145,962 of 147,467 miles). (Exceeded) BUR Ia4B Water Quality Acres: 72.0% (3,045,960 of 4,230,500) of surface waters acres in Parks that meet state and federal water quality standards as defined by the Clean Water Act. Actual 74.1% (3,338,275). (Exceeded) BUR Ia4D Water Quantity: 10 surface and groundwater systems protected and/or restored. Actual 24 (exceeded)	Water Resources
Goals related to strategy to improve information base, resource management, and technical assistance	
PART-6 Natural Resource Inventories: 84.5% (2,338) of the 2,767 outstanding data sets identified in 2002 of basic natural resource inventories for all parks will be delivered. Actual 85.3% (2,361). (Exceeded)	Inventory and Monitoring
¹ The reported GPRA percentages and numbers are from the Performance Management Data System (PMDS). The 'actual' numbers differ from those reported by parks in the NPS Endangered Species Act Database. In FY 2008, 35% (369 out of 1,053) of park populations were making progress toward recovery. (Exceeded)	

Servicewide natural resource stewardship programs that are not part of the Natural Resource Challenge (e.g., Natural Sounds Program, Environmental Quality Program, Cave and Karst Program).

Future Challenges

Fiscal Year 2008 was the first year since the completion of the Natural Resource Challenge funding increases that spanned 2000–2007. The state of natural resources in the National Park Service improved significantly during that time, as this report documents. But, as the National Park Service looks toward its centennial in 2016, what does the future hold for natural resources?

Park managers must look ahead to the next round of challenges, whether they come from

close to home or far away. Climate change, ocean stewardship, landscape fragmentation, invasive species, energy development, and the value of parks are all issues the National Park Service is beginning to, and will continue to, face. The availability of sustained funding for natural resources, which is eroding each year due to increases in fixed costs, will determine the ability of the National Park Service to deal with these issues.

The gains in natural resource stewardship over the life of the Natural Resource Challenge were significant, but the work of the National Park Service is not done. Park managers must continue to work with Congress, partners, and the American public to ensure that the nation's special places remain unimpaired for current and future generations.



Chapter II: Park and Regional Resource Management Programs

The Natural Resource Challenge helped NPS resource managers address complex resource issues at a variety of scales. Thirty-six parks received Natural Resource Challenge funding in FY 2001 or 2002. These funds were added to base budgets to be used for natural resource management projects in the following areas:

- Invasive species control
- Threatened and endangered species restoration and recovery
- Native species efforts
- Basic natural resource capability for small parks

Regional programs also benefited from the Natural Resource Challenge, which provided funding to establish specialist positions that could use their knowledge and skills to assist multiple parks with resource management issues.

Park Base Funding Increases

Parks of all sizes received base funding increases via the Natural Resource Challenge. Smaller parks, like **Monocacy National Battlefield (MD)** and **Hopewell Culture National Historical Park (OH)**, used the funding to establish natural resource management programs. Prior to this funding, many small parks were forced to rely on the regional office, staff from nearby parks, or internal staff from other divisions, such as law enforcement or interpretation, to help protect their natural resources.

Larger parks used Natural Resource Challenge funding to supplement existing resource management efforts—to fill holes in their programs or staffs—or to establish programs that met an urgent but unfulfilled need. In some cases parks were able to leverage the Natural Resource Challenge funding through partnerships and volunteer support. At **Haleakala National Park (HI)** the base increase was used to hire a volunteer coordinator to manage a volunteer program aimed at invasive management.

The funding from the Natural Resource Challenge remains today. Some parks, however, report an effective erosion of these funds as fixed costs, such as salaries, rise. Parks have

countered some of this erosion by obtaining Flexible Base Increases, engaging in partnerships, and competing for project funds. While these resourceful methods allow parks to spread out existing funds for maximum impact, deficiencies remain.

- **Curecanti National Recreation Area (CO)** reports that in FY 2008 Natural Resource Challenge funds supported an interdisciplinary quagga and zebra mussel prevention and monitoring program, including an integrative prevention and response plan. The current funding is insufficient, however, to keep the area free of the invasive, ecosystem-altering mussels or to contain an outbreak should one occur. Quagga and zebra mussels are a relatively new invasive, arriving and establishing themselves since the start of the Natural Resource Challenge in FY 2000.
- **Sequoia and Kings Canyon National Parks (CA)** state that current base funding is unavailable to support seasonal employees working to contain exotic plants and that the parks may need to cut permanent base-funded FTEs (full-time equivalents) for the first time since the Exotic Plant Management Program began in FY 2001.
- **Acadia National Park (ME)** reports that several positions funded by or targeted to be funded in part by the Natural Resource Challenge (including a botanist; two permanent, subject-to-furlough biological technician positions; and a data manager position) are vacant and cannot be rehired due to funding levels.
- **Jewel Cave National Monument (SD)** identified the need for funding that would provide a natural and cultural resource division chief that would oversee above- and below-ground resources, as well as cultural resources.

Even when parks are faced with these monetary challenges, natural resources benefit from the Natural Resource Challenge. Parks continue to use the funds to engage in discovery, learning, understanding, sharing, protecting and restoring, and evaluating the diverse natural resources of the National Park System.

Andrew Banasik, Chief, Natural Resource Management, Monocacy National Battlefield, leads a field visit to the restored field and stream at Thomas Farm. Prior to receiving a Natural Resource Challenge base increase, the battlefield had no dedicated natural resource management staff.

Discovery

Great Sand Dunes National Park and Preserve (CO). Park staff assisted researchers with the collection of several datasets during FY 2008. A collaborative effort between the U.S. Geological Survey, the National Science Foundation, and the University of Colorado installed a global positioning system (GPS) base station on bedrock within the park to collect key positional data about the movement of the Rio Grande Rift, which encompasses much of the park. NPS researchers also collected data that quantify the darkness of the night sky and the level of ambient sound within the park. This information will serve as a baseline for future monitoring efforts.

Hopewell Culture National Historical Park (OH). Park staff updated three datasets: birds and mammals, herpetofauna (reptiles and amphibians), and aquatic resources. The information for these updates was gathered through breeding surveys, bird walks, and bird banding; fish surveys and water quality monitoring; and observation and visitor reports. Baseline information like this helps natural resource managers understand which species live in their parks.

Obed Wild and Scenic River (TN). Natural resource management activities in the park uncovered the presence of two aggressive exotic species—hemlock woolly adelgid and

hydrilla—in FY 2008. The resource management specialist discovered hemlock woolly adelgid (*Adelges tsugae*) immediately adjacent to park boundaries. A funding request for a hemlock woolly adelgid survey was submitted and approved for the FY 2009 Servicewide Comprehensive Call (SCC); now park managers will use the funds for treatment and control. Botanists discovered large areas of hydrilla (*Hydrilla verticillata*), which dominates the streambed along Daddys Creek. Park staff submitted and received approval for a project in the FY 2010 SCC to pinpoint the source of the infestation. In the meantime, the resource management specialist is working with the Southeast Region Exotic Plant Management Team to investigate treatment methods.

Walnut Canyon National Monument (AZ). Park staff and cooperators produced several surveys and inventories during FY 2008. A seasonal resource technician, working with Northern Arizona University through the Colorado Plateau Cooperative Ecosystem Studies Unit, developed an invasive exotic plant inventory of the area. Surveys were completed for Mexican spotted owls (threatened) and northern goshawks (a federal species of concern) through the U.S. Geological Survey and a contract, respectively.

Elk take heel at the Great Sand Dunes National Park and Preserve (CO) during an elk count. The count was part of the collection of vital sign data.



Learning and Understanding

Appalachian National Scenic Trail (multiple states). In FY 2008, staff completed the first resource management plan for the national scenic trail, finishing a multi-year effort. The comprehensive plan was a collaborative effort including all trail resource management staff and others. The plan—with sections on rare, threatened, and endangered species and plant communities; air, water, and cultural resources; threats; description of the current resource management program and needs; and project statements to meet those needs—will help resource managers protect the diverse resources of the more than 2,000-mile trail that stretches from Maine to Georgia.

Catoctin Mountain Park (MD), Monocacy National Battlefield (MD), Rock Creek Park (DC), and Antietam National Battlefield (MD). The high population density of white-tailed deer is one of the biggest challenges facing urban parks in the East. Ongoing monitoring programs at these parks help resource managers understand the effects of deer on park lands. At Catoctin, vegetation monitoring of 24 plots showed very little forest regeneration over the past five to ten years, while spotlight surveys of deer revealed a density of 105 deer per square mile (up from 88 in 2006). This information was used to prepare the *Catoctin Mountain Park White-Tailed Deer Management Plan and Environmental Impact Statement*, which will guide management of the species in the future.

Channel Islands National Park (CA). In 2008, park staff monitored all 32 kelp monitoring sites around the Channel Islands. The monitoring of kelp forests helps staff evaluate the performance of newly established marine reserves that protect kelp forests off the Channel Islands. These forests provide food and shelter for more than 1,000 species of marine plants and animals. Natural Resource Challenge funds continue long-term evaluation of the sites established in 1982 and 2005 and provide for the overall stewardship of the marine protected areas, as well as outreach and education.

Curecanti National Recreation Area (CO). Park staff continued the Gunnison sage-grouse habitat use study, which was initiated in 1999. The goal of the study is to develop a habitat

utilization model that promotes sustainable management of the Gunnison Basin sagebrush steppe ecosystem in a manner that enhances the bird's population. In FY 2008, researchers captured and fitted 27 adult and juvenile grouse with radio transmitters. Field crews classified 10,070 acres of sage-grouse habitat on public and private lands adjacent to the recreation area and completed 12 permanent nesting transects. NPS biologists, U.S. Geological Survey researchers, and Colorado Division of Wildlife biologists continued a chick survival study. While the Gunnison sage-grouse is not listed under the Endangered Species Act, the species is found only in a small area of Colorado and Utah.

Haleakala National Park (HI): Two endangered bird species, the 'ua'u (Hawaiian dark-rumped petrel, *Pterodroma phaeopygia sandwichensis*) and the nene (Hawaiian goose, *Branta sandvicensis*), continued to be the focus of research in the park. Park staff monitored and recorded activity data on the ground-nesting 'ua'u and recorded 68 nesting attempts for the nene.

Sharing

Homestead National Monument of America (NE). The Kids in Parks Program introduced children to the biodiversity of the monument. Using data from the Heartland Inventory and Monitoring Program and the Prairie Cluster Monitoring Program, staff developed six programs exploring plants, birds, bugs, aquatic macroinvertebrates, trees, and mammals. Each program was presented to economically and racially diverse children from YMCA day camps in Beatrice and Lincoln, Nebraska, and then to the public on the weekend. Overall, the effort reached 408 children through 18 programs.

Padre Island National Seashore (TX). The Kemp's Ridley Sea Turtle Monitoring Program, which in FY 2008 saw the largest number of nests found in the park (93) since record-keeping began in 1980, continues to include a strong public element. More than 3,000 visitors attended 18 public hatchling releases. Park staff conducted 36 media interviews, wrote a biweekly column for a local newspaper, and invited the media to two hatchling releases. The Kemp's ridley sea turtle (*Lepidochelys kempii*) is considered the

most endangered sea turtle by the U.S. Fish and Wildlife Service.

Sequoia and Kings Canyon National Parks (CA). The Exotic Plant Management Program includes an educational element to aid in early identification (and therefore treatment/control) of exotic species. Park staff developed weed identification cards for park staff, neighbors, and visitor groups and presented information sessions about invasive plants and prevention techniques. Staff throughout the park received invasive plant newsletters and exotic plant observation cards that provided the information and means to identify and report exotic species.

Zion National Park (UT). The outreach program for the federally threatened desert tortoise (*Gopherus agassizii*) has three goals: to increase awareness of the needs of and threats to the species, foster enhancement of habitat on private lands, and increase the public's support for protection of the species. As part of this effort, wildlife biological technicians created educational posters and activities, hosted six outreach events, and developed a welcome packet for new residents in and adjacent to desert tortoise habitat in Springdale, Utah. They shared this information with Joshua Tree National Park and Bryce Canyon National Park for use in their outreach programs.

Resource Protection and Restoration
Saugus Iron Works National Historic Site (MA). Major actions for the restoration of historic waterfront and marsh have been substantially completed. Site preparation included treatment of invasive non-native phragmites by the NPS Northeast Region Exotic Plant Management Team. Implementation included: excavation of contaminated sediments and a monoculture of invasive non-native phragmites in the intertidal marsh; grading to establish topography appropriate for high marsh, low marsh, and mudflat environments; planting of 2000 high marsh plants from 12 species and nearly 12,000 low marsh plants from 4 species; and berm planting of 350 sedges, 51 shrubs, and small trees from 4 species. The park is now coordinating a multi-resource monitoring program that began in 2008 and will continue for at least five years. The monitoring will be beneficial for ongoing management, and also was required by project

permits, but was not funded as part of the project.

Antietam National Battlefield (MD). Park priorities for 2008 included two closely linked projects: exotic plant control and historic scene restoration. Invasive plant species threaten important historic areas such as the Otto and Roulette Farms and the North, West, and East Woods. Park staff combined several techniques to manage these areas. To re-establish the historic appearance of the Otto Farm landscape by reducing woody vegetation and enhancing native vegetation, park staff performed two prescribed fires, burning 24 acres. The Roulette Farm is farmed as a hay field by an agricultural permittee to maintain its open appearance. Park staff planted 100 seedlings and 52 larger trees in the North and West Woods and shielded naturally regenerating seedlings with tree tubes to prevent damage from animal browsing and mowing. In the East Woods, park staff hand-pulled, treated, and monitored several exotic plant species.

Buck Island Reef National Monument (VI). In an effort to lessen the potential for catastrophic loss of remaining populations and to increase species range into high-quality, protected habitat, researchers released 57 St. Croix ground lizards (*Ameiva polops*) on Buck Island in July 2008. Prior to the restoration, the globally endangered species was found only on three near-shore cays near St. Croix. This effort concludes 40 years of preparation for the restoration of the species to Buck Island—a long process that included elimination of mongoose and control of tree rats on the island, a habitat assessment, and an environmental assessment. The restored population will be monitored biannually by researchers from Texas A&M University, the National Park Service, and U.S. Virgin Islands Department of Planning and Natural Resources—Division of Fish and Wildlife.

Channel Islands National Park (CA). The end of 2008 marked a high point in the recovery of the endangered island fox (*Urocyon littoralis*). After a nine-year captive breeding and restoration effort, all captive breeding facilities were closed and the captive breeding program ceased due to the rapid success of the program. More than 650 island foxes now live in the northern Channel Islands, which is close

to meeting the biological criteria for de-listing from the endangered species list. Wild populations have increased rapidly due to high fox survival and high reproductive success in the wild. Park managers believe that the high survival rate is due primarily to the relocation of golden eagles, a primary predator of island foxes, from the northern Channel Islands to the mainland.

Great Basin National Park (NV). Park staff wrapped up an eight-year effort to restore the Bonneville cutthroat trout (*Oncorhynchus clarki utah*) to park streams. Viable, self-reproducing populations were found in five stream systems within the park. In October 2008, the U.S. Fish and Wildlife Service found that the Bonneville cutthroat trout was not warranted for listing under the Endangered Species Act, citing the work at Great Basin as a significant factor in the decision. This project was one of the original Natural Resource Challenge funded projects.

John Day Fossil Beds National Monument (OR). In conjunction with the National Marine Fisheries Service, Bureau of Land Management, and Oregon Natural Desert Association, park staff initiated a project to increase threatened steelhead (*Oncorhynchus mykiss*) populations in the Bridge Creek watershed. The project has two parts designed to make the habitat more suitable: installing in-stream structures to slow down flow of the stream and restoring riparian vegetation. In spring 2008, 1,300 native tree cuttings were planted along Bridge Creek.

Evaluation

Buck Island Reef National Monument (VI).

The Buck Island Sea Turtle Research and Monitoring Program had another record sea turtle nesting year. The park usually records between 30-70 adult nesting hawksbill sea turtles (*Eretmochelys imbricata*). This year researchers observed 77 endangered hawksbill sea turtles nesting on the monument beaches; however this number is not the full seasonal nesting count as hawksbill turtles continued to nest after conclusion of night-time beach patrols through December. Observers also discovered 12 threatened green sea turtles (*Chelonia mydas*), one endangered leatherback sea turtle (*Dermochelys coriacea*) nest, and the return of one nesting threatened log-

gerhead sea turtle (*Caretta caretta*), which is a very rare occurrence in the Virgin Islands. To date only two adult loggerheads have been observed nesting in the Virgin Islands; their nests have done well and they continue to return to nest every two years. As of October 15, 2008, prior to impact of Hurricane Omar (Category 3) hitting St. Croix and Buck Island Reef National Monument, staff recorded 560 sea turtle nesting activities on the park's 1500 meters of available nesting beach.

Virgin Islands National Park (VI). The park has an extensive program for removal of exotic species, including cats, rats, mongoose, hogs, goats, sheep, and, new in FY 2008, chickens. These species create a number of problems in the park: disease transmission, impacts on native wildlife, destruction of natural resources, and damage to park trails. While removal for most species is an ongoing effort, staff continually monitor to see if all animals have been removed from a particular area. In the case of rats on Henley Cay, traps set by park staff found no animals; thus indicating that the cay remains rat-free.

Regional Resource Management Activities

The 391 sites in the National Park System are organized into seven geographic regions: Alaska, Intermountain, Midwest, National Capital, Northeast, Pacific West, and Southeast. These regional offices provide support and guidance to parks, leverage resources to most effectively respond to issues faced by multiple parks, and work with local and state agencies on behalf of parks. Table 2.1 details the number of NPS sites and acreage that each region serves, as well as the states the region covers.

Six of the seven regions reported continued erosion of funding for regional and park natural resource management programs. While Natural Resource Challenge funds dramatically improved the financial dynamics in the regions, funding has effectively declined since FY 2002. Regional managers reported that parks are facing a number of challenges, including insufficient funding to cover annual operational costs and cost-of-living increases. This has translated into a continued loss of permanent, full-time natural resource staff positions and therefore less time and money available to address natural resource issues. The small to medium-sized parks are the most

affected by the loss of natural resource staff and have dealt with fewer funds by not refilling natural resource positions when they become vacant, sharing a single natural resource position among several parks, or having individuals assume part-time responsibility for other park divisions.

The parks and regions reported other challenges as well. Restrictions on travel funding reduced the ability of regional natural resource staff to provide technical assistance to parks and reduced the ability of park resource managers to travel to meetings or trainings to continue professional development or participate in external or interagency work groups. Some parks are also finding it difficult to identify partners for natural resource projects because many potential partners are hesitant to commit funds to projects scheduled three or more years out, the length of time required for project selections. Despite these challenges, several regions and parks were able to augment their resource management programs through partnerships with state agencies and citizen scientists.

The seven regions identified climate change, development within and surrounding parks, threatened and endangered species, invasive species, restoration, and ocean/coastal stewardship as focus areas for their natural resource efforts, which they undertake as part of the natural resource stewardship cycle.

Climate Change

The NPS Alaska Region formed a partnership with bureaus of the Department of the Interior (DOI) and others in Alaska to document and forecast the long-term effects of climate change on DOI areas in Northern Alaska. Three programs are part of this effort: WILDCAST (for NPS areas on the southern side of the Brooks Range), WILDREACH (for areas north of the Brooks Range), and the North Slope Initiative (also north and including **Gates of the Arctic National Park and Preserve** and **Noatak National Preserve**). These projects will provide information to help the parks plan ways to adapt to future changes in climate, soil conditions, land cover, fire, and wildlife. One result of these projects to date is the availability of downscaled future climate maps for several Alaska parks. In addition, more than 100 scientific studies were presented as part of planning exercises, training, and science symposia in FY 2008. Another significant accomplishment in FY 2008 was the receipt of three international awards for the 2007 climate change issue of the *Alaska Park Science* journal.

Development

As the District of Columbia explores the selling of its properties for commercial purposes, NPS areas are being considered to fill the district's recreational needs—which could result in public open space being used for “bricks and mortar” projects. Legislation has identi-

Table 2.1

Acreage and Sites per NPS Region

Region	States	Number of NPS Sites	Acres
Alaska	AK	19	54.63 million
Intermountain	MT, CO WY, UT, OK, TX, AZ, NM	91	10.19 million
Midwest	NE, WI, AR, SD, KS, OH, IA, ND, IN, MO, MN, MI, IL	57	1.82 million
National Capital	DC, VA, MD	34	77,432
Northeast	ME, VT, NH, NY, RI, MA, CT, NJ, PA, WV, MD, VA	71	711,490
Pacific West	MT, CA, ID, OR, NV, WA, HI, AZ, SAMOA, GUAM	58	12.82 million
Southeast	KY, GA, TN, FL, NC, VA, MS, VI, LA, SC, MS, PR, AL	66	3.85 million



Equipment and operational improvements have reduced, though not eliminated, fugitive dust releases from contaminated truck and road surfaces during transport of lead and zinc ore concentrates from the Red Dog across Cape Krusenstern National Monument in Alaska. (NPS photo)

Patti Happe, Mitch Lewis, and Cokie Smith release a male fisher into the Elwha Drainage, Olympic National Park, in March 2008. Photo: Coke Smith

fied 80–85 acres of **National Capital Parks–East (DC, MD)** land available for transfer to the District of Columbia for development into mixed commercial/residential and open space. Some of these lands include meadows managed for pollinators, river riparian areas, and wetlands. An additional 15 acres being considered for transfer would be used for recreation buildings and parking lots in the Fort Dupont area. Plans for construction of a consolidated Department of Homeland Security headquarters at the former St. Elizabeth’s Hospital site could destroy significant portions of forest along Shepherd Parkway and threaten the prominent green backdrop that has been an important design element of the nation’s capital.

The National Park Service and U.S. Geological Survey continue to evaluate data from research on the effects of heavy metal dust contamination from the Red Dog Mine, the world’s largest lead-zinc mine, on the vegetation, snow, water, and wildlife of **Cape Krusenstern National Monument (AK)** and **Noatak National Preserve (AK)**. While research has been ongoing for several years, new research has found that impacts to native vegetation (especially lichens) are widespread and severe in some areas. Limited and sublethal physiological effects were detected in small mammals and birds. A formal risk assessment was completed, and risk management and environmental impact planning are underway with the oversight of the Environmental Protection Agency.

Two new virtual learning centers reach beyond park boundaries to engage the public and park neighbors in resource stewardship. These virtual learning centers provide quick access to natural resource information. The Greater Yellowstone Science Learning Center and the Learning Center of the American Southwest form a collaboration among 51 NPS units in five Inventory and Monitoring (I&M) networks, three Cooperative Ecosystem Studies Units (CESUs), and six nonprofit partners. Designed to complement park websites, these virtual learning centers take a resource-centric approach to information, which is organized by resources as well as park units. Resources, therefore, no longer stop at park boundaries but can be viewed in a holistic manner that encourages exploration at multiple levels of

scale and detail and highlights the significance and connectivity of smaller parks to larger neighbors. (The virtual learning center websites are available at www.greateryellowstone-science.org/ and <http://dev.southwestlearning.org/>. The Learning Center of the American Southwest is still under construction.)

Threatened and Endangered Species

The Intermountain Region, along with the Midwest Region, signed a memorandum of understanding (MOU) with the Western Association of Fish and Wildlife Agencies. This MOU provides for state and federal agency cooperation in the conservation and management of wildlife species and grassland habitats within the western Great Plains. The interagency cooperation will focus on shared collection and analysis of data related to threatened and endangered species (both state listed and federally listed) and other species of management concern.

Due to unregulated trapping and fragmentation of low-elevation forests, the fisher (*Martes pennant*), a candidate species under the Endangered Species Act, was extirpated from the state of Washington in the mid to late 20th century. In early 2008, park staff, Washington Department of Fish and Wildlife biologists, and U.S. Geological Survey biologists released 18 fishers—the first of up to 100—in **Olympic National Park (WA)**. This restoration effort was the result of eight years of analysis and planning among many partners. To evaluate the success of the restoration, managers launched a study that will help researchers understand the factors that influence the survival of released fishers and to determine landscape components selected by fishers in establishing home ranges. Data collection is ongoing, as the study will continue for several years (partial funding is secured through 2010), but so far preliminary results show that the fisher has remarkable abilities to move widely from release sites and colonize diverse landscapes throughout the Olympic Peninsula.

Invasive Species

Since the late 1990s, large numbers of native birds have been found dead along the shores of the Great Lakes due to Type E botulism.

Sleeping Bear Dunes National Lakeshore (MI) lost nearly 3,000 birds in 2006 and another 1,100 in 2007. Resource managers have initi-

ated a project to determine the factors that contribute to these outbreaks. The project includes four elements: water quality monitoring, toxin monitoring, underwater image and video collection, and stable isotope and stomach content analysis of toxin-killed birds. To date, data show that many of the birds examined were feeding on exotic species believed to be associated with botulism toxicity (e.g., quagga mussels and round gobies). The image and video collection have documented changes in light penetration, an increase in areas able to produce native algae, and quagga mussel and round goby population explosions. When complete, the study will add to the understanding of impacts from invasive species in the Great Lakes and, researchers hope, identify links in food pathways or ways to disrupt populations of exotic species to break the botulism toxin cycling and prevent die-offs of native birds.

Parks in the National Capital Region continue to be affected by exotic species. Three parks continued the treatment of areas affected by gypsy moths, a widespread forest pest that defoliates trees. With the detection of the emerald ash borer in Maryland and Virginia this year, National Capital parks took action. **Antietam National Battlefield (MD)** wrote and implemented an emerald ash borer monitoring plan and collaborated with **Catoctin Mountain Park (MD)**, **Chesapeake and Ohio Canal National Historical Park (DC, MD)**, and the U.S. Department of Agriculture's Animal and Plant Health Inspection Service on a larger-scale monitoring effort. Since the discovery of these exotic beetles in Michigan in 2002, they have spread to nine states and Canada's Province of Ontario and killed tens of millions of ash trees.

Restoration

Halstead Meadow is a 25-acre wet meadow crossed by the General's Highway in **Sequoia National Park (CA)**. The rare and highly visible wetland had developed severe gullies 12–15 feet deep, resulting in a lower water table, dieback of wetland vegetation, and export of sediment downstream. Park staff and partners developed a pilot restoration design for upper Halstead Meadow in 2006, and earthmoving began in 2007. In 2008, volunteers helped repair erosional features and prepared the ground for planting; in June, contractors, volunteers,

and park staff planted 53,000 native wetland plants. Monitoring in 2008–2009 will help staff evaluate pilot project methods and plan restoration of lower Halstead Meadow.

Ocean/Coastal Stewardship

Horseshoe crabs are an important marine resource. They serve as the primary prey-base for sea turtles, sharks, and other marine organisms; their eggs provide critical food resources for migrating shorebirds; and they play the role of predator in the estuarine benthic community food web. Harvested within **Cape Cod National Seashore (MA)** boundaries prior to 2001, legislation ruled that the harvesting of horseshoe crabs, as a wildlife species, was prohibited. During that time, Cape Cod staff and University of Rhode Island researchers initiated a study to quantify spawning activity and egg densities on beaches within and outside the boundary. The sites established during that study will be revisited in 2008 and 2009. Results from 2008 suggest that spawning crabs routinely return to the same beaches, which means that certain beaches are critical to spawning and population maintenance. Data analysis to compare spawning densities between the harvest and harvest ban periods is currently underway. The findings from this study will have widespread implications to other seashores, U.S. Fish and Wildlife Service refuges, and other public lands.

Beginning in 2001, staff at **Biscayne National Park (FL)** cooperated with the Florida Fish and Wildlife Conservation Committee to develop a fisheries management plan (FMP) that would guide the sustainable use of the park's fishery-related resources over the next five to ten years. Using input from the public, a FMP working group, and local fisheries experts, they prepared a draft environmental impact statement (EIS) to describe the five management alternatives, the affected environment, and the environmental consequences of the alternatives. The draft EIS is expected to be released for public comment in early 2009. When implemented, the FMP will guide management actions that promote sustainability and responsible harvesting, leading to healthier marine resources.

At **Canaveral National Seashore (FL)**, 5,400 volunteers from schools, community groups,

and local organizations assisted park staff with an oyster reef restoration project. They treated 13 acres of reefs by scraping down accumulated mounds of dead shells and covering the areas with restoration mats containing oyster shells in the natural live (vertical) position. These mats provide oyster larvae with a substrate on which to settle, creating a new reef over time. Oyster reefs are in dramatic decline due to habitat degradation, disease, over-harvesting, reduced water quality, and recreational boating. As a keystone species and ecosystem engineer, oysters provide habitat for fish, crab, shrimp, and snails. This project was funded entirely by partners.



Chapter III: Network Programs

Park managers across the country are confronted with increasingly complex and challenging issues that require a broad-based understanding of the status and trends in the condition of natural resources in parks, working with other agencies, and communicating with the public to protect natural systems and native species. To help in these efforts, the Natural Resource Challenge funded four programs that link parks into biogeographic networks across the country: Cooperative Ecosystem Studies Units (CESUs), Exotic Plant Management Teams (EPMTs), Inventory and Monitoring (I&M) networks, and Research Learning Centers (RLCs). Through these networks, the parks accomplish much more together than they could as single units—and the networks save money through consolidating efforts and leveraging funding with partners.

These networks work side-by-side with park resource programs, the NPS Natural Resource Program Center, federal and state agencies, universities, non-profit organizations, and other partners that share similar resource protection goals. They were, however, established as four separate entities so that they remain accountable for fulfilling their purposes and accomplishing their goals. **Cooperative Ecosystem Studies Units (CESUs)** link parks with appropriate subject-matter experts at universities. **Exotic Plant Management Teams (EPMTs)** survey to *discover* invasive plant species in the parks, use the latest research and best practices to *understand* how to control them, and take action to control problem species and *restore* native species. **Inventory and Monitoring (I&M) networks** offer *discovery* through baseline inventories of key ecosystem indicators, *learning* through long-term monitoring of trends of these indicators, and *understanding* through collaboration with scientists at universities and other agencies. *Sharing* that information leads to science-based management decisions and actions to *protect* the parks. Continued monitoring will provide *evaluation* of the effectiveness of park actions. **Research Learning Centers (RLCs)** provide support and assistance for scientists working through park programs, I&M networks, CESUs, or

the Natural Resource Program Center. RLCs strive to make research and science in the National Park System more effective and to communicate its results to peers, partners, and the public.

This chapter presents some of the accomplishments of the network programs in the context of the natural resource stewardship cycle: discovery, learning, understanding, sharing, resource protection and restoration, and evaluation.

COOPERATIVE ECOSYSTEM STUDIES UNITS

Cooperative Ecosystem Studies Units (CESUs) are multi-agency partnerships between universities, federal agencies, and other institutions, organized around the country according to biogeographic areas. The National Park Service is one of 13 federal agencies within the CESU network, which was established in FY 1999 with leadership from the National Park Service, U.S. Geological Survey, and other federal agencies. A total of 188 universities (including 43 minority institutions) and 45 non-federal research partners participate in the CESU network. The objectives of this network are to:

- 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 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
- Manage federal science resources efficiently

The broad scope of CESUs includes the biological, physical, social, and cultural sciences needed to address natural and cultural resource management issues at multiple scales and across ecosystems.

The California Exotic Plant Management Team initiates a treatment of Harding grass (*Phalaris aquatica*) after inventorying a meadow at Redwoods National Park, California.

In FY 2008, the National Park Service received \$1.985 million to support NPS participation in the CESU network. The Natural Resource Challenge funding provides salary and support for a coordinator at the host university in 12 of the 17 CESUs. The CESU coordinators are “brokers,” working with NPS park managers to identify research, technical assistance, and education needs, and to facilitate specialized expertise and assistance from the universities and other federal agency partners. An equal level of funding, \$154,920, was allocated to each CESU; as in previous years, a portion of the funding provided Service- and department-wide administrative support (\$125,960) and coordination activities. CESUs facilitated 777 projects, which were supported by a range of funding sources that totaled more than \$45 million. These numbers repre-

sent a 9% decrease in project numbers, but a nearly 5% increase in project dollars.

Natural Resource Challenge funding is not available for 5 of the 17 coordinator positions (Californian, Great Rivers [formerly Upper & Middle Mississippi Valley], Hawaii-Pacific Islands, North and West Alaska, and Piedmont-South Atlantic Coast CESUs); regional offices help support NPS participation in those five CESUs through assigning collateral duties to regional office staff, providing additional funding, or assigning responsibilities to other CESU coordinators. Lack of national support has affected the ability of these CESUs to provide support for CESU operations at host universities or to provide funds for projects, especially at small parks that lack discretionary funding.

Table 3.1

Project Activity and Funding, by Region and Individual CESU, FY 2008

Region	CESU	Total Projects and Funding (All Sources), FY 2008	
		Projects	Funding
Alaska	North and West Alaska*	23	\$780,793
Intermountain	Colorado Plateau	153	\$4,174,285
	Desert Southwest	67	\$2,351,029
	Rocky Mountains	181	\$12,360,981
Midwest	Great Plains	10	\$289,046
	Great Lakes-Northern Forest	30	\$1,400,016
	Great Rivers*	9	\$535,109
National Capital	Chesapeake Watershed	26	\$1,314,995
Northeast	North Atlantic Coast	21	\$1,319,970
Pacific West	Californian*	16	\$547,458
	Great Basin	33	\$4,558,814
	Hawaii-Pacific Islands*	20	\$2,069,561
	Pacific Northwest	55	\$2,968,369
Southeast	Gulf Coast	46	\$2,863,874
	Piedmont-South Atlantic Coast*	28	\$1,678,934
	South Florida/Caribbean	39	\$4,802,508
	Southern Appalachian Mountains	20	\$1,029,391
TOTALS		777	\$45,045,133

* Not funded by the Natural Resource Challenge.

In FY 2008, many CESUs reported level or declining project numbers and dollars; others reported a substantial increase in both. For example, the Chesapeake Watershed CESU saw a 285% increase in project dollars. The Rocky Mountains CESU also reported an increase: significant funding increases came from the Centennial Challenge (six projects) and line-item construction funds that were used to assess the impacts from planned coal mine development in the vicinity of **Glacier National Park (MT)**. By contrast, the Great Basin CESU reported a 15% decline in project dollars due to a decline in Southern Nevada Public Lands Management Act funding. See Table 3.1 for project funding and activity for each CESU. Table 3.2 shows the total funding and number of NPS projects administered by the CESUs from FY 2001 to FY 2008.

Examples of CESUs activities in FY 2008 include the following:

- In FY 2008, the number of federal agency partners remained at 13; the number of university and non-government partners was 233, representing a 3% increase over FY 2007. Although the network of 17 CESUs is complete, individual CESUs continue to add partners.
- Four CESUs successfully completed their five-year renewals in FY 2008: the Californian, Great Rivers, North and West Alaska, and Piedmont-South Atlantic Coast CESUs.
- In FY 2008, three NPS CESU research coordinator positions—Colorado Plateau, Gulf Coast, and Pacific Northwest CESUs—were vacated and refilled.
- The CESU research coordinators continue to perform important collateral duties. CESUs and NPS coordinators provide key

services to I&M networks and continue to play important roles in organizing and conducting workshops, symposia, regional summits, and training sessions on natural and cultural research and management issues. Coordinators continue to collaborate with each other to ensure that parks in their regions have access to the best available expertise across the entire CESU Network.

- Opportunities for undergraduate and graduate students at participating CESU institutions to become involved in NPS CESU projects are being provided through project activities, internships, fellowships, design of degree programs, and student career positions. NPS personnel in the CESUs participate in student education by teaching classes, giving seminars, serving on graduate committees, providing student funding, and mentoring students.
- As the CESUs mature, opportunities for interagency and inter-university projects, including those that involve ecosystem-level research and restoration, are increasing. For example, in FY 2008, the DOI Interagency Bison Strategy made use of data and information on bison genetics, ecology, and populations generated by university and agency partners, including those in the Gulf Coast, Rocky Mountains, and Great Plains CESUs.
- Climate change is an increasingly important CESU focus area. There are interagency activities in most biogeographic regions in the country, including collaboration across the borders with protected areas in Mexico and Canada.

CESU-Specific Accomplishments

Great Basin CESU: Great Basin National Park (NV). Staff at Great Basin National Park

Table 3.2

NPS CESU Projects and Funding, FY 2001–2008			
Fiscal Year	Projects Initiated	Total Funding	CESUs in Network
2001	260	\$10 million	8
2002	380	\$15 million	12
2003	540	\$19 million	16
2004	650	\$27 million	17
2005	635	\$32 million	17
2006	728	\$39 million	17
2007	848	\$43 million	17
2008	777	\$45 million	17

collaborated with the University of Utah to develop a field guide to mammals of the park and vicinity. The park has 22 sensitive mammal species and uses small mammals as indicator species of climate and habitat change. Park biologists needed a tool to train staff in mammal identification and assist in management, compliance, and NEPA planning. To meet this need University of Utah mammalogists together with NPS staff completed *A Guide to the Mammals of Great Basin National Park*. The guide includes a dichotomous identification key, mammal checklist, and species accounts summarizing the characteristics, regional distribution, natural history, and ecology of the 67 species of mammals found in the South Snake Range. The guide is now being used as a mammal identification training tool and field guide by park staff and is available to the public online (<http://www.nps.gov/grba/naturescience/upload/CompletedGBguideAllSections.pdf>).

Great Plains CESU: Badlands National Park (SD). American bison are a critical keystone species in grassland ecosystems. Nearly all of the 500,000 bison that exist today are derived from a handful of publicly-managed herds in the U.S. and Canada which represent the genetic “stock” of the bison species. The Badlands National Park bison herd was first established in 1963 with bison originally from Nebraska (Fort Niobrara National Wildlife

Refuge lineage) and later supplemented in 1983 with bison from Colorado. Genetic data were collected over a period of five years to investigate the levels and patterns of variation within the herd in order to assist with long-term management goals and priorities. Two different genetically defined “subpopulations” were discovered in the Badlands herd, corresponding to the two historical lineages represented in this herd (Nebraska and Colorado). The observation that bison in this herd preferentially associate with others from their original founding lineage 25 years after the lineages were “mixed” was an unexpected finding by scientists and population managers. This new discovery could have significant implications for the future management of this national resource and may require more detailed evaluations of hidden population structure and management policies with other important federal bison herds. Computer simulations were also performed to test the effects of intensive culling, which has been proposed to reduce the herd size from around 850 to 600 bison. While culling duration (years) and intensity are predicted to have only a minimal impact on short-term (less than 10 years) genetic diversity, over longer periods (100 years) total population size is expected to have a significant impact on genetic diversity. The results of this study indicate that to maximize levels of genetic diversity the herd should be maintained with at least 800–1000 bison. This

Researchers discovered two different genetically defined “subpopulations” in the Badlands National Park (SD) bison herd. These two subpopulations correspond to the two historical lineages represented in this herd (Nebraska and Colorado).



study underscores the value of using modern biotechnology to help ensure the preservation and conservation of the park bison herd for generations to come and could provide valuable insight for future species conservation endeavors.

Great Rivers CESU: George Washington Carver National Monument (MO), Pea Ridge National Military Park (AR), and Wilson's Creek National Battlefield (MO). Cooperators are working to develop an assessment of natural resources and watershed conditions for these sites that will provide (1) information for managers to more precisely and accurately define desired future conditions and thus provide a more comprehensive and accurate assessment of current resource conditions and (2) assessment statistics and report summaries for park managers to develop reports that meet GPRA and OMB reporting requirements. The assessment will use available data from the I&M Program and other NPS and non-NPS sources. The project will also identify where additional data are needed to characterize the park's natural resources and document these information gaps for each major resource group, ecological attribute, and spatial scale of analysis.

Hawaii Pacific-Islands CESU: Hawaii Volcanoes National Park (HI). In 2003, volunteers discovered that federally endangered hawksbill sea turtles that nest within Hawaii Volcanoes National Park were also nesting at four adjacent beaches outside park boundaries. The park and CESU worked with volunteers, the Hawaii Natural History Association, and private landowners to initiate monitoring, reduce adverse effect on nesting habitat, and conduct outreach activities to educate the public. The project was very successful at reducing adverse effects on nesting. As of FY 2008, invasive plant and animal control in important nesting habitat resulted in 14 successful turtle nests and over 1,500 hatchlings that safely reached the ocean. To lessen the human impact on nesting habitat, project volunteers and cooperative staff provided education to numerous community members, visitors, and land owners via direct contact and the installation of interpretive signs for beach users. Additionally, baseline data were analyzed and compiled into a technical report detailing results of the last 15 years of

Hawaii Island hawksbill turtle research. This long-term monitoring information is being shared with researchers and land and resource managers, and constitutes an important contribution to the understanding of hawksbill demography and reproductive biology and behavior.

Piedmont-South Atlantic Coast CESU: Great Smoky Mountains National Park (NC, TN). An Asian earthworm species (*Amyntas agrestis*), the Chinese jumping worm, was first reported in the Great Smoky Mountains National Park in 2002. This is an active worm that disturbs and consumes the organic surface layers of forest soils. Exotic earthworms are potentially destructive to forest litter and duff layers, thereby jeopardizing rare species, forest succession, and ecological processes over the long-term. Researchers focused on the southwest corner of the park where there is an active infestation of *A. agrestis*. The perimeter of this infestation was delineated and documented. Additional sampling on nearby lands was conducted to determine the distribution of endemic/rare/undescribed earthworm species within the same area, and to estimate the rate of spread of *A. agrestis*. Prescribed burning in small acreages and in the appropriate season was used to experimentally determine if existing populations of *A. agrestis* can be reduced and/or exterminated. It was determined that prescribed burning dramatically reduced abundance of *A. agrestis*, but populations rebounded if the duff layer was not fully consumed. This is important information for the park and will help determine the desired objectives of prescribed fires in *A. agrestis* infested areas.

Rocky Mountains CESU: Glacier National Park (MT). The Montana Heritage Program began a pilot study to determine the presence of land snail species of concern likely to occur in the park. The work included training NPS personnel in survey and inventory techniques, as well as field identification of species, so the park can undertake additional survey work when resources become available. The inventory included a fall 2008 survey of 20 sites. Researchers from the University of Montana found seven species new to the 1967 park checklist, including brown-banded arion (*Arion circumscriptus*), chocolate arion (*Arion rufus*), dusky arion (*Arion subfuscus*),

glossy pillar (*Cochlicopa lubrica*), meadow slug (*Derocerus laeve*), reticulate taildropper (*Prophysaon andersoni*), and lovely vallonia (*Vallonia pulchella*). While this animal group is not included in the base inventories under the I&M Program, it is valuable to have a baseline inventory of this kind in light of the potential effects of climate change on species.

Southern Appalachian Mountains CESU: Obed Wild and Scenic River (TN). One of the strongest remaining populations of the spotfin chub fish (*Erimonax monachus*) occurs within the Emory River watershed within the boundaries of the Obed Wild and Scenic River. Researchers from Tennessee Technological University identified and mapped sensitive aquatic habitats and communities through the spring, summer, and fall. They discovered five habitat variables that were significantly associated with the presence or absence of spotfin chubs: depth, substrate, velocity at substrate, velocity at 60%, and habitat unit occupied. Seven significant habitat variables were identified for both summer and fall: temperature, conductivity, depth, substrate, velocity at substrate, velocity at 60%, and habitat unit occupied. The results of this study will help park staff protect this species through preparation of a comprehensive resource monitoring plan for this state and federally threatened species.

EXOTIC PLANT MANAGEMENT TEAMS
National parks are home to complex native communities of plants and animals that have developed over millions of years. This natural heritage is threatened by the invasion of exotic plants and animals as well as by human-caused disturbances that foster the establishment of exotic species. The introduction of harmful exotic species is an emerging global problem. A Cornell University study in 2000 estimated that invasive plants and animals cost the U.S. Economy \$137 billion annually. The Ecological Society of America notes that invasive species contribute to the listing of 35 to 46 percent of all threatened and endangered species. Exotic plants infest some 2.6 million acres in the national parks. Control of exotic species is one of the most significant land management issues facing national parks.

Exotic Plant Management Teams (EPMTs) are an important part of the NPS response to the

problem of invasive plant species. The Natural Resource Challenge funded 16 EPMTs; these teams serve more than 200 parks. EPMTs provide a framework and first response to exotic plant invasions within the National Park Service. The teams were modeled after the coordinated rapid response approach used in wild land fire fighting. The success of the EPMTs derives from their ability to adapt to local conditions and needs using weed science expertise and partnerships. The EPMTs are composed of highly trained individuals with expertise in plant identification, plant ecology, weed management, and pesticide use.

The goals of the EPMTs are to:

- Manage the sources of new infestations
- Reduce the effects of existing infestations
- Restore native plant communities

To achieve these goals the EPMTs combine techniques from inventory and monitoring, prevention, restoration, control, and research. Through Inventory and Monitoring the teams locate invasive plant infestations and detect changes in plant populations to facilitate development of management plans. EPMTs seek to manage the sources of new infestations, provide early detection of infestations, and develop outreach to staff and the public to increase awareness. Partnering with non-NPS researchers allows the EPMTs to identify and develop effective treatment methods. With treatment and control techniques the effects of existing infestations are reduced and eliminated. Restoring native plant communities and ecosystem functions reduces the chances of reinfestation. The teams leverage resources and maximize results through working with other agencies, adjacent landowners, and academic institutions. Table 3.3 shows the results of the EPMTs' efforts in FY 2008.

Table 3.3	
FY 2008 EPMT Accomplishments	
Inventoried Acres	169,695
Monitored Acres	85,612
Treated Acres	15,642
Gross Infested Acres	112,538
Infested Acres	17,946
Restored Acres	98
Maintained Acres	613



A pedestaled saltcedar at White Sands National Monument in New Mexico before (top) and after treatment (bottom).

The following lists include highlights of EPMT accomplishments for FY 2008.

Prevention

- In conjunction with the Midwest Invasive Plant Network, the **Great Lakes EPMT** produced an early detection flyer, *Aquatic Invasive Plants in the Midwest*, and a fold-out laminated guide, *Invasive Plants of the Eastern United States*. Staff participated in a weed education booth at a local farmers' market throughout the summer.
- The **Colorado Plateau EPMT** conducted training at **Hubbell Trading Post National Historic Site (AZ)** for the youth corps and volunteers who conduct invasive plant control activities at the park and on surrounding Navajo Nation tribal land.

Inventory and Monitoring

- EPMTs inventoried approximately 169,695 acres, recording information on 366 invasive plant species. Over the last eight years, the EPMT Program has inventoried more than three million acres and recorded information for more than 600 species.
- Teams monitored more than 85,600 acres and 243 invasive plant species. Monitoring is increasing as sustained treatments are making progress toward invasive plant goals.
- The **Florida Caribbean EPMT** is working with partners to map invasive species across the region. Using aerial mapping techniques developed by the U.S. Forest Service, the team has mapped more than four million acres in south Florida.

Treatment and Control

- EPMTs treated 347 taxa on 15,600 acres.
- Since 2005, the **North Cascades EPMT** has worked with **Lewis and Clark National Historical Park (OR, WA)** to control dense populations of Himalayan blackberry (*Rubus discolor*) and evergreen blackberry (*R. laciniatus*) on a newly acquired tract. The large infestations have been dramatically reduced and now only require annual monitoring and minimal treatment maintenance to keep the area free of invasive plants. Native vegetation is being restored along the iconic Fort to Sea Trail.
- The **Pacific Island EPMT** has taken the lead role in controlling the tropical superweed miconia (*Miconia calvescens*) on the

island of Maui. Miconia is being successfully contained across 35,000 acres.

Restoration and Research

- EPMTs restored 98 acres.
- At **Minute Man National Historical Park (MA)**, the **New England EPMT** teamed up with a Student Conservation Association Invasive Species Project Team and the Town of Lincoln Conservation Department at a restoration site on the park's border. The area, choked with Oriental bittersweet (*Celastrus orbiculatus*) and other invasive woody plants, looked remarkably different after a few days of work. As exotic vines and shrubs die back, existing grasses and other native vegetation should fill in naturally.
- The **Lake Mead EPMT** joined the Bureau of Land Management, U.S. Geological Survey, and University of California–Santa Barbara to conduct new research on the restoration of tamarisk (*Tamarix aphylla*) control sites following defoliation from bio-control.

Cooperation and Collaboration

- The **Alaska EPMT** partnered with the Southeast Alaska Guidance Association (SAGA), an Americorps program. SAGA worked in seven Alaskan national parks, giving nine weeks of service in 2008 towards invasive plant control. The volunteer cooperative effort led to successfully treating nearly 60 acres.
- The **National Capital EPMT** is working to establish a Cooperative Weed Management Area in the nation's capital, one of the first in a major metropolitan area. The group will coordinate invasive plant control efforts for various city agencies, private landowners, and federal agencies.
- The **Rocky Mountain EPMT** is leading an effort at ten parks in the northern Great Basin and Rocky Mountains to establish a series of strategic plans for the management of invasive plants.
- **Guilford Courthouse National Military Park (NC)** resource staff partnered with the **Southeast EPMT**, the Piedmont-South Atlantic Coast CESU, and North Carolina State University to develop a draft ten-year exotic plant management plan. This plan will serve as a template for other park units and partners. Ultimately the goal is to in-

clude the prevention and containment of exotic plants in all aspects of park management.

INVENTORY AND MONITORING NETWORKS

The Inventory and Monitoring (I&M) Program is an important part of the effort to revitalize the NPS natural resource program and improve park management through greater reliance on scientific information. In 2000, the National Park Service organized 270 parks with significant natural resources into a system of 32 bioregional I&M networks. The I&M Program provides funding, technical assistance, and coordination for these parks to complete 12 basic natural resource inventories and to monitor the condition, or “health,” of key vital sign parameters.

The scientifically sound information obtained through inventories and long-term ecological monitoring assists in decision-making, research, education, and promotion of public understanding of park resources. Combined with an effective education program, inventory and monitoring results can contribute not only to park issues, but also to larger quality-of-life issues that affect surrounding communities and can contribute significantly to the environmental health of the nation. As a direct result of funding through the Natural Resource Challenge, the I&M Program has become a significant component of the overall scientific and information management infrastructure and expertise of the National Park Service.

Parks in each I&M network share core funding and a professional staff that is augmented by funding and staff from park base accounts and other sources. The national program office and 32 I&M networks leverage the program’s resources through partnerships with other NPS programs and agencies as part of a strategy to maximize the use and relevance of the data for target audiences. This integration and collaboration, and the interdisciplinary approach to compiling, analyzing, and reporting natural resource information, are key aspects of the I&M strategy.

For most parks, funding and staff from the I&M Program is the primary means of measuring the status and trends in the condition of park resources and is a central com-

ponent of an effective natural resource management program. Network staff are involved in numerous activities, such as organizing and cataloging data, analyzing and synthesizing data, modeling, providing data and expertise to park planners and for occasional resource assessments and resource stewardship strategies, and contributing to performance reporting. In just a few short years, the I&M networks have become known as a key source and supplier of reliable, organized, and retrievable information about parks that was formerly unavailable, misplaced, or lost to managers and others who needed the information for sound decisions or sound science.

Two factors have been key to the success of the 32 I&M networks: (1) leveraging limited funding and staff through partnerships with other programs and agencies and (2) explicitly linking park management and planning.

Partnerships and Leveraging

- I&M is not a stand-alone program. The network strategy allows parks to include and augment long-term monitoring that was already being done by parks, other NPS programs, and other agencies.
- In most networks, funding and staffing are closely intertwined between parks and networks.
- Parks were able to identify their highest priorities for monitoring (as opposed to a top-down, “one size fits all” approach), which allowed them to take advantage of local partnership opportunities.
- Parks enlisted subject-matter experts from more than 150 universities, plus the U.S. Geological Survey and other agencies, to design a scientifically credible monitoring program based on the best available information.

Explicit Link to Park Management

- I&M staff began by asking park managers and planners what they needed and how best to deliver the information to them.
- Park superintendents and natural resource staff are fully engaged through each network’s board of directors and technical committee.
- Park managers, planners, and interpreters are key audiences and are provided with products they can use. Science-communication and customer

satisfaction are key aspects of the I&M Program.

- I&M network data and expertise are a catalyst and key data source for natural resource condition assessments, resource stewardship strategies, and reporting on land health goals and other GPRA goals.

The primary responsibilities of the 32 I&M networks are to:

- facilitate baseline inventories
- collect, manage, analyze, and report long-term data for a modest set of vital signs (measurements of resource condition)
- effectively deliver data and information on resource condition to park managers, planners, interpreters, and other key audiences

Natural Resource Inventories

The inventory component of the I&M Program reports to the strategic planning goal on natural resource inventories that states that by September 30, 2008, acquisition or development of 84.5% (2,338) of the 2,767 outstanding data sets identified in 2002 of

basic natural resource inventories for all parks will be delivered. The increased funding for natural resource inventories received through the Natural Resource Challenge in FY 2000 and FY 2002 has allowed the National Park Service to significantly increase the rate at which the basic natural resource inventories are completed. The goals set for each year were ambitious, yet the I&M Program exceeded the FY 2008 goal by completing an additional 184 data sets, bringing the total to 2,361 (85.3%) of the outstanding datasets.

Table 3.4 shows the number of baseline natural resource inventories completed in FY 2008 for the 270 parks served by the I&M Program. The number of data sets remaining after FY 2008 reflects the number of parks with outstanding needs.

The purpose of the basic inventories is to assess and document the current condition and knowledge of natural resources in the parks and to establish a solid baseline for making scientifically sound management decisions and long-term monitoring plans that ensure

Table 3.4

Natural Resource Inventories								
Fiscal Year:	2001	2002	2003	2004	2005	2006	2007	2008
Natural Resource Bibliography	257	263	270	270	270	270	270	270
Base Cartography Data	248	260	270	270	270	270	270	270
Air Quality Data	250	250	250	270	270	270	270	270
Air Quality Related Values	0	0	0	48	100	150	175	210
Climate Inventory	0	197	270	270	270	270	270	270
Geologic Resources Inventory	2	14	17	52	68	92	117	138
Soil Resources Inventory	37	57	57	59	70	100	141	171
Water Body Location/Classification	0	220	270	270	270	270	270	270
Baseline Water Quality Data	225	270	270	270	270	270	270	270
Vegetation Inventory	22	27	36	51	62	80	127	155
Species Lists	210	270	270	270	270	270	270	270
Species Occurrence & Distribution	0	0	0	3	44	100	200	270
Grand Total	1,251	1,828	1,982	2,103	2,234	2,412	2,650	2,834
Completed before 2001	473	473	473	473	473	473	473	473
GPRA Actual	778	1,355	1,509	1,630	1,761	1,939	2,177	2,361
GPRA Target	768	1,121	1,498	1,637	1,771	1,942	2,145	2,338
Percent GPRA Complete			54.5%	58.9%	63.6%	70.1%	78.7%	85.3%

the future health of the parks. The I&M Program continues to deliver high-quality data sets and other inventory products to parks each year, but because of budget shortfalls and increased costs, the delivery of the initially defined inventory data sets and products to the 270 I&M parks will require at least another seven years at current funding levels, and even longer for some of the large Alaska parks.

These natural resource inventories reveal many new and exciting insights into the natural resources in parks. Not only are the investigations increasing our knowledge and understanding about park resources, but also the information provided is used to address a wide variety of resource management issues and activities. The profiles below illustrate how inventory results during FY 2008 were used to better understand, manage, and protect park resources.

Appalachian Highlands Network Parks (KY, NC, TN, VA). All inventories of vertebrates and vascular plants were completed for the network's parks, verifying that this is one of the most species-rich temperate regions on earth. As part of the inventories, 720 new species were documented, including first records of globally rare or state-listed species, as well as populations of federally listed endangered and threatened species that were previously unknown to the parks. Nationwide, **Blue Ridge Parkway (NC, VA)** and **Great Smoky Mountains National Park (NC, TN)** have the highest amphibian diversity documented for any units in the National Park System and rank 3 and 4, respectively, among parks nationwide for greatest vascular plant diversity.

Arctic Network: Noatak National Preserve and Bering Land Bridge National Preserve (AK). The Arctic Network completed an extensive lichen inventory that documents three species new to science: *Hypogymnia castanea*, *H. fistulosa*, and *H. beringiana*. These lichens are members of the "bone lichen" group. They frequently form showy rosettes in the tundra, though *H. beringiana* is globally rare.

Central Alaska Network: Wrangell-St. Elias National Park and Preserve and Denali National Park and Preserve (AK). Field efforts to sample remote streams in the parks resulted

in extending the Alaska Department of Fish and Game's Anadromous Waters Catalog. The presence of coho salmon in a tributary of the Nizina River approximately five miles upstream of their previous known extent was documented, along with Chinook salmon in Moose Creek, sockeye salmon in the Gilahina River, coho salmon in Lake Creek, and the pink and coho salmon and Dolly Varden in four coastal Wrangell-St. Elias streams. The presence of Chinook and coho salmon was documented in Willow Creek, a tributary of the Tana River that had not been known to support anadromous fish (migrate from salt water to fresh water to spawn).

Eastern Rivers and Mountains Network: New River Gorge National River (WV). The recent vegetation classification and mapping project resulted in the recognition of three new riparian vegetation associations: the sycamore-ash floodplain forest (*Platanus occidentalis*-*Fraxinus pennsylvanica*/*Carpinus caroliniana*/*Verbesina alternifolia*), the black willow slackwater woodland (*Salix nigra*-*Betula nigra*/*Scheonoplectus pungens*), and the oak-tulip poplar/silver bell high floodplain forest (*Quercus (alba, rubra, velutina)*/*Halesia tetraptera*). These three types have not been documented from areas outside the New River Gorge and are potentially globally rare. Eastern Rivers and Mountains Network staff are currently working with NatureServe and other scientists to develop global conservation ranks for these communities.

Klamath Network: Oregon Caves National Monument (OR). A northern waterthrush (*Seiurus noveboracensis*), not currently listed on the park's species list, was captured in the monument as part of a long-term land bird vital sign monitoring project. The birds are neotropical migrants and can usually be found spending their summers throughout Alaska and Canada and their winters in Florida, Mexico, and South America.

Mediterranean Coast Network: Channel Islands National Park (CA). Project staff from U.S. Geological Survey Colorado Plateau Research Station compiled and edited data from museum records and information from published and unpublished reports on bat distribution and abundance on the northern Channel Islands from 1985 through



The Appalachian Highlands Network has completed inventories of vascular plants and vertebrates. This meadow vole was captured at the Blue Ridge Parkway during a mammal inventory. Photo: Nora Murdock

At Assateague Island National Seashore scientists noted the first record of over-wintering in Maryland by the migratory common green darner dragonfly. Photo: Berlin Heck



1989. These previously unknown records are particularly valuable because they cover a time period prior to the loss of island foxes on San Miguel and Santa Rosa and prior to eradication of rats on Anacapa Island.

Mid-Atlantic Network Parks (VA). Vegetation mapping was completed for all parks in Virginia. A variety of rare vegetation communities was identified, including Coastal Plain/Outer Piedmont Acidic Seepage Swamp, a G3 (vulnerable/rare) community known from most coastal states of the mid-Atlantic region from New York south but restricted to a specialized environment. Forested seeps provide breeding habitat for several uncommon dragonflies and damselflies, which are relatively small in size and threatened by beaver activities, agricultural pollutants, hydrologic disturbances, and logging. A regional analysis of all quantitative data for Virginia's Piedmont and Coastal Plain provided an accurate evaluation of the vegetation communities in the Mid-Atlantic Network parks.

Mid-Atlantic Network: Shenandoah National Park (VA). Recent lichen surveys on roadside walls and banks discovered 28 lichen species new to the park and seven species new to Virginia. A lichen specimen from one of the park's most popular rock outcrops was identified as *Calvitimela talayana*, a species known only from eastern Siberia.

Northeast Coastal and Barrier Network: Assateague Island National Seashore (MD, VA). A three-year survey of dragonflies, beetles, bees, and other arthropods documented more than 600 species and included the first recorded sightings in Maryland of two species of paper wasps, four species of leaf beetles, and two species of bees. The survey also noted the first record of over-wintering in Maryland by the migratory common green darner dragonfly and the most northern record to date of over-wintering by the Carolina saddlebag dragonfly. Information from the survey will be used to make decisions concerning mosquito control measures, wildlife management, and protection of salt marshes and other habitats affected by climate change and rising sea levels.

Pacific Island Network: Haleakala National Park (HI). The Koele Mountain damselfly (*Megalagrion koelense*) was recorded breeding in native lilies (*Astelia menziesiana*). Pacific Islands Network biologists also documented the use of high-elevation lakes as major breeding grounds for the giant Hawaiian darner, or Pinao (*Anax strenuus*), one of the largest dragonflies in the world, and recorded four species of endemic Hawaiian damselflies.

Southwest Alaska Network: Kenai Fjords National Park (AK). Rapid glacial recession (greater than 1 km/year for some tidewater glaciers) has left behind large areas of exposed substrate that are being colonized by early successional species, whereas the outer fjords are characterized by late-successional and old-growth coniferous forest. In 2008, 26 forested and non-forested inventory plots originally measured in 1993 were re-surveyed. Preliminary results show detectable changes in species composition, shrub height, and shrub cover across the majority of sites. The 2008 data, paired with ground photos from the plots, will provide Southwest Alaska Network staff with a qualitative measure of the rate of change in these communities as well as possible successional trajectories.

Vital Signs Monitoring

More than 1,000 scientists, resource specialists, park managers, and data managers actively contributed to the design and implementation of a long-term vital signs monitoring program, which produced an integrated, park-based program with a strong link between inventory and monitoring information and management needs. Each network developed a monitoring program tailored to the highest needs of their parks by defining network goals and objectives, identifying and prioritizing potential vital signs, and selecting a modest set of vital signs for long-term monitoring.

As of September 30, 2008, all 270 (100%) of parks had identified their vital signs; 253 (94%) had completed the design of their state-of-the-art monitoring plans and implemented vital signs monitoring; and 197 (73%) had completed at least one year of field data collection and are able to estimate current conditions for specific vital signs. The final two networks funded in FY 2007 will implement monitoring during FY 2009, ahead of schedule. As a direct

result of the efficiencies gained through the network approach, the majority of parks can now provide “current condition” estimates for key measurements of the condition of high-priority natural resources. The NPS performance goals for vital signs monitoring have been met or exceeded every year.

Table 3.5 shows the annual accomplishments of the 32 I&M networks in completing the planning and design of their long-term monitoring programs and implementing vital signs monitoring.

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. The monitored elements and processes are a subset of the total suite of natural resources that park managers are directed to preserve “unimpaired for future generations,” including water, air, geological resources, plants and animals, and the ecological, biological, and physical processes that act on those resources.

Because of funding restrictions, only the highest-priority vital signs, or those that are already funded by another source, can be monitored initially. However, by leverag-

ing Natural Resource Challenge funds with personnel and funding from other sources and establishing partnerships with other agencies and universities, it is often possible to monitor several vital signs and parameters together. For example, a field crew may visit a stream segment and make numerous measurements on the physical and chemical parameters of the water (e.g., channel width, flow rate, pH, dissolved oxygen) as well as measures of aquatic macroinvertebrate and fish communities (e.g., species occurrence, relative abundance) using funding from both the core vital signs and water quality monitoring components of the Natural Resource Challenge.

The number of networks and parks that expect to monitor a vital sign with currently available funding is summarized in Table 3.6. Vital signs monitored in fewer than 30 parks are not listed. The number of networks and parks for each vital sign category will change as each network completes the final design and testing of sampling protocols and negotiates with partners on options for implementing the monitoring in as many sites as possible with the limited resources available.

The following profiles highlight park monitoring accomplishments during FY 2008 that resulted in a better understanding of

Table 3.5

Annual I&M Network Vital Signs Accomplishments

Actual and Projected Accomplishments Vital Signs Monitoring and Resource Assess- ments		# Parks Completed by end of FY			# Parks Projected	
		2006	2007	2008	2009	2010
Planning and Design Phase	Identify and Synthesize Existing In- formation	270	270	270	270	270
	Prioritize and Select Vital Signs (Vital Signs identified)	250	270	270	270	270
	Monitoring Plan Completed, Peer-Re- viewed, and Approved – Operational Monitoring Begins (Monitoring Implemented)	157	197	253	270	270
Monitoring & Assessments Implemented	“Current Condition” Values Available for Specific Vital Signs - Operational Monitoring Ongoing	104	157	197	253	270
	Park Natural Resource Condition As- sessments Completed	0	0	1	20	40
	“Target Values” Identified and Compared to “Current Condition” for Specific Vital Signs as part of Resource Stewardship Strategy De- velopment	1	1	2	7	11

Table 3.6

Number of Parks Monitoring a Vital Signs		
Vital Sign Category	Example Measures (varies by network)	# Parks
Weather and Climate	Temperature, precipitation, wind speed, ice on/off	255
Land Cover and Use	Area in each land cover and use type; patch size & pattern	231
Water Chemistry	pH, temperature, dissolved oxygen, conductivity	224
Invasive/Exotic plants	Early detection, presence/absence, area	214
Birds	Species composition, distribution, abundance	188
Surface Water Dynamics	Discharge/flow rates (cfs), gauge/stage height, lake elevation, spring/seep volume, sea level rise	184
Ozone	Ozone concentration, damage to sensitive vegetation	151
Fire and Fuel Dynamics	Long-term trend of fire frequency, average fire size, average burn severity, total area affected by fire	125
Visibility & Particulate Matter	IMPROVE network; visibility and fine particles	112
Wet and Dry Deposition	Wet deposition chemistry, sulfur dioxide concentrations	111
Mammals	Species composition, distribution, abundance	108
Forest/Woodland Communities	Community diversity, coverage and abundance, condition & vigor classes, regeneration	105
Vegetation Complexes	Plant community diversity, relative species / guild abundance, structure / age class, incidence of disease	102
Soil Function and Dynamics	Soil nutrients, cover and composition of biological soil crust communities, soil aggregate stability	91
Aquatic Macroinvertebrates	Species composition and abundance	87
T&E Species and Communities	Population estimates, distribution, sex & age ratios	81
Stream/River Channel Characteristics	Channel width, depth, and gradient, sinuosity, channel cross-section, pool frequency and depth, particle size	80
Groundwater Dynamics	Flow rate, depth to ground water, withdrawal rates, recharge rates, volume in aquifer	75
Air Contaminants	Concentrations of SOCs, PCBs, DDT, Hg	71
Amphibians and Reptiles	Species distribution & abundance, population age/size structure, species diversity, percent area occupied	56
Fishes	Community composition, abundance, distribution, age classes, occupancy, invasive species	60
Insect Pests	Extent of insect related mortality, distribution and extent of standing dead/stressed/diseased trees, early detection	55
Grassland/Herb Communities	Composition, structure, abundance, changes in treeline	52
Nutrient Dynamics	Nitrate, ammonia, DON, nitrite, orthophosphate, total K	47
Riparian Communities	Species composition and percent cover, distribution and density of selected plants, canopy height	47
Wetland Communities	Species composition and percent cover, distribution and density of selected plants, canopy height, aerial extent	42
Invasive/Exotic animals	Invasive species present, distribution, vegetation types invaded, early detection at invasion points	39
Water Toxics	Organic and inorganic toxics, heavy metals	33
Coastal/Oceanographic Features & Processes	Rate of shoreline change, sea surface elevations, area and degree of subsidence through relative elevation data	32
Microorganisms	Fecal coliform, <i>E. coli</i> , cyanobacteria	30
Soundscape	Types and time periods of natural and anthropogenic sound; percent-time-audible	30

resources, better resource management, or better protection of park resources. These examples illustrate some of the successes that can be achieved through a program of consistent, continuous long-term monitoring of natural resources.

**Integration of Science and Management
Appalachian Highlands Network: Great
Smoky Mountains National Park (NC, TN).**

The Twin Creeks Science and Education Center was dedicated in FY 2008. The new 14,000-square-foot center near Gatlinburg, Tennessee, on the north slope of Mt. LeConte, houses the park's natural history collections, a chemical use laboratory and biology laboratory, a multiple use room designed for cooperative research permittees, work space, and a 1,000-square-foot education/conference room. Offices for I&M, air quality, and vegetation management staff are also housed in the building to optimize collaborations between "outside" scientists and park staff.

**Chihuahuan Desert Network: Big Bend
National Park (TX) and Nearby Mexican Parks.**

To address the importance of these sites for conserving biodiversity and the identification of landscape connectivity and fragmentation as high-priority environmental indicators for these parks, network staff designed a new study to assess the suitability of habitat and landscape connectivity among Big Bend National Park, Cañon de Santa Elena in Chihuahua, Mexico, and Maderas del Carmen in Coahuila, Mexico. Ecological, biogeographical, and landscape modeling and population genetics will be used to predict the distribution of four carnivore species—kit fox (*Vulpes macrotis*), ringtail (*Bassariscus astutus*), gray fox (*Urocyon cinereoargenteus*), and striped skunk (*Mephitis mephitis*)—and to develop a linkage map that illustrates the quality of corridors connecting suitable habitat patches.

Cumberland/Piedmont Network: Mammoth Cave National Park (KY). Network staff developed a video executive summary (VES), a short, narrated PowerPoint presentation addressing the results of cave cricket monitoring at the park. This effort utilizes new media to better communicate the results of vital signs monitoring with park resource management officials and the public. VES was designed to entice busy park officials to watch a short,

dynamic presentation, supplementing traditional media such as executive summaries. Each VES will be posted on its respective vital signs website to inform the public as well as park management.

**Eastern Rivers and Mountains Network
Parks (NJ, NY, PA, WV).** As part of the network's Landscape Dynamics Protocol, socioeconomic indicator atlases were completed for each park. These atlases provide park managers, planners, community leaders, and others with a better understanding of changing human activities and socioeconomic conditions in the area surrounding national park units.

Greater Yellowstone Network: Grand Teton National Park (WY) and Yellowstone National Park (ID, MT, WY). The ability to use the highest quality science information to manage park resources is one step closer as a result of the Greater Yellowstone Science Learning Center website at www.greateryellowstonescience.org. Nearly 300 researchers work in these parks each year, producing more than 200 papers, manuscripts, books, and book chapters. To address the challenge of collecting, summarizing, and making this scientific information accessible, this website was developed as a portal for park managers, scientists, educators, students, the media, and the general public. NPS staff and cooperating scientists are already creating products for a web portal to help people understand park resources and management issues at various levels of complexity.

Heartland Network Parks (AR, IL, IN, KS, MN, MO, NE, OH). Network staff developed a protocol that represents the first attempt anywhere to conduct annual monitoring of aquatic vegetation, invertebrates, and fish and their respective habitats (in-stream and riparian) in large spring ecosystems. There has never been a complete, published inventory of the aquatic vegetation, invertebrates, and fish from these springs, which are some of the largest springs in the United States. The protocol calls for annual, long-term monitoring that will provide critical information on long-term status and trends and a foundation for other scientists to develop protocols for monitoring similar springs around the world.

North Coast and Cascades Network: Olympic National Park (WA), San Juan Island National Historical Park (WA), and Lewis and Clark National Historical Park (OR). One component of the North Coast and Cascades Network Intertidal Protocol is rocky intertidal community monitoring. The network hosts the highest diversity of intertidal invertebrates and seaweeds along the entire west coast of North America. In 2008, four rocky intertidal monitoring sites were established in Olympic, along with two San Juan Island sites, and one Lewis and Clark site. The network will examine trends in light of water temperature, another component of the protocol. Temperature is a key driver of community structure and diversity and is predicted to be altered by global climate change.

Northeast Coastal and Barrier Network: Cape Cod National Seashore (MA). The Herring River restoration project is potentially one of the largest wetland restorations in the northeastern U.S. The I&M vegetation map supported hydrologic modeling for the project, as the map and field observations data provided the best available land cover information for existing conditions for the National Environmental Policy Act restoration process. Adaptive management and permitting processes will weigh land cover types resulting from changed conditions—e.g. uplands may become marsh, freshwater marsh may become tidal marsh, tidal cycles may be restored to freshwater bogs.

Servicewide Effort. The “Connect the Dots” effort is a strategic, long-term framework for coordinating the efforts of the I&M networks, Watershed Condition Assessment Program, park planning, park-funded monitoring and research relevant to assessing natural resource condition, and other research and monitoring efforts. A natural resource summary table will eventually be developed for each park as part of the park’s resource stewardship strategy document. This year, the 32 I&M networks are developing the first draft of a vital signs summary table for each park, which will feed into the larger natural resource summary table. The “current condition” estimates for selected vital signs that I&M networks routinely provide will be a major contributor to development of the natural resource summary table and will help managers and planners see

how I&M scientific achievements relate to the watershed condition assessment and resource stewardship strategy efforts.

San Francisco Bay Area Network: Muir Woods National Monument (CA). Coho and steelhead monitoring is conducted during three crucial periods in the life cycle of the salmon: juvenile, adult, and smolt. Spawner survey results indicated a dramatic decline during the 2007–2008 coho salmon run. The Olema Creek watershed total redd production for this year class declined by 80% from the 2004–2005 year class levels. The largest decline was observed in Redwood Creek, where total redd production declined by 99% for this year class. These dramatic declines track regional declines noted throughout the California Coast. Preliminary coho smolt production estimates indicate lower than normal overwintering survival rates, which ranged from 29% in Redwood Creek to 8% in Pine Gulch. In contrast to the adult escapement and smolt production, spring rearing survival rates were higher than normal during the spring and summer of 2007.

Sonoran Desert Network: Montezuma Castle National Monument (AZ). In summer 2008, network staff detected relatively high levels of lead in Wet Beaver Creek at Montezuma Well, a unit of Montezuma Castle National Monument. Aqueous lead concentrations exceeded the U.S. Environmental Protection Agency partial body contact limits, indicating a significant human and ecological health issue. Network staff quickly alerted park staff to take appropriate precautions and avoid exposure. Initial investigations suggest the elevated levels may be the result of natural leaching of mineral deposits upstream of the park, though a more detailed study is planned for 2009.

Partnerships / Leveraging

Greater Yellowstone Network: Grand Teton National Park (WY) and Yellowstone National Park (ID, MT, WY). Long-term network monitoring began in 2004 to detect amphibian declines should they occur. Following years of drought in the Greater Yellowstone Ecosystem, amphibians and their habitat responded vibrantly to the wet winter and spring of 2008. While this snapshot indicates the resilience of the region’s

native amphibians, whose widespread distributions and long lives as adults allows them to endure years of drought, it also suggests their vulnerability if climate change results in extended periods of unrelieved drought and shrinking wetlands. The monitoring also detected the threat of amphibian disease, with mass mortalities of Columbia spotted frogs and tiger salamanders; the suspected cause was ranavirus. The events in Yellowstone suggest both the importance of field surveys in which disease victims are collected for analysis and the need for research on other diseases, including their vectors and causes.

Greater Yellowstone Network Parks (ID, MT, WY). The significant outbreak of mountain pine beetle at parks in the Greater Yellowstone Network led to intense research in recent years to address the status, trends, and restoration of the highly valuable whitebark pine. Whitebark pine is viewed as a foundation species capable of changing forest structure and ecosystem dynamics in the subalpine zone. The latest research has shown that mountain pine beetle activity increases significantly in whitebark pine with heavy white pine blister rust infection, a finding that has raised concerns regarding the health of the tree since the I&M Program established that blister rust infection is wide-spread, albeit at low proportions throughout the Greater Yellowstone Ecosystem. The results from monitoring will be used by the Greater Yellowstone Coordinating Committee whitebark pine subcommittee, which is developing an ecosystem-wide restoration plan.

Chihuahuan Desert Network: White Sands National Monument (NM) and Sister Park Área de Protección de Flora y Fauna Cuatrociénegas (Mexico). A grant through the Intermountain Region International Conservation Office Sister Parks Program funded a three-day workshop held in early September 2008. Participants included representatives from two Mexican parks and the Mexican northeastern regional director for the Natural Commission of Protected Natural Areas, staff from White Sands National Monument and Chihuahuan Desert Network, and other university researchers. The network facilitated this effort by leading the Mexican participants through scop-

ing resource issues, identifying management concerns, and identifying vital signs that may be important to the sister park. If both park units use similar monitoring protocols, the exchange of information and data will be enhanced, and the data may be combined to detect trends or changes occurring across a broader area.

Gulf Coast Network: Gulf Islands National Seashore (FL, MS), Jean Lafitte National Historical Park and Preserve (LA), Natchez Trace Parkway (AL, MS, TN), and Vicksburg National Military Park (MS). New LIDAR (Light Detection and Ranging) datasets were collected at Vicksburg and portions of Natchez Trace, along with large portions of Gulf Islands immediately after the passage of Hurricane Gustav in September 2008. This emergency effort was possible because several NPS Programs, including the Geologic Resources Program and the national I&M Program, were able to combine funds and partner with the U.S. Geological Survey Storm Response project to expand data collection to areas of NPS interest. In addition, network staff continued their collaborative effort with U.S. Geological Survey and Florida Integrated Science Center to collect and analyze EAARL (Experimental Advanced Airborne Research LIDAR) data for detecting change in vegetation and coastal topographic features. The team developed and performed extensive analyses of Jean Lafitte National Historical Park and Preserve/Barataria Preserve vegetation data to evaluate the LIDAR-based models and began collaborative development of the vegetation models at Gulf Islands National Seashore/Naval Live Oaks Unit to develop methods for analyzing change in vegetation over time.

Mediterranean Coast Network: Santa Monica Mountains National Recreation Area (CA). The preliminary vegetation map delivered to the park in August 2007 has become the data layer most requested by partners and outside agencies. Interest has been extremely high, and the data have already been used in a variety of reports and analyses. The map, which follows the NPS Vegetation Mapping Program Standards, includes more than 50,000 mapped units ranging from native vegetation associations to land use types at the urban edge. This map will provide the critical



Dr. Lauren Nolfo-Clements (LSU Cooperator, left) and Nancy Walters (Resource Management Specialist) are assessing tree-canopy coverage as part of the sampling being performed on Jean Lafitte National Historical Park and Preserve to provide ground-truth assessment of the LIDAR classification model under development for the Gulf Coast Network vegetation monitoring protocol.

Photo: Robert Woodman

baseline for the design and implementation of all long-term vegetation monitoring in the Santa Monica Mountains. Currently park staff are evaluating the accuracy of the map and expect to complete the accuracy assessment by the end of calendar year 2009.

Northern Colorado Plateau Network: Zion National Park (UT). The Utah Division of Water Quality (UDWQ) removed Zion National Park's North Creek from its 303(d) list of impaired water bodies based on monitoring results indicating that high salt concentrations are a natural result of underlying geology. Under the Clean Water Act (CWA), states must identify all waters that do not meet or are not expected to meet water quality standards. These waters have become known as "303(d)" water bodies after the CWA section in which the requirement is contained. The National Park Service has also petitioned the UDWQ to upgrade classification of North Fork Virgin River from secondary-contact to primary-contact recreation; reclassification is pending.

Southeast Alaska Network: Glacier Bay National Park and Preserve (AK). To assess the health and disease status of harbor seals (*Phoca vitulina*), the network supported a partnership between the park, University of Alaska–Fairbanks, Oceans Alaska Science and Learning Center, Alaska Department of Fish & Game, and the Alaska Sealife Center. The study will assess contaminant load and health status in the context of the recent population decline, representing the first systematic study of contaminant loads in an upper-trophic level predator in Glacier Bay. Archived samples collected during previous capture trips were sent for processing; analysis has begun.

Southeast Coast Network: Timucuan Ecological and Historic Preserve (FL). The network entered into an agreement with the City of Jacksonville, Florida Department of Environmental Protection, The Nature Conservancy, and the preserve to collaboratively preserve, protect, and enhance the preserve's water quality. In FY 2008, monitoring efforts resulted in more than 100,000 observations recorded at each of

three permanent monitoring stations and nearly 100 samples sent in for laboratory analysis from a long-standing transect of stations. In addition, the network funded a probabilistic survey for a complete assessment of park waters. A preliminary summary of data resulted in a jointly authored presentation at the most recent Estuarine Research Society Conference (“Water Quality Monitoring through Partnerships at Timucuan Ecological and Historic Preserve”) and other regional and national forums. One significant finding from shared data suggests slow flushing of the system, which means that preventing the inflow of contaminants and excess nutrients will be essential to the long-term management and protection of park water resources.

Southern Colorado Plateau Network: Mesa Verde National Park (CO). Six large, high-intensity fires have swept through the park in the last 15 years, drastically altering the pinyon-juniper woodlands that occur over much of the park. The Southern Colorado Plateau Network and the park collaborated with researchers to delineate the different vegetation types within the broader post-fire mixed herbaceous vegetation type. The team found that multiple pathways of post-fire succession were clearly evident in the 14 different vegetation associations they identified. They also detected significant differences in the susceptibility of the 14 associations to invasive plants, and the patterns were different for invasive forbs—primarily musk thistle (*Carduus nutans*)—and grasses—primarily cheatgrass (*Bromus tectorum*) and smooth brome (*Bromus inermis*). Unlike the native perennial bunch grasses, cheatgrass presents an unprecedented continuous fuel that threatens post-fire successional processes.

Credible Science

Great Lakes Network: Sleeping Bear Dunes National Lakeshore (MI) and Other Parks.

A five-year project on diatoms, a diverse group of algae that preserves well in lake sediments, is providing insights into historic water quality conditions. In the fifth and final year of this network study, preliminary results show changes in diatom communities over time, with accelerated trajectories in recent years that suggest climate change as the driving force. A core from Lake Manitou in Sleeping Bear Dunes National Lakeshore

shows dramatic changes in the sedimentation rate and composition over the last 150 years. The sedimentation rate increased sharply between 1900 and 1920 and switched from an organic-dominated composition to one that is carbonate-dominated. Changes in both the rate and composition correspond to changes in land use on the island. Despite abandonment of farms and the second growth of forests on the island, the sedimentation rate and composition have not returned to pre-settlement conditions, suggesting an irrevocable change in the hydrology in the basin.

Mojave Desert Network Parks (CA, NV). The network is exploring remote sensing technologies for monitoring landscape-level patterns and processes. High-resolution imagery (1 m pixel size) is becoming more available and cost-effective but is still too coarse to evaluate plant community metrics. In FY 2008, the network supported the evaluation of very high-resolution (2-3 cm pixel size) aerial photography to estimate vegetation cover and composition and augment ground-based sampling in remote, inaccessible areas. This imagery also holds promise for detecting plant community shifts and quantifying abundance and spread of invasive species.

Northeast Temperate Network Parks (MA, ME, NH, NJ, NY, RI, VT). The Northeast Temperate Network mammal inventory provided data used to develop statistical models for estimating occupancy based on multiple detection methods, as reported in the *Journal of Applied Ecology*. Findings from the network’s study of changes in important landscape characteristics across a range of scales are reported in a paper to appear in *Remote Sensing of Environment*. The network’s forest ecological integrity scorecard methodology and results will be reported in *Frontiers in Ecology and the Environment*. In addition, a number of programs supported by the network were featured prominently in a *BioScience* article about citizen science.

South Florida/Caribbean Network Parks (FL). The revised Draft Cooperative Reef Fish Sampling Protocol is a joint effort to standardize reef fish monitoring protocols and sampling design in the Florida Keys ranging from **Biscayne National Park** to **Dry Tortugas**

National Park. In March 2008, the network hosted the South Florida Reef Fish Sampling Methodology workshop, with attendees from the National Oceanic and Atmospheric Association, National Park Service, University of Miami, and Florida Fish and Wildlife Conservation Commission. The past years have seen two disparate methods of reef fish visual surveys, and this workshop was a follow-up to a meeting in spring 2006, which for the first time achieved agreement for the standardization of reef fish monitoring across all agencies.

Upper Columbia Basin Network (ID, MT, NV, OR, WA). A master's degree candidate in the Department of Conservation Social Sciences at the University of Idaho recently developed an award-winning teaching curriculum that engaged high school volunteers in the long-range scientific monitoring of camas plant (*Camassia quamash*) populations in collaboration with the Upper Columbia Basin Network. Entitled "Camas Citizen Science Monitoring Program, May–August 2007, May–June 2008," the teaching project was part of a NPS initiative to monitor selected indicator species that represent the overall health or condition of park resources. The master's candidate was presented with the Rocky Mountains Cooperative Ecosystem Studies Unit Student Award for this effort.

RESEARCH LEARNING CENTERS

Beginning in FY 2001, the National Park Service created research learning centers (RLCs) as another essential part of the NPS effort to deal with complex and challenging natural resource issues. The mission of the RLCs is to increase the effectiveness and communication of research and science in the National Park System by:

- facilitating use of parks for scientific inquiry
- supporting science-informed decision-making
- communicating the relevance of and providing access to research knowledge
- promoting resource stewardship through partnerships

Twelve RLCs were funded through the Natural Resource Challenge; an additional eight were funded through a combination of existing park base and partner support.

Centers are typically park-based but generally provide research and educational services to a network of parks. RLC support is an integral component of successful resource management, interpretation, and I&M programs at many parks.

Research continues to be a priority for RLCs. In FY 2008, research coordinators helped establish and implement more than 1,000 research projects by collaborating with researchers; many of these research projects informed park management decisions. RLC efforts helped produce more than 170 peer-reviewed journal articles in FY 2008 alone. The centers provided accommodations for more than 26,000 person-nights, saving researchers more than \$1.2 million in lodging expenses. In addition to researchers, students play an important role in RLCs: about 40% of the RLCs offer internship and fellowship programs, and more than 450 university students participated in park research this year.

Science-communication and educational activities are integrated into many research projects to promote science literacy, science-informed decision-making, and resource stewardship. Hundreds of science-communication products are produced by the RLCs each year for use by teachers, students, park staff, and the public. These include on-line multi-media features, such as video and audio podcasts and electronic field trips, along with more traditional products, such as research briefs, newsletters, brochures, resource and site bulletins, wayside and visitor center exhibits, and nature trail guides. RLCs held dozens of public workshops and seminars on specific topics such as mercury, invasive species, and wildlife conservation as well as conferences synthesizing a range of park research projects. Hundreds of teachers and thousands of students were engaged in hands-on science activities in and about parks. Internally, RLCs provided hundreds of hours of training for park resource managers, interpreters, and concessionaires. To jointly produce products that consistently convey high-quality resource information to managers and the public, RLCs collaborate with and support I&M and CESU programs.

Partnerships are the key to RLC success. In

FY 2008, RLCs engaged hundreds of park partners, including universities and schools; non-profit organizations; community groups; federal, state, and tribal agencies; and other NPS programs. RLC staff implemented and pioneered multiple citizen science programs, including “bioblitzes” and other long-term programs to monitor the health of a species or ecosystem. RLCs coordinated more than 20,000 volunteer hours and leveraged more than \$2.3 million in direct match and in-kind support. Additionally, outside funding agencies supported millions more in research projects facilitated by the RLCs. A number of projects involve multiple research learning centers, leveraging park resources and bringing park themes together:

- Geology of the National Parks Curriculum Development (nine RLCs-NSF Grant)
- California Environmental Legacy Project (two RLCs-NSF Proposal)
- National ATBIs (more than five RLCs—Centennial Challenge Program)
- NPS Tel sessions on integrating interpreters and research programs (three RLCs)

RLCs facilitate science to aid park management and science education. The examples below are only a small part of RLC activities.

Appalachian Highlands Science Learning Center: Great Smoky Mountains National Park (NC, TN). Great Smoky Mountains National Park received a \$1 million grant from Toyota, Inc. to use the park to reconnect Americans with their natural environment. The center will implement parts of the grant, including expanding science education to currently under-served audiences, adapting and expanding middle school programs to other locations in the Smokies, and expanding the high school intern program and teacher training workshops. Additionally, another grant in partnership with the Eastern Band of the Cherokee Indian’s Central School District will provide two more years of a summer science camp in which middle school students assist researchers in the field.

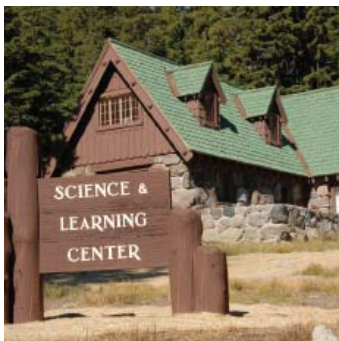
Atlantic Research Center: Cape Cod National Seashore (MA). The center works extensively on water quality monitoring projects and with the park management team to address natural resource issues. The center provides hous-

ing and lab space for research and supports nearly 50 research projects each year. Center staff continue to produce scientific publications and presentations that disseminate the results of research conducted in the park, ranging from natural history to estuarine ecology to engineering considerations for tidal restoration. Similarly, the audiences for these presentations have been extremely diverse, including students, citizens groups, and scientists and engineers.

California Mediterranean Research Learning Center: Santa Monica Mountains National Recreation Area (CA). Center staff coordinated, developed, and presented the “Technology Tools for Connecting People to Parks and Parks to People” session at the Pacific West Region/Alaska Region Superintendents/Managers Conference in La Jolla, California. Discussion focused on the **Cabrillo National Monument (CA)** wireless system and the wide range of research, education, and emergency response applications enabled by wireless communications systems. The center also hosts the Mediterranean Coast I&M website, which includes datasets and reports from the network I & M Program and the research prospectus for the network parks. The center also supports local all-taxa biological inventory work.

Continental Divide Research Learning Center: Rocky Mountain National Park (CO). In cooperation with the Center of the American West at the University of Colorado, the center convened a two-day workshop on climate change and the park. The workshop brought together many of the region’s leading biologists, physical scientists, and climatologists to assess the ecological consequences of climate change to the park, determine priorities and needs in monitoring and research, and suggest possible mitigation strategies. Workshop participants worked toward a consensus of the changes that the park will likely undergo as the region experiences climate warming. The center also facilitates workshops on bighorn sheep in the park.

Crater Lake Science & Learning Center: Crater Lake National Park (OR). This center opened in 2006 and continues collaborative research and education projects with the Oregon



The Crater Lake Science and Learning Center was created in FY 2006 from sales of license plates and park base funds. Photo: Mary Smothers

Visiting graduate student Brett Thelan trains a citizen science volunteer to monitor shellfish for the Atlantic Research Center at Cape Cod National Seashore. NPS Photo

Institute of Technology and Southern Oregon University, the primary partner universities. The center also opened its researcher housing facility.

Crown of the Continent Research Learning Center: Glacier National Park (MT). The center engages the public by recruiting volunteers. In FY 2008, volunteers contributed nearly 4,500 hours to wildlife and vegetation monitoring and native plant restoration. The citizen science program to monitor the health of common loons in Waterton-Glacier International Peace Park engaged 120 volunteer observers, including 26 staff members, for approximately 300 surveys. Two new citizen science projects in 2008 included the mapping of non-native invasive plants in the backcountry and a high-country citizen science project that focused on determining the status of three wildlife species whose habitat may be adversely impacted by climate change.

Great Lakes Research & Education Center: Indiana Dunes National Lakeshore (IN). The center continues the study of methyl mercury in wetlands of the Grand Calumet watershed and Indiana Dunes National Lakeshore. This project may allow broad-scale studies of methyl mercury to be conducted by NPS field workers without a great deal of training and at a very modest cost compared to having specially trained field researchers collect water for analysis. Several publications have been or will be produced from this work. "Park Break! 2008" was a field-based seminar designed to give students at the PhD and masters levels a chance to interact with park scientists, managers, and policy-makers while exploring issues of importance to parks and protected areas on the wildland-urban interface. The National Park Service, Texas A&M University, U.S. Geological Survey, Student Conservation Association, and George Wright Society co-sponsored the program.

Greater Yellowstone Science & Learning Center (WY). During FY 2008, the Greater Yellowstone Science Learning Center website (www.greateryellowstonescience.org) continued to grow. More than 20 new resource briefs, four overviews, and other products on natural and cultural resources for **Yellowstone and Grand Teton National Parks** and **Bighorn Canyon National Recreation**

Area (MT, WY) were completed and posted; many other pages were updated. The center website is the definitive source, regardless of who funds the studies, for scientific information on the resources considered most important to track in order to monitor ecosystem health and make informed management decisions at the three units. Center staff gathered existing information, previously scattered in various locations and formats, and developed new information and outreach products and made this information accessible through the website. In 2008, new partners joined the center, including the Yellowstone Association, Montana State University's Computer Science Department, and the Sonoran Institute. Using Centennial Challenge funds, a website usability assessment and evaluation was started. During the three-year review for the Greater Yellowstone Vital Signs Network, an independent panel highlighted the network's excellence in science-communication through the Greater Yellowstone Science Learning Center.

Jamaica Bay Institute: Gateway National Recreation Area (NY, NJ). The Jamaica Bay BioBlitz, held by the Jamaica Bay Institute, resulted in two publications in 2008. More than 250 volunteers attended the all-taxa BioBlitz and assisted scientists in documenting 365 species throughout the Jamaica Bay Unit of Gateway. This year, the results of the event were verified and published as an informative eight-page booklet highlighting interesting finds and general results. Staff developed a Microsoft Excel database of the raw data, which can be accessed at www.nps.gov/gate/jamaica-bay-bioblitz.htm. Overall, the BioBlitz was a huge success; due to popular demand, the institute plans to host a second event this upcoming fall. Additional accomplishments include the Natural Resources Research Opportunities Catalogue for Jamaica Bay, prepared by the Jamaica Bay Institute and North Atlantic Coast CESU, and the annual Tri-State Harbor Herons and Colonial Water Birds conference.

Learning Center of the American Southwest. The center continues to collaborate closely with three I&M networks and the Greater Yellowstone Science Learning Center to pioneer a comprehensive science and natural history website for more than 40 parks in the

American Southwest. Center staff actively support efforts by additional RLCs and I&M networks to follow this robust and efficient strategy for disseminating information to managers, stakeholders, and the public.

Mammoth Cave International Center for Science and Learning: Mammoth Cave National Park (KY). The center continues to support and coordinate many cave-related research projects that inform management, assist in the re-lighting of Mammoth Cave, provide research-based field experiences for high school and college students as well as adult learners, and partner with Western Kentucky University's Hoffman Institute to provide intensive, week-long, field-based workshops and classes during the summer.

Murie Science and Learning Center: Denali National Park (AK). The center promotes park research priorities via fellowships. The Murie Science and Learning Center Fellowship Program used funds from the Alaska Geographic Association to extend fellowship opportunities across the Murie network (consisting of eight parks in the Central Alaska and Arctic I&M Network) to fund projects on wood frogs, retreating glaciers, climate change and permafrost carbon, treeline advance in **Noatak National Preserve**, and Dall's sheep.

North Coast and Cascades Research Learning

Network: North Cascades National Park (WA). In 2008, the network focused on communicating the presence of the network's I&M Program and building public awareness of its value. As time passes, more emphasis will be placed on disseminating and interpreting the results of monitoring. To aid with this, the network committed funding and staff support to a cooperative agreement with Colorado State University and the Natural Resource Program Center Office of Education and Outreach. The agreement was used to draft a science-communication plan for the network and develop sample communication materials (e.g., resource briefs, video podcasts, and graphic identity materials).

Ocean Alaska Science & Learning Center: Kenai Fjords National Park (AK). The center has taken the lead in Alaska for development of the state's strategic ocean park plan and manages, in collaboration with the National Park Foundation, the Alaska Region Coastal and Marine Grant Program. The center synthesized current climate change research and utilized the information to develop a presentation for staff and the general public, resulting in raised awareness of the potential impacts of rapid climate changes to northern ecosystems.

Old-Growth Bottomland Forest Research and Education Center: Congaree National Park

Participants work with laptops and handheld devices as they explore Sunshine Creek during the Denali Susitna Exploration Camp offered through the Murie Science and Learning Center. NPS Photo



(SC). The center sponsored the 2008 Congaree National Park Research Symposium, which showcased research conducted at Congaree over the last 30 years. The center provided additional products and services to support current research projects and provide useful information to park management, including spatially explicit maps that delineated search areas for ivory-billed woodpecker (*Campephilus principalis*) research efforts. Furthermore, the center developed and provided an array of high-quality science and citizen science education programs that integrate with on-the-ground science programs.

Pacific Coast Science and Learning Center: Point Reyes National Seashore (CA). Center staff analyzed 13 years of legacy I&M data, which resulted in a peer-reviewed journal publication that is informing wilderness management at the park. The center also continued a highly successful high school science program for underrepresented students that immerses them in research projects with park staff and university scientists each summer. The staff also expanded collaboration with the I&M Network, including hosting joint positions and projects in science-communication for the network, and with the interpretation program, including initiating an ocean education and outreach program with the National Oceanic and Atmospheric Administration that will reach thousands of visitors.

Schoodic Education and Research Center: Acadia National Park (ME). Acadia Partners for Science and Learning started a program in cooperation with the Maine Department of Education and the University of Maine to use research at Acadia as the basis for inquiry-based science programs in Maine high schools. The program engages hundreds of teachers and students in high-quality lab and field-based science education. Acadia Partners built and extended partnerships with the Center for Science and Mathematics Education Research at the University of Maine, the Senator George J. Mitchell Center for Environmental and Watershed Research, and the College Board. These partnerships have focused in different ways on promoting resource stewardship by training teachers. More than 60 people volunteered 1,850 hours in conducting the park's sixth annual BioBlitz

focusing on true bugs (Hemiptera). The center continued the L.L.Bean Fellowship Program to support high-priority research projects.

Sierra Nevada Research Institute at Yosemite (CA). The institute was established as a University of California field station in collaboration with the University of California–Merced, offering programs for underrepresented youth from California's Central Valley to participate in hands-on research programs. The center also has a full time UC faculty member on site to perform and coordinate research in the park.

Urban Ecology Research Learning Alliance: National Capital Parks (DC). The alliance facilitated three researcher-led workshops that connected science and park research projects to managers. It also began the Urban Ecology Science and Education Program with pilot urban ecology internships designed to provide much-needed on-the-ground support to natural resource managers and give students the opportunity to explore careers in science and natural resource management with the National Park Service, become familiar with issues in the field of urban ecology, and gain hands-on work experience.



Chapter IV: Natural Resource Preservation Program

Established in 1981, the Natural Resources Preservation Program (NRPP) provides funding to parks for natural resource management projects that are beyond the scope of base-funded park budgets. The NRPP supports diverse park-level activities, including wildlife, fisheries, and vegetation management; specialized inventories; planning; mitigation actions; and restoration activities.

Through the Natural Resource Challenge, funding for NRPP increased from \$5,432,000 in FY 2000 to \$12,789,000 in FY 2003; however, recent budget cuts have decreased NRPP funding in FY 2008 to \$8,100,000. Since 2005, NRPP has lost \$4,689,000 to these funding reductions. In addition, regions were allowed to assess NRPP projects up to one percent of their budget to provide funding for contingency uses. These reductions translate into 20 to 25 fewer on-the-ground projects in parks per year—and reduced performance outcomes.

The NRPP continues to serve as a comprehensive, accountable funding source for resource management projects. Pre-panel technical reviews, professional cost estimates, and Servicewide Comprehensive Call (SCC) guidance continue to increase the accountability and efficiency of this funding source. Over half of NRPP funds are available for general park-level natural resource management projects. The balance of the 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

(see Table 4.1). A complete list of all NRPP projects is included in Appendix B.

Natural Resource Management Projects (\$3,140,000)

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.

To receive NRPP–Natural Resource Management funding, regions must submit high-priority park project proposals for review and ranking by a panel of subject-matter experts. The panel provides project funding recommendations to the NPS associate director for natural resource stewardship and science based on project quality, resource threats, and other factors. Not all highly ranked projects are funded as a result of this review. Highly ranked project proposals in excess of anticipated funds generally must be resubmitted and re-compete during the next SCC. Projects must cost at least \$50,000 but no more than \$900,000 and be complete within three years. Many projects require at least two years to complete; most require three. Projects receive their funding annually and are subject to review and approval through an annual accomplishment report.

The total number of projects funded through the NRPP–Natural Resource Management Program has significantly decreased since

Table 4.1

NRPP Funding Categories		
Type of project	Number of Projects	Actual Allocation (\$)
Natural Resource Management	33	3,140,000
Threatened and Endangered Species	11	467,000
Disturbed Lands Restoration	13	790,000
Small Park	62	933,000
Regional Block Allocation	74	1,303,000
Alaska Projects	11	467,000
USGS/BRD Technical Assistance	Not Reported	236,000
Servicewide Projects	25	764,000
Total	229	\$8,100,000

At Hawaii Volcanoes National Park, staff used NRPP funds to create three fenced enclosures for the federally endangered Mauna Loa silversword (*Argyroxiphium kauense*). The enclosures protect the plants from non-native ungulates in the Kahuku unit of the park.

FY 2002, from a high of 82 projects in FY 2002 to 33 projects in FY 2008. The majority of projects funded fall within these categories: restoration, invasive species control, resource assessment and mapping, and natural resource management plan development. The following examples highlight some of the FY 2008 NRPP–Natural Resource Management projects.

Great Smoky Mountains National Park (NC, TN). The park contains an extraordinary diversity and abundance of native species and plant communities. Of the more than 1,600 vascular plant species in the park, however, more than 20 percent (315 species) are exotic. These exotic species affect the diversity, abundance, and habitat function of native species throughout the park, including in more than 50 acres of wetland habitat. Park staff, with the assistance of an AmeriCorps team, worked to eradicate exotic species at 11 targeted wetland sites and restore native plant communities using plant materials propagated from remnant on-site populations. In FY 2008, exotic plants were controlled on 9.5 acres of wetlands. Native species were planted at five of the treatment sites, and seeds were collected for future restoration efforts.

Jean Lafitte National Historical Park and Preserve (LA). The park initiated a project to determine the effectiveness of prescribed fire and the appropriate burning season to control Chinese tallow (*Triadica sebifera*) within marshes at the Barataria Preserve. In 2007, researchers sampled vegetation within the marsh to determine pre-burn Chinese tallow densities and native community structure and composition. All field sampling was repeated in September 2008. Samples are still being processed from the 2008 field season, and data are being entered. Due to weather and administrative issues, burning did not occur in the first year, and project leaders will review project goals contingent on a cool-season burn this winter.

Saguaro National Park (AZ). The invasive buffelgrass (*Pennisetum ciliare*) is designated as a noxious weed in Arizona; by out-competing native species and promoting intense fires, it threatens to alter the Sonoran Desert vegetation and cause local extinctions of saguaros. A multi-year project aims

to remove invasive buffelgrass and fountain grass from the south-facing slopes of the Tanque Verde Ridge, restore habitat for four sensitive animal species—the Sonoran desert tortoise (*Gopherus agassizii*), gila monster (*Heloderma suspectum*), lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*), and cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*)—and increase public knowledge of exotic plants and their ecological impacts. In FY 2008, park staff and volunteers treated 653 acres of the invasive grasses using lessons learned from the establishment of experimental plots. Park staff developed site bulletins and briefing statements about the project and participated in 22 community events in 2008. Despite the park’s progress, buffelgrass continues to spread; the park continues to aggressively fight this species.

Servicewide. The effects of light pollution are being quantified throughout the National Park System. This project continued a Servicewide strategy of inventorying night sky quality, allowing some parks to begin outreach programs and engage surrounding communities on light pollution issues. A park lighting guideline for **Cape Hatteras National Seashore (NC)**, which will protect threatened loggerhead sea turtles, is underway. Data collection is complete at eight of the 20 parks and is in progress at an additional eight parks. Data has yet to be collected for four parks.

Upper Delaware Scenic & Recreational River (NY, PA). The Upper Delaware River provides high-quality habitat for nesting bald eagles. Staff began a project to determine the most important habitats for bald eagles along the river, map these habitats by type of use, and prioritize these areas for protection. Researchers document habitat utilization through performing field observations, live-capturing and fitting birds with radio and satellite transmitters, and tracking habitat use. Sixteen bald eagles and one golden eagle were live-captured and fitted with transmitters. Because nesting-pair territories along the river average approximately five to six river miles, they seem to be approaching full occupation of the 73.4 miles of river. Twenty-nine young fledged from 13 of 15 active nests; this average of 2.23 young fledged per successful nest is attributable to the high-quality habitat found in this area.



In FY 2008, park staff and volunteers treated 653 acres of invasive grasses at Saguaro National Park (AZ) using lessons learned from the establishment of experimental plots. The foreground shows an area post-treatment.

Thousands of school children follow the migrations and movements of tagged bald and golden eagles every year at <http://learner.org/jnorth/eagle/>. The Eagle Institute's eagle watcher volunteers contacted more than 7,100 visitors at six locations in the Upper Delaware area, educating and enabling visitors to observe bald eagles in a non-disruptive manner during the wintering season, a stressful and critical survival time for bald eagles.

Wind Cave National Park (SD). In 2005, the U.S. Geological Survey Northern Prairie Wildlife Research Center and the National Park Service initiated a cooperative study of elk population ecology. Researchers marked 205 elk with GPS collars that track location and collect additional data, such as pregnancy status. An interim report included preliminary estimates of the park areas used by elk, rates of egress, cause-specific mortality rates, and age-class-specific pregnancy rates. Results will be updated, finalized, submitted for publication, and presented at professional conferences during FY 2009. The project's outreach component included development of a slide program for the visitor center and presenta-

tion of preliminary results at 25 public programs and four public meetings for the park's elk management plan/environmental impact statement. Researchers continue to share information with Custer State Park, South Dakota Game Fish and Parks, the Rocky Mountain Elk Foundation, ranching and hunting groups, and the Elk Partnership Group.

Threatened and Endangered Species Projects

NRPP funding for projects on threatened and endangered (T&E) species helps implement the Natural Resource Challenge and meet NPS strategic plan performance management goals. The long-term goal of the Threatened and Endangered Species Program is to increase the number of park populations of listed species that are making progress toward recovery and to restore these species when they have been extirpated from parks. The program funds on-the-ground conservation efforts. In FY 2008, \$467,000 was allocated specifically for these projects. The following examples highlight some of the FY 2008 NRPP-Threatened and Endangered Species projects.

Big South Fork National River and Recreation Area (KY, TN). In conjunction with the Kentucky Division of Fish and Wildlife Resources and several federal agencies, the park began to propagate and augment several federally listed mussel species. In June 2008, 300 adult mussels were restored to the river. Species included the dromedary pearlymussel (*Dromus dromas*), oyster mussel (*Epioblasma capsaeformis*), fluted kidneyshell (*Ptychobranchus subtentum*), and spectaclecase (*Cumberlandia monodonta*). Biologists checked the mussels in September and found them to be in good health; biologists will recheck them again in spring 2009. Also in spring 2009, biologists will release about 500 common mussel species into the river; these mussels are currently held in a quarantine facility to ensure their health.

Ebey's Landing National Historical Reserve (WA). Golden paintbrush (*Castilleja levisecta*) was once a common component of native grasslands in Washington, Oregon, and British Columbia. Federally listed in 1997, the threatened species now exists in only 11 populations, four of which are within the reserve. Working in conjunction with other federal and state agencies, non-profits, non-governmental groups, and the University of Washington, park staff implemented a multi-year recovery plan for the species, which included continuation of paintbrush habitat restoration, monitoring of natural and restored populations, and expansion of science communications. Outreach included a U.S. Forest Service brochure and a website created by the Whidbey Land Trust to highlight prairie restoration (www.northsoundprairies.org/). In FY 2009, park staff will continue outplanting and monitoring of paintbrush, develop interpretive signs for two sites, and expand the website to include pages on paintbrush restoration.

Hawaii Volcanoes National Park (HI). Park staff initiated a project to establish at least 5,000 individuals of the federally endangered Mauna Loa silversword (*Argyroxiphium kauense*) in three fenced enclosures protected from non-native ungulates in the Kahuku unit of the park. In 2007, 4,322 individuals were planted; in 2008, the planting of 3,454 individuals completed the project. The total area protected in the enclosure (45 acres)

exceeded the project goal of 29 acres and will accommodate additional plantings in the future. Outreach efforts include a video podcast and an exhibit in the Kilauea Visitor Center describing park restoration efforts. Project partners included the Hawaii Silver-sword Foundation, University of Hawaii's Volcano Rare Plant Facility, U.S. Geological Survey Biological Resources Division, U.S. Fish and Wildlife Service, Hawaii Division of Forestry and Wildlife, and Hawaii Department of Corrections.

Kalaupapa National Historical Park (HI). Critically endangered monk seals (*Monachus schauinslandi*) frequent the park's beaches but little was known about their distribution. Working in cooperation with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service, the park examined spatial distribution patterns, foraging activity, nursing behavior, and mother-pup requirements of critically endangered monk seals around the park. Results of the distribution study showed that monk seals preferred the park's remote sandy beaches for pupping and then expanded their foraging activity to deeper depths and habitats off West Molokai as animals matured. A graduate student from the University of Hawaii-Hilo examined mother-pup requirements, and volunteers will conduct surveys outside the park boundaries. The work is ongoing; results will be submitted at the end of the calendar year.

Mojave National Preserve (CA). Mojave National Preserve is home to the sole remaining source population of the endangered Mohave tui chub (*Gila bicolor mohavensis*). To learn more about possible effects of the mosquitofish, an introduced species, on the Mohave tui chub, staff tested the impact of mosquitofish on the survival of Mohave tui chub larva. The study found that mosquitofish appeared to have no effect on larval survival; in fact, mosquitofish populations declined over the course of the study. Most remaining mosquitofish were large females, suggesting that Mohave tui chubs were preying on the mosquitofish. The study also collected chubs from several locations to gather life history descriptions, which will be completed in 2009.

Organ Pipe Cactus National Monument (AZ). The monument continues to partner with

the Arizona Game & Fish Department, U.S. Fish and Wildlife Service, Pinacate Biosphere Reserve (Mexico), and other U.S. agencies to operate the Sonoran Pronghorn Semi-Captive Breeding Facility, which aims to boost recovery of the endangered Sonoran pronghorn (*Antilocapra americana sonoriensis*). The facility is located on the Cabeza Prieta National Wildlife Refuge, adjacent to the monument. As of October 2008, the facility contained 54 Sonoran pronghorn, with 25 fawns born in 2008. Five pronghorn were released in 2008; two died, likely due to epizootic hemorrhagic disease. The facility expects to release a much larger numbers of pronghorn into the wild in future years. In 2009, the first releases into the monument may take place.

Presidio of San Francisco (CA). The rare annual, endangered plant species Presidio clarkia (*Clarkia franciscana*) and the threatened Marin dwarf-flax (*Hesperlinon congestum*) are adapted to xeric (dry) and nutrient-poor conditions and are threatened by competition from exotic grasses. The park initiated a project to stabilize populations of these species by reducing exotic grasses and restoring degraded habitat. In 2007, a researcher developed an experimental design for habitat restoration; the final report is pending. In areas where invasive trees were removed, grassland restoration continues. A task agreement was awarded in FY 2008 to Golden Gate National Parks Conservancy (GGNPC) to develop an experimental design for new questions related to the Presidio clarkia and the Marin dwarf-flax habitat restoration. The GGNPC will soon award a contract for research to continue.

Disturbed Lands Restoration Projects

In FY 2000, the Natural Resource Challenge established the Disturbed Lands Restoration Program, which provides funding for parks to restore disturbed lands. Disturbed lands are those park lands where the natural conditions and processes have been degraded, damaged, or destroyed by development (e.g., facilities, roads, mines, dams) and/or by agricultural practices. Restoration is the process of assisting the recovery of these disturbed areas through direct manipulation of degraded ecosystem components.

Past mining continues to be a major issue on NPS lands, leaving an estimated 3,100 sites with 8,400 mined features in 126 units of the National Park System. On July 25, 2008, the Department of the Interior's Inspector General (IG) released *Audit Report: Abandoned Mine Lands in the Department of the Interior*. The report focused on human health and safety issues at abandoned mine land (AML) sites on NPS lands and concluded that the NPS AML program was in need of a firm commitment to protect the public, sustained funding, and dedicated staff. In response, the NPS director issued a memorandum to address a course of action with timelines for how the NPS will address the concerns raised by the IG. The program's primary objective now is to oversee implementation of the IG's recommendations, particularly in coordinating the temporary or long-term closures of high-risk sites, finalizing the Servicewide AML database, and identifying present and future funding sources.

In FY 2008, the Disturbed Lands Restoration Program administered \$764,750 in NRPP funding for 14 park projects, distributed through three NPS regions. These projects restored nearly 619 acres of severely disturbed land. The following examples highlight some of the FY 2008 NRPP-Disturbed Lands Restoration projects.

Carlsbad Caverns National Park (NM). Since the 1920s, several generations of trails facilitated visitation in Carlsbad Cavern. The trails and their associated infrastructure affected cave resources, burying habitat for native fauna, introducing chemicals into the caves, upsetting the nutrient balance of the cave system, and creating an environment for non-native microbes to thrive and native microbes to over-populate. The park removed and rehabilitated some of the infrastructure within Carlsbad Cavern to remove sources of contamination and nutrient sources for non-native microbes. The park also restored areas that were heavily impacted by trail development and use to provide a more suitable habitat for cave fauna.

Hawaii Volcanoes National Park (HI). The endangered Hawaiian goose or nene (*Branta sandvicensis*) breeds in the former Kipuka Nene Campground in the park. To return

the campground to a natural landscape while improving goose habitat, park staff removed campground infrastructure and manipulated the land to aid in recovery. Features were removed (parking area and outhouses) or obscured (former access road), and the land was recontoured as necessary. Exotic plants were removed. Throughout the area, staff planted eight native plant species that were propagated in the park's nursery. Nene use of the area was monitored throughout the duration of the project. Overall, the project was effective at removing the former campground while restoring a natural viewscape and an inconspicuous brooding site for the nene.

Mammoth Cave National Park (KY). Twenty-six open wells or cisterns and three dumps in the park posed a serious threat to people and wildlife. Open shafts could entrap people, although no such incidents had occurred. The dumps contained an abundance of heavy metal scraps and hazardous compounds, which could become mobile in the acidic soil environment and available for uptake by wildlife such as the endangered Kentucky cave shrimp (*Palaemonias ganteri*), seven species of endangered fresh-water mussels, plus Gray and Indiana bats (*Myotis grisescens* and *Myotis sodalis*). Three Student Conservation Association interns worked on a project to restore habitat in these areas. Materials were hauled away from the dumps; 2,044 pounds of metals

were recycled. The wells portion of the project is ongoing, as the staff conducts surveys of each well and formulates work plans. Elimination of the hazards led to the safeguarding of 10 federally endangered species and eliminated numerous threats to visitors and staff.

Wupatki National Monument (AZ). Perennial surface waters and riparian habitat are critical to sustaining biodiversity within the arid Colorado Plateau. At Wupatki, perennial surface water is limited to Heiser and Peshlaki springs. Heiser Spring was developed to support historic ranching, a CCC camp, and a NPS operations area during the 20th century. Numerous structures were built, and all available spring water was contained and diverted for human use. As a result, the spring is one of the most severely impacted natural and cultural resources within the monument. The National Park Service has phased out operations in the Heiser area and removed most structures. The *Wupatki General Management Plan* proposed formally abandoning the area and restoring native riparian vegetation and surface water. The project improved resource conditions, restoring approximately one-half acre of riparian habitat for migratory and breeding birds; providing a source of perennial water for wildlife, including the American pronghorn, a regional "species of special management concern"; and restoring approximately 12 acres of Colorado Plateau desert

Park staff corrected drainage and erosion on the Big Glassy Trail at Carl Sandburg Home National Historic Site (NC).



shrub vegetation. The project controlled 2.5 acres of non-native, invasive vegetation and reclaimed the cultural integrity of approximately 12 documented archaeological sites and 12 acres of cultural landscape.

Zion National Park (UT). The park *General Management Plan* (2001) recommends restoration of two miles of the Virgin River subjected to channelization since the 1920s. The ultimate goal of the project is to remove the stabilizing revetments to restore the natural connection between river and floodplain, improve riparian vegetation and aquatic habitats, and reinvigorate the natural cottonwood gallery of Zion Canyon. Planning for the project will continue over the next five to seven years. As one part of the restoration effort, the park tested revegetation methods on small areas before embarking on the larger scale. First-year results showed a decrease in plants in more disturbed sites and that seeding methods had no effect on germination. The second-year results are being analyzed and will eventually be compiled and published. In addition, the park is currently working with the U.S. Geological Survey to set up monitoring protocols for the project.

Small Park Projects

NRPP 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 (regional discretion regarding variances to this definition is allowed). These funds are provided to help small parks achieve some of their natural resource goals. Projects are generally selected during the Servicewide Comprehensive Call process. NRPP–Small Park funds are used for a wide variety of projects, including control of invasive plants, species inventory, eco-

system restoration, acoustical monitoring, and improvement of visitor safety.

In FY 2008, NRPP–Small Park funds financed 61 projects in at least 56 parks, totaling \$933,000. Table 4.2 shows the funding and number of parks/projects by region.

The following examples highlight some of the FY 2008 NRPP–Small Park projects.

Arkansas Post National Memorial (AR).

Seasonal staff, with the assistance of Youth Conservation Corps members, surveyed and treated six acres of invasive plants on the memorial unit; four of these acres received initial treatment in 2007. Staff created GIS maps of the treated areas to facilitate tracking treatment and results. The long-term goal is to move much of the affected area to a maintenance regime where exotic plants constitute less than one percent of the cover in a particular area. Forested areas that are moving toward the controlled designation receive spot treatments of plants that have re-sprouted or emergent exotic plants that grow from dormant seed. The strategy, if continued, will allow native plant communities to establish in treated areas. Monitoring of exotic plants is conducted by the Heartland I&M Network. The exotic plant program is a major component of the effort to restore ecological function to the forested areas of the memorial.

Carl Sandburg Home National Historic Site

(NC). Big Glassy Trail serves as the main access route to the summit of Big Glassy Mountain. When the Sandburg family used this trail, maintenance required only the occasional removal of branches or small trees that fell across the pathway. Today, the one-mile trail receives much heavier traffic; combined with steep trail alignment and run-off, this use

Table 4.2

NRPP—Small Park Projects			
Region	Funding (\$)	Number of parks	Number of projects
Alaska	19,000	2	2
Intermountain	242,000	15	14
Midwest	170,000	12	14
National Capital	19,000	2	2
Northeast	116,000	8	10
Pacific West	161,000	7	8
Southeast	206,000	10	11
Total	\$933,000	56	61

caused severe erosion in several areas. The granitic rock outcrops affected by trail erosion are part of a feature classified by the National Vegetation Classification System as Southern Appalachian low-elevation granitic dome, which has a rarity rating of G2, meaning that the community is globally imperiled. Park staff protected these areas by correcting the trail drainage and stopping erosion.

City of Rocks National Reserve (ID). Staff initiated a project to eradicate/control invasive plants on the reserve based on the recommendations of the City of Rocks National Reserve Invasive Plant Inventory. Work focused on the riparian areas of Circle, Trail, and Graham creeks, the primary water sources within park boundaries, which provide critical forage and shelter for native wildlife species. If noxious weeds are controlled or eradicated in the riparian areas that serve as a conduit for the spread of noxious weeds, exotic plant management can be controlled within annual operations and resources. A two-person crew treated a total of 110 acres. Target weed species included Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), musk thistle (*Carduus nutans*), field bindweed (*Convolvulus arvensis*), black henbane (*Hyoscyamus niger*), hoary cress (*Cardaria draba*), and spotted knapweed (*Centaurea maculosa*), all of which are noxious weeds in Idaho, as well as other exotic species.

Harpers Ferry National Historical Park (WV). Harpers Ferry National Park contains more than 700 acres of karst topography—a landscape dominated by sinkholes, springs, and streams that sink into subsurface caverns. This survey will identify and locate all potential cave entrances and surface karst features in the Bolivar Heights, Elk Run, and School House Ridge North and South sections of the park. Contractors with expertise in recognizing karst and epikarst features will perform the work, which is scheduled for completion by April 2009.

Sitka National Historical Park (AK). Park staff initiated a project to test Environment and Natural Resources Institute (ENRI) macroinvertebrate and algae sampling protocols to analyze the stream health of the Indian River. The project included sampling macroinvertebrates and algae, applying water

quality indexes, and comparing results with previously established index streams. Local seventh-grade students helped sample macroinvertebrates as part of the Stream Team. Testing will continue for two more years, but the results of the macroinvertebrate sampling to date indicate very high water quality. The algae sampling discovered the presence of several species of algae, including the increasing diatom *Didymosphenia geminata*, which is known to exhibit invasive-like behavior in some areas of the world.

Sunset Crater Volcano National Monument (AZ). Geology students at Northern Arizona University completed a detailed geologic survey of the entire monument and documented the baseline condition of the most unique geologic features to allow for future monitoring. Field data were collected in digital formats and incorporated into geographic information systems (GIS), along with appropriate metadata. In addition, they developed methods for repeat photography, with a list of important archival photos to re-photograph.

Regional Block Allocation Projects

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

NRPP–Regional Program Block Allocation funds are used for a wide variety of projects. For example, the Intermountain Region has funded projects that are multi-park projects, meaning the same project is conducted in several parks in that region. In the Southeast Region, the projects fall under several broad topical categories: resource inventories, ecology and species management, impacts to resources, and ecosystem restoration.

In FY 2008, NRPP–Regional Program Block Allocation funds allocated a total of \$1,303,000 to 74 projects in 52 parks. Table 4.3 shows the funding and number of parks/projects by region.



A survey crew at Badlands National Park documented fossil resources at the park, like this fossilized turtle.

Installation of a water gauge on the Taiya River, Klondike Gold Rush National Historical Park, 2008.
Photo: Dave Schirohauer.

The following examples highlight some of the FY 2008 NRPP–Regional Program Block Allocation projects.

Assateague Island National Seashore (MD, VA). Topographic maps created just after the powerful 1962 Ash Wednesday storm document the topography, shoreline, infrastructure, and habitats of northern Assateague Island, but the hard copy map format made their use difficult. A temporary student GIS technician digitized the maps and created GIS layers, providing a valuable asset for park management, improving the ability of interpretive staff to share the island’s cultural history with the public, and allowing park staff and scientists to evaluate both decadal and storm-related changes in island habitat and morphology. The data can be overlaid on current datasets, allowing for the analysis of geomorphic change and other changes in island conditions, and can now be easily distributed to researchers, partner agencies, universities, and the general public by uploading the newly created GIS data to the NPS Data Store.

Badlands National Park (SD). Badlands National Park is a 244,000-acre repository of significant mammalian and marine fossils that are at risk to erosion and fossil poaching. Currently, the park paleontologist is limited to reactive monitoring and salvage collection to support routine maintenance and construction. As a result, each year undocumented fossils worth thousands of dollars are stolen from the park. A survey crew began to document the park’s fossil resources in the Cedar Pass area, which receives high visitation, is prone to fossil poaching, and is often impacted by new construction. The Paleontology Locality Database team documented 13 new localities and completed site assessments for

seven existing paleontological sites. Three paleontological localities remain in good condition. They collected more than thirty fossil specimens, which are being prepared for curation.

George Washington Memorial Parkway (MD, DC, VA). To address a need for baseline species diversity, abundance, and habitat preference of selected insects, park staff launched a survey of seven insect groups in Turkey Run and Great Falls parks. Researchers used a variety of survey techniques based on the most successful methods for each group. To date, researchers identified 529 species. A comparison of the results with recent surveys of selected insect groups elsewhere in the region, such as on Plummers Island (Maryland) on the opposite side of the Potomac River, will be of great interest.

Gulf Islands National Seashore (FL). Two major hurricanes within a 10-month period (Hurricane Ivan in September 2004 and Hurricane Katrina in July 2005) toppled many trees and dramatically increased downed wood that could create fuel for fires in the Naval Live Oaks area. A combination of salt stress and bug infestation killed more trees. To reduce fuel loading on the western boundary, a contractor mechanically cleared the western boundary, and 64 acres were treated with prescribed fire. A contractor also cleared the eastern and northern boundaries. These efforts resulted in a proper fuel break along the boundary of Naval Live Oaks.

Sitka National Historical Park (AK). The park continues to monitor river flow on the Taiya River after removal of the U.S. Geological Survey gauge in fall 2008. A contractor helped NPS staff install a new gauge, which operat-

Table 4.3

Regional Block Allocation Projects			
Region	Funding (\$)	Number of parks	Number of projects
Alaska	187,000	4	11
Intermountain	186,000	12	13
Midwest	186,000	8	11
National Capital	186,000	6	12
Northeast	186,000	7	12
Pacific West	186,000	6	6
Southeast	186,000	9	9
Total	\$1,303,000	52	74

ed simultaneously with the existing gauge to assist in calibration. The contractor also provided training to NPS staff on monitoring stream flow, surveying a reference point, and developing and maintaining rating curves. The contractor is analyzing gauge data and will provide a report on the 2008 water year.

Zion National Park (UT). Park staff initiated a project to determine the impacts of encroaching development on the threatened desert tortoise (*Gopherus agassizii*) population. The project included both research and a significant educational component. In the first year, staff monitored radio-tagged tortoises and created more than 40 posters and 27 activities for the local community. Event messages progressed from generating interest and pride in the local desert tortoise population to providing tools for citizens to participate in stewardship. In the second year, park staff surveyed tortoises in conjunction with state-trained biologists and presented six outreach programs. Because crews encountered only two tortoises during transect surveys, they will change the focus to locational/behavioral questions (e.g., home range size, use of park compared to use of land in town, habitat use, seasonal movement patterns, patterns in colonial vs. individual burrow use). Results will be applied to management of this species and will become the focus of educational programs.

Alaska Special Projects

This funding category was established in FY 2003 to enable the National Park Service to undertake projects that improve the protection and management of Alaska's NPS units, which are managed under the Alaska National Interest Lands Conservation Act and other Alaska-specific requirements. Selection criteria for projects supported through this source included appropriations language, proposal reviewers' recommendations, and park and regional priorities. Alaska Special Projects funding focused on the highest priority natural resource projects that lacked adequate funding from other sources.

In FY 2008, NRPP-Alaska Special Projects funds allocated a total of \$467,000 to parks. The following examples highlight some of these projects.

Denali National Park and Preserve (AK). The park contains significant unidentified paleontological resources. To address this, park staff initiated a two-year field project to identify paleontological resources (dinosaur fossils or trace fossils) in the Cantwell Formation; develop a feature or site risk assessment of those resources; provide research, education, and interpretation opportunities; and present management priorities and options for their protection. To accomplish this project, the park initiated a CESU agreement with the University of Alaska-Fairbanks and the Dallas Museum of Science and Natural History.

Denali National Park and Preserve (AK). The park continued to document the nonvascular flora of Denali and make an assessment of the completeness of the nonvascular plant inventory data for two other parks in the Central Alaska Network (**Yukon-Charley Rivers National Preserve** and **Wrangell-St. Elias National Park and Preserve**). Progress for all three parks this year included compilation of the known information on nonvascular specimens and creation of a database containing all documented and expected nonvascular plant species (mosses, lichens, and liverworts). In the comprehensive nonvascular plant inventory of 15 sites in Denali, researchers collected more than 400 voucher specimens, which identified several new locations for the globally rare boreal felt lichen (*Erioderma pedicellatum*), previously not known to occur in Alaska. Many new taxa to Denali were documented through this work; final totals will be known in the spring.

Wrangell-St. Elias National Park and Preserve (AK). To support the preparation of an environmental impact statement for off-road vehicle use in the Nabesna District, the park collected information on wetlands, vegetation, scenic quality, and invasive species. Accomplishments included field verification of wetlands and vegetation mapping by St. Mary's University, with logistical support by park staff and aviation. This enables the park to overlay trail assessment data with wetlands/vegetation mapping to quantify effects for both existing trails and proposed re-routes. The project also included completion of feasibility determinations and prescriptions for trail re-routes, which is invaluable for assessing potential impacts to scenic quality

and for predicting potential spread of invasive species. Project funding allowed the collection of information essential to support the analysis of impacts of off-road vehicles, which will result in a trails management plan that will protect park resources.

USGS—Biological Resources

The U.S. Geological Survey-Biological Resources Division and the National Park Service, through the Natural Resource Preservation Program, jointly support biological projects that provide exploratory research and technical assistance to parks. In FY 2008, the National Park Service contributed \$236,000 via the NRPP USGS—Biological Resources funding to these projects. Information on the project topics and status reports are found in Appendix E.

Servicewide Projects

In addition to park-based projects, there are often needs that do not fit into other funding categories but are important to achieving the mission of the National Park Service. These special needs are often interdisciplinary and may include activities with professional organizations, certain publications, or work on Servicewide databases.

In FY 2008, NRPP—Servicewide Projects funds allocated a total of \$764,000. The following examples highlight some of these projects.

National Park Owners Manual for New Citizens of the United States of America.

The booklet briefly orients new citizens of the United States to the concept of public lands, particularly the National Park System, and their safe and legal use and enjoyment. The publication is given to new U.S. citizens at swearing-in ceremonies conducted in or near a variety of national parks. Parks that have distributed the booklet include **Jefferson National Expansion Memorial, Everglades National Park** and **Ellis Island National Monument**. It has proved very popular with national park staffs, officiating judges, and new citizens.

Park Science shares the implications of research findings for national park management and planning. Edited for nontechnical audiences, articles explore the role of science

in finding solutions to a broad array of park management issues. The publication is an effective means for NPS staff, federal and non-federal researchers, conservation partners, and other collaborators to translate scientific information into usable knowledge for park management, planning, and interpretation.

Research Permit and Reporting System

(RPRS). Scientific research in parks must be administered properly to meet NPS goals and policy, including resource management based on science, increase of knowledge for the benefit of present and future generations, and the appropriate curation of scientific specimens. Parks are expected to administer scientific research permits fairly and efficiently in a manner that will protect park resources, encourage research, follow appropriate policy and museum management guidelines, and ensure appropriate documentation of research projects. Providing trained research coordinators and park curators to conduct RPRS functions increases the effectiveness of RPRS for scientists who submit applications. Coordinators were trained in NPS policies, best practices in curation, and how to use the online RPRS.

Views of the National Parks (Views) is a multimedia educational program that engages the public and school children and offers opportunities for life-long connections with national parks. Views is being transferred from an HTML framework to a Flash-based framework. This change will allow efficient searching across modules, decrease module production time, standardize interface controls, and decrease the time for new pages to appear.



Chapter V: Servicewide Natural Resource Programs

Servicewide natural resource programs provide invaluable services to the nearly 400 units of the National Park Service. Within each discipline, program staff offer policy and regulatory expertise, provide technical assistance and advice, help develop plans and proposals, and guide education and outreach efforts. The Natural Resource Challenge enhanced these Servicewide efforts by strengthening four basic program areas:

- Air Quality
- Biological Resource Management
- Geologic Resources
- Water Resources

In addition to these core programs, the Environmental Quality and Natural Sounds Programs also provide expertise and direct assistance to requesting parks. The Resource Protection Program, a Servicewide program that was formed by the Natural Resource Challenge, is included at the end of this chapter.

This chapter summarizes the results of the effective partnerships formed between parks and these programs that improve natural resources through discovery, learning, understanding, sharing, resource protection and restoration, and evaluation.

AIR QUALITY PROGRAM

The Air Quality Program is responsible for preserving, protecting, and enhancing air quality and air quality-related values in the National Park System in accordance with the NPS Organic Act and the Clean Air Act. Working in regulatory and policy arenas to accomplish this goal, the Air Quality Program emphasizes the collection and analysis of credible air quality information 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 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. In FY 2008, the Air Resources Program received \$8,673,000 to address these critical resource goals.

The Air Quality Program focuses its efforts in six areas: collaboration, review and comment (prevention of significant deterioration and the National Environmental Policy Act), regulatory review, interpretation and outreach, air quality monitoring, and ecosystem effects. The examples below highlight some of the FY 2008 efforts in each of these areas. Following these examples is a detailed look at some of the projects facilitated by the Air Quality Program in FY 2008.

Collaboration

The program works in various policy arenas to help protect park resources from the adverse effects of air pollution. These activities involve coordination with states and the Environmental Protection Agency to help develop air programs that are consistent with preserving and protecting air quality in parks and participating in numerous stakeholder forums to review, discuss, and develop new air quality policies and strategies.

Review and Comment: Prevention of Significant Deterioration and the National Environmental Policy Act (NEPA)

The Prevention of Significant Deterioration Program established by the Clean Air Act gives federal land managers and park superintendents a responsibility to protect air quality related values (AQRVs), including visibility, of Class I areas. Whenever a major new or expanding source wishes to locate near a Class I area, the National Park Service must assess whether its emissions would cause or contribute to an adverse impact on AQRVs. The Air Quality Program permit review activities involve an engineering analysis of proposed control technology to minimize emissions, review of the air quality impact analysis to determine whether impacts will be within federal air quality standards and limits, and an AQRV analysis to assess potential impacts on sensitive park resources. In FY 2008, the program reviewed 20 new source permit applications for projects proposing to locate near NPS-managed areas, routinely suggesting

Inventorying lichens at lower elevation along the Chilkoot trail in Klondike Gold Rush National Historical Park (AK), 2008. Photo: Dave Schirokauer.

that the new sources be equipped with better pollution control technology to minimize emissions and, therefore, reduce impacts on NPS areas.

The Air Quality Program also reviews and provides comments on environmental impact statements, required by NEPA, issued by other federal agencies for federal actions that may impact air quality resources in NPS units (e.g., oil and gas development activities). This often involves extensive collaboration with the responsible agencies and other affected jurisdictions to ensure that air quality analyses are adequate to estimate potential impacts and that mitigation measures are considered.

Regulatory Review

The Air Quality Program staff reviews federal regulations regarding air quality. During FY 2008, the program provided comments on the Environmental Protection Agency's proposed changes to the Prevention of Significant Deterioration increment modeling rule and suggested revisions to minimize impacts on park air quality. The program also worked with Environmental Protection Agency staff in addressing technical issues in identifying which major stationary sources are subject to Best Available Retrofit Technology (BART) analyses under the Regional Haze Rule and what level of controls should constitute BART. Program staff also began initial regulatory review on actions by some states as they develop state implementation plans for regional haze.

Interpretation and Outreach

Interpretive and public awareness programs and activities promote public appreciation and awareness of air quality conditions and effects in NPS areas. The outreach program synthesizes data from NPS air quality monitoring programs and disseminates this information to parks. Air quality-related interpretive projects and activities help promote public understanding of the highly complex issues facing the National Park Service.

To help disseminate air quality information to the public and educate the public on air quality issues in the parks, the program operates an air quality Web camera network consisting of 16 cameras at 15 park areas. In FY 2008, the NPS established a three-year partnership

with Olympus Imaging America, Inc., resulting in funding for the technical support and equipment upgrades for the Air Quality Web Camera Network. These cameras often show the visible effects of air pollution. Because the cameras are typically located near air quality monitoring sites, the camera webpages display other information along with the photo, such as current levels of ozone, particulate matter, or sulfur dioxide air pollutants; visual range; and weather conditions. These popular websites had more than 100 million "hits" in FY 2008.

Air Quality Monitoring and Data Analysis

Monitoring projects provide air quality assessments for most park units with significant natural resources, respond to park-specific monitoring issues, and identify status and trends of ambient air quality conditions in NPS units. Identifying the state of air quality and AQRVs in the parks is crucial to determine the emission reductions necessary to protect the resource and visitor health and enjoyment. In their effort to plan for long-term monitoring of ecosystem health, the I&M networks monitor air quality as an ecosystem health indicator; thus, I&M networks rely on the Air Quality Program for guidance and support.

The program operates a network of ambient air quality monitoring sites in NPS units, measuring ozone, carbon monoxide, sulfur dioxide, nitrogen oxides, and particulate matter under the NPS Gaseous Pollutant Monitoring Program; ozone and dry deposition as part of the Clean Air Status and Trends Network; wet deposition as part of the National Atmospheric Deposition Program/ National Trends Network; mercury under the Mercury Deposition Network; and visibility and particulate matter as part of the Interagency Monitoring of Protected Visual Environments.

Funding for monitoring equipment, installation, and data analysis is covered and obligated under Servicewide contracts or cooperative agreements and managed by the Air Quality Program. Partners, in particular the Environmental Protection Agency, also contribute substantially to monitoring costs (approximately \$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, employ less-expensive monitoring equipment in some areas (e.g., portable ozone samplers), and solicit funding support from state and local agencies.

Ecosystem Effects

The Air Quality Program has identified natural resources sensitive to air pollutants in more than 200 parks. It is also important to identify specific ecosystem indicators that respond to pollution and the thresholds, or critical loads, associated with a given response. Information on indicators and thresholds can be used to establish park management goals, report and communicate more effectively on resource trends and condition, and ultimately help protect sensitive resources in parks. The program collaborates with scientists from other federal and state agencies and universities in park and regional-scale ecosystem effects projects for the northeastern U.S. and the Rocky Mountains.

Air Quality Program Accomplishments Discovery

Forty-four parks have made the first step in developing a greenhouse gas emissions inventory using the Climate Leadership in Parks greenhouse gas emissions inventory tool; more than 50 parks received training in using the tool. This effort is part of the Climate Friendly Parks initiative, a collaboration between the Environmental Protection Agency and the National Park Service that seeks to understand climate change impacts in parks, assess and reduce greenhouse gas emissions that contribute to climate change, help park managers prepare adaptation strategies, and educate the public about climate change impacts, park adaptation strategies, and ways to mitigate their own greenhouse gas emissions.

Learning and Understanding

Acadia (ME), Badlands (SD), Glacier (MT), Grand Teton (WY), Great Smoky Mountains (TN, NC), Isle Royale (MI), Joshua Tree (CA), Mount Rainier (WA), Rocky Mountain (CO), Sequoia (CA), Shenandoah (VA), Wind Cave (SD), and Yosemite (CA) National Parks. The Air Quality Program is working to provide park-specific information on resources sensitive to air quality, including measurable ecosystem indicators and quantitative thresholds

for effects (i.e., pollutant levels where effects begin to occur), to guide park and regional planning efforts. Ecological indicators and critical loads for atmospheric deposition of pollutants have been identified for a number of parks, including Rocky Mountain, Shenandoah, and Great Smoky Mountains. The critical load for Rocky Mountain has been adopted as a park management goal and is being used to guide the Nitrogen Reduction Plan developed by the state of Colorado, Environmental Protection Agency, and National Park Service. The plan calls for a gradual reduction in nitrogen emissions in Colorado to reduce nitrogen deposition and related ecosystem impacts in the park. In Shenandoah and Great Smoky Mountains, critical loads for nitrogen and sulfur deposition are being used to evaluate ecosystem condition and air quality improvement strategies. Critical loads are also a valuable communication tool, used to educate visitors about how ecosystems work and how their actions, such as driving cars and using electricity, affect ecosystems.

The Air Quality Program enhanced monitoring efforts at many NPS units. At **Hawaii Volcanoes National Park (HI)**, the opening of a new vent at Halema'uma'u doubled the sulfur dioxide emissions in the park. The Air Quality Program added to existing monitoring, helped enhance the public alert system used by the park, enhanced reporting of sulfur dioxide to the general AirNow webpages, and initiated special AirNow webpages to display the Hawaii sulfur dioxide levels. As part of the adaptive management plan and in support of the environmental impact statement and final rule on winter use in **Yellowstone National Park (ID, MT, WY)**, additional monitoring of air pollutants from winter vehicles was performed at two locations. Portable Ozone Monitoring Systems (POMS) were deployed in support of the I&M networks at **Agate Fossil Beds National Monument (NE)**, **Devils Tower National Monument (WY)**, **Mojave National Preserve (CA)**, **Yosemite National Park (CA)**, **Joshua Tree National Park (CA)**, and **Rocky Mountain National Park (CO)**. Enhanced monitoring instruments to better understand the concentrations and deposition of nitrogen to the ecosystem were installed at **Great Smoky Mountains National Park (TN, NC)** and **Rocky Mountain National Park (CO)**. These continuous analyzers measure gaseous

reactive nitrogen oxides that are precursors to ozone formation and deposition. The Great Smoky Mountains monitoring is run under a partnership with the state of Tennessee and the Tennessee Valley Authority to provide a rural National Core Monitoring Network (NCore) station. In reference to the new ozone standard issued in 2008, program staff analyzed park monitoring, including POMS and representative monitors, to discover that 92 parks with direct data measurements are likely to violate the new ozone standard.

Cumberland Piedmont Network: Abraham Lincoln Birthplace National Historic Site (KY), Big South Fork National River and Recreation Area (KY, TN), Cumberland Gap National Historical Park (KY, TN, VA), and Mammoth Cave National Park (KY). The Air Quality Program is working with Western Kentucky University to assess the impact of mercury bioaccumulation in the parks. The purpose of this project is to examine the fate and transport of mercury in four parks with karst ecosystems. In FY 2008, sampling of bat hair, insects, water, and sediment was continued for mercury analyses.

National Capital Region Parks (DC, MD, VA). Staff began a project to determine the influences of atmospheric nitrogen deposition and ground-level ozone on the composition of native flora and on Japanese stiltgrass or microstegium (*Microstegium vimineum*), an aggressive invasive species negatively affecting the native flora of all parks within the National Capital Region.

Southeast Alaska Network: Klondike Gold Rush National Historical Park, Glacier Bay National Park and Preserve, and Sitka National Historical Park (AK). FY 2008 was the first year of a study designed as a follow-up and enhancement of a 1999 study that revealed elevated levels of contaminants in lichens at Klondike Gold Rush. Lichens were re-sampled in the park, and the study was expanded to include all parks in the Southeast Alaska Network. In addition to lichen tissue collection and analysis, passive ambient air samplers and deposition samplers were deployed at lichen collection sites in all three parks. More than 100 lichen samples were collected along with weekly passive air samples and seasonal deposition samples. The samples

are all currently being processed. Initial work was also completed on an emissions inventory for Skagway. This is a collaborative effort between the National Park Service, U.S. Forest Service, municipality of Skagway, and state of Alaska.

Rocky Mountain National Park (CO).

RoMANS (Rocky Mountain Airborne Nitrogen and Sulfur Study) was initiated to investigate the pollutant sources that contribute to nitrogen and sulfur deposition in the park. The first step in mitigating the potential effects of enhanced nitrogen deposition to the park's ecosystems is to identify the source regions that are upwind of the park and to quantify their relative contribution to the overall nitrogen deposition budget. RoMANS is the first attempt to do this. Results from this study will guide policy-makers on the management of pollutant sources with the largest impact on the park.

Sharing

In November 2007, the Four Corners Air Quality Task Force, including Air Quality Program staff, published a several-hundred page report containing 125 mitigation strategies for addressing air quality impacts from energy development and growth in the area. The Policy Oversight Group of the task force continued to meet to discuss implementation of the air pollution mitigation strategies. Staff also developed a year-long simulation of ozone and its precursors, which was evaluated in terms of its ability to predict regional ozone concentrations. Ozone "hotspots" due to emissions from oil and gas extraction were identified. These efforts raised the awareness of air quality issues and AQRVs at parks with the overall community and park staff. There is greater understanding of how the air quality in the area might be better managed, which will ultimately result in better protection of park resources.

A 2000 interagency effort, the Federal Land Managers' Air Quality Related Values Work Group (FLAG), resulted in a report that provides permitting agencies and permit applicants with information about AQRVs and approaches for evaluating impacts on them. Because the science and regulatory frameworks have evolved since 2000, an interagency work group discussed revisions and updates



Air quality monitoring documents the impact of pollution on visibility at Elk Ridge in Rocky Mountain National Park (CO). On a clear day visibility is 137 miles (220 km), contrasted with just 12 miles (20 km) on an extremely poor air quality day.

to the FLAG document. In FY 2008, the group developed a draft revised report, which was approved by both the U.S. Department of the Interior and the U.S. Department of Agriculture. The draft report underwent a 60-day public review and comment period. Public comments are being reviewed and appropriate changes will be made before finalizing the report.

Acadia (ME), Great Smoky Mountains (NC, TN), Mammoth Cave (KY), Rocky Mountain (CO), Sequoia and Kings Canyon (CA), and Yosemite (CA) National Parks. Program staff assisted these park areas with their ozone and fine particle health advisory programs. Parks issue advisories to staff and visitors when concentrations have the potential to reach unhealthy levels. Ozone air quality forecasting is supported through current data webpages and submission of data hourly to the Environmental Protection Agency AirNow air quality website where it is used on pollution maps and as presentation of current conditions. The data are used by several parks to provide public warnings of unhealthy air quality conditions for ozone and sulfur dioxide.

Great Smoky Mountains National Park (NC, TN). Air Quality Program staff reviewed the final design for an air quality educational traveling exhibit. The exhibit will educate the public about air quality concerns at the park and provide information about what the public can do to conserve energy.

The Air Quality Program supported several projects to assess the ecological effects of air pollutants in parks, which resulted in the following scientific publications: “Evaluating Regional Patterns in Nitrate Sources to Watersheds in National Parks of the Rocky Mountains using Nitrate Isotopes” in *Environmental Science and Technology*; “A Spatial Distribution of Acid-sensitive and Acid-impacted Streams in Relation to Watershed Features in the Southern Appalachian Mountains” [Great Smoky Mountains National Park (TN, NC) and Shenandoah National Parks (VA)] in *Water, Air, and Soil Pollution*; “Fixing Nitrogen Levels” [Rocky Mountain National Park (CO)] on the Environmental Research Web; and “Streamwater acid-base chemistry and critical loads of atmospheric sulfur deposition

in Shenandoah National Park, Virginia” in *Environmental Monitoring and Assessment*.

BIOLOGICAL RESOURCE MANAGEMENT PROGRAM

The Biological Resource Management Program provides specialized support to assist NPS units address highly complex biological resource management issues in the following areas: ecosystem management and restoration, endangered species, human dimensions, integrated pest management, invasive animals, invasive plants, migratory species and migration corridors, vegetation mapping, and wildlife health. The program also provides support for the Exotic Plant Management Teams (see Chapter III). A scientific cadre with expertise in a variety of disciplines addresses priority and complex issues that arise from park to Department of the Interior needs.

In FY 2008, Natural Resource Challenge funding for the program’s work on strategic biological and invasive plant control support totaled \$9,770,000. The examples below highlight some of the FY 2008 efforts in each of the above-mentioned areas. Following these examples is a detailed look at some of the projects facilitated by the Biological Resource Management Program in FY 2008. Appendix C provides a sampling of Biological Resource Management Program projects addressed in FY 2008.

Ecosystem Management and Restoration

The Ecosystem Management and Restoration Program supports ecosystem approaches to management and facilitates consistent policy and practices in parks. Servicewide accomplishments include development of a guide defining desired future conditions, a draft framework for assessing the ecological integrity of natural resources, and a technical presentation and recommendations on roadside revegetation for use by the NPS Federal Highway Program. The program also provides direct support to parks; in FY 2008, 16 parks benefitted from consultations on restoration strategies, project work plans, and desired conditions determinations. The program works with partners on projects such as engaging the National Ecosystem Restoration Council and participating as a team member on the DOI Bureau of Land Management program review of the use of

interagency funds to develop native plant materials. The program also consulted and offered guidance on restoration and mitigation activities associated with the southwestern border issues.

Endangered Species

The Endangered Species Program works to restore and stabilize threatened and endangered (T&E) species federally listed under the Endangered Species Act (ESA) and species identified by parks as species of management concern (SOMC). The program provides compliance, consultation, and technical assistance for T&E projects and technical assistance for SOMC projects. In 2008, 281 endangered species, 115 threatened species, and one similarity of appearance species (American alligator listed because it is similar in appearance to the threatened American crocodile) currently and historically inhabited 195 NPS areas. In FY2008, parks reported in the NPS ESA Database that 35% of park T&E populations made progress toward recovery and more than \$12.7 million was expended for this effort. The amount of progress made toward recovery, as defined by the NPS Threatened & Endangered Species GPRA goal, declined in FY 2008 because more than 150 park populations of American bald eagle, grizzly bear, and gray wolf were delisted and are now tracked by the SOMC goal instead. In FY 2008, 4,513 park SOMC populations were identified, 12.5% of these were managed to their desired condition, and nearly \$16.5 million was expended. This program also ensured that theories and concepts behind conservation genetics are incorporated into landscape-level planning throughout the Service in addition to playing an integral role in the conservation of the American bison.

Human Dimensions

The Human Dimensions Program is new, established in FY 2008 to provide Service-wide policy guidance, technical assistance, and consultation for integrating social science into biological decision-making. Understanding how visitors and stakeholders value biological resources and the management of those resources helps park managers protect park resources, incorporate diverse views in management decisions, and ensure that parks remain relevant. Servicewide initiatives include management of human-wildlife

habituation and a national strategy to engage the public in biodiversity stewardship. Staff provided professional assistance to six parks in four regions and to other Servicewide resource programs and is partnering with other organizations to address human-wildlife conflicts and wildlife-associated risks in parks. The program also coordinated national efforts associated with the All Taxa Biological Inventories and Bioblitzes funded through the Centennial Challenge.

Integrated Pest Management

Federal law directs all federal agencies to implement an integrated pest management (IPM) approach when addressing pest management activities through procurement, regulatory policies, and other management activities. The National Park Service defines pests as living organisms that interfere with the purpose of a specific site objective within a park or that jeopardize human health or safety. The National Park Service implements a nationwide IPM Program to reduce risk from pests and pest-related management activities affecting the public, employees, park resources, and the environment. The IPM process involves the coordinated use of science-based decision-making, pest biology, environmental information, site ecology, and available technology to prevent unacceptable levels of pest damage using cost-effective means and posing the least possible risk to people and resources. The IPM approach, which incorporates the concepts of adaptive management, is the process used to manage pest animal and plant species (native or nonnative) on NPS lands.

Invasive Plants

The spread of invasive species is recognized as one of the major factors contributing to ecosystem change and instability throughout the world. The proliferation of invasive plants is changing the native landscape across North America. The National Park Service is not immune to this accelerating biological invasion—invasive plants have been found on virtually all NPS lands. Current estimates are that more than 2.6 million acres, or between 3–5 percent, of park lands are dominated by non-native, invasive plant species. Invasive plant programs within the National Park Service work to manage the sources of new infestations, reduce the effects of existing infestations, and restore native plant com-



Joe Castello, Lake Mead EPMT Special Projects Lead, is preparing to cut down an exotic invasive date palm tree (*Phoenix dactylifera*) from the Middle East at Death Valley National Park (CA, NV) in December 2007. Some palm tree species have spread into springs of the desert displacing native plants and increasing wildfire danger. Photo: Curt Deuser

munities and ecosystem functions. The Exotic Plant Management Teams are part of the NPS response to the invasive plant problem (see Chapter III).

Migratory Species

The National Park Service is in the process of developing a program to address landscape-level guidance on the stewardship of migratory species-addressing corridors, habitat fragmentation, climate change impacts and connectivity. A component of this program is the Park Flight Migratory Bird Program which works to protect shared migratory bird species and their habitats in the national parks. The program develops bird conservation and education projects and creates opportunities for technical exchange and cooperation between U.S. national parks and protected areas in Canada, Latin America, and the Caribbean. Park Flight is a partnership between the National Park Service and a variety of non-governmental organizations and state and federal agencies.

Vegetation Mapping

The Vegetation Mapping Program, part of the NPS I&M Program, develops vegetation map inventories for the 270 national parks in the I&M Program. The Vegetation Mapping Program adheres to established inventory mapping standards, ensuring that the products are nationally consistent, appropriately detailed in scale and resolution, and accurate. This information complements a wide variety of resource assessment, park management, and conservation needs. As vegetation mapping progresses throughout the parks, the program offers expertise and recommendations on forest health and integrity.

Wildlife Health

The Wildlife Health Program provides professional veterinary and wildlife management support to parks, regions, and the NPS directorate on the policy and technical aspects of wildlife diseases and their management, preventive health actions, fertility control, field anesthesia, and animal welfare issues. The Wildlife Health Program provides Service-wide leadership in addressing diseases on

NPS lands, with particular emphasis on highly pathogenic avian influenza (HPAI) in wild-life and chronic wasting disease (CWD). The Wildlife Health Program provides technical assistance, consultation, and training to enhance the ability of park staff to meet the increasing demands of wildlife health issues.

Biological Resource Management Program Accomplishments

Discovery

Great Basin National Park (NV). Yellow-bellied marmots (*Marmota flaviventris*), Utah mountain kingsnakes (*Lampropeltis pyromelana infralabialis*), pygmy rabbits (*Brachylagus idahoensis*), and sagebrush voles (*Lemmiscus curtatus*) are dependent upon sagebrush habitat, and their populations have declined across the Great Basin. Staff collected locality and habitat data on these species to guide restoration and fire management of sagebrush habitats. These surveys documented six previously unknown populations of marmots, no pygmy rabbits (suggesting that pygmy rabbit habitat is extremely limited), no king snakes (although anecdotal reports and suitable habitat suggest that they are present), and two previously undocumented park species (Merriam's shrew [*Sorex merriami*] and chisel-toothed kangaroo rat [*Dipodomys microps*]).

Learning and Understanding

Grand Teton National Park (WY). Park staff began a project to measure the impacts of the invasive New Zealand (NZ) mud snail (*Potamopyrgus antipodarum*) on the endemic Jackson Lake spring snail (*Pyrgulopsis robusta*) and their shared algal resource. A secondary objective is to understand how these interactions and the impacts of the NZ mud snail on entire stream communities vary with resource availability. The study found that the NZ mud snail (1) has the strongest grazing impacts in highly productive streams, (2) reduced competitive effects on the endemic snail with increased resources, and (3) potentially will also dominate benthic communities in highly productive streams. Understanding how the impacts of the NZ mud snail differ across a productivity gradient might allow managers to predict impacts in stream communities in future invasions.

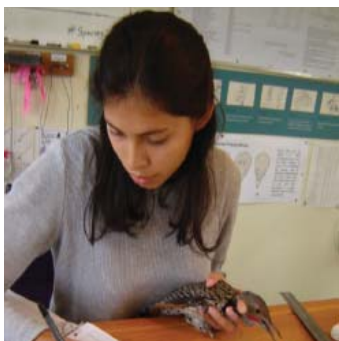
Great Sand Dunes National Park and Preserve (CO) and Rocky Mountain National Park (CO).

Limber pines are long-lived, slow-growing trees that range in elevation from 2,600 to 3,400 meters in Colorado. Recently researchers have found some limber pines infected with white pine blister rust, a lethal, nonnative disease of white pines. In conjunction with the U.S. Department of Agriculture Rocky Mountain Research Station, the parks began a study to determine the frequency and geographic variation in white pine blister rust resistance in limber pine to evaluate the efficacy of proactive management intervention and aid in the prioritization of stands for restoration within the parks.

Great Smoky Mountains National Park (NC, TN). American chestnut trees have been decimated by the chestnut blight fungus. In an effort to preserve remaining elements of native American chestnut, the park began sampling infected trees for detection and potential for hypovirulence (an infection of the blight that is less damaging to the tree) and field-testing of an American chestnut predictive model for trees within the park. To date, the sampling and screening has yielded locations of 55 American chestnut trees previously unknown in the park, 20 of which had no lethal cankers. The study is ongoing; results of compatibility tests and a master's thesis will be produced from this part of the project.

Lake Clark National Park (AK). Park staff initiated the collection of baseline data for northern pike (*Esox lucius*) residing in the Chulitna River and Chulitna Bay area of the Lake Clark watershed. Specific project objectives were to determine basic population parameters and seasonal movement patterns and to identify critical spawning, feeding, and over-wintering habitats. Early data suggest that northern pike reside in the shallows of Chulitna Bay and the lower Chulitna River between April and October and in the deeper waters of Chulitna Bay and Lake Clark during the winter months (November–March). The final report is in progress.

Voyageurs National Park (MN). The Canada lynx (*Lynx canadensis*) is a federally threatened species. In FY 2008, the park continued a project to improve the limited knowledge of the ecology and population status of the species. No detections of Canada lynx were made, but other mesocarnivores (medium-



At Great Basin National Park (NV) yellow-bellied marmot populations are declining. Photo: Dave Herr

Roselvy Juárez from El Salvador holds a Northern Flicker at the Palomarin Field Station in Point Reyes National Seashore (CA) as an international intern (International Volunteers in Parks) with the National Park Service Park Flight Migratory Bird Program. El Salvador shares 169 migratory bird species with the U.S.

sized mammalian carnivores) were sighted; data are being analyzed for patterns in distribution and relative abundance. Snowshoe hare (*Lepus americanus*) pellet counts confirm that the park contains limited quality snowshoe hare habitat and generally low numbers of snowshoe hares, which are the primary food source for Canada lynx. While no lynx were captured and fitted with GPS collars during the two years of this project (2007/08), lynx have been detected in or near the park in 2003, 2004, and 2009. The project's final report will provide an assessment of Canada lynx habitat quality within and adjacent to the park.

Wind Cave National Park (SD). Development of a forage production and allocation model will assist the park in making science-informed decisions regarding the management of foraging species and their forage. With the assistance of the Great Rivers CESU and a PhD student at the University of Missouri, the park began to assess and model predictors of forage production for rangeland and woodland habitats, estimate food habits of bison and elk, and develop a forage allocation model and estimate carrying capacity based on forage availability and nutritional constraints. FY 2008 accomplishments include an assessment of current and historical data, field sampling, and preliminary analysis of field data, including food habits of bison (*Bison bison*) and elk (*Cervus canadensis*). Upcoming work includes the initial programming and development of the forage model, continued statistical analysis of historical and field data, and completion of vegetation sampling.

Sharing

Wildlife Disease & Anesthesia Training.

The Wildlife Health Program produced a training CD entitled *Highly Pathogenic Avian Influenza Surveillance in the National Park Service* to teach park personnel how to safely conduct surveillance for Highly Pathogenic Avian Influenza (HPAI) in sick and dead birds. The training CD was distributed to over 200 park units in all seven NPS regions that last year received surveillance kits for collecting samples. The program taught a wildlife field anesthesia class to 20 students from seven parks and offices representing three NPS regions, thus facilitating safe and effective capture of wildlife and aiding those parks'

natural resource and visitor protection programs. In addition, the program provided on site field anesthesia training and assistance on capture projects at **Big Cypress National Preserve (FL)**, **Isle Royale National Park (MN)**, **Rocky Mountain National Park (CO)**, and **Wind Cave National Park (SD)**. The first NPS wildlife managers' training course on wildlife diseases was attended by personnel from six NPS regions, and accomplished by the Wildlife Health Program through a CESU agreement with the University of Wyoming.

Golden Gate National Recreation Area (CA).

The federally endangered tidewater goby (*Eucyclogobius newberryi*) is a small fish that inhabits only California waters. It was once found in at least 134 localities; 23 of these are considered extirpated, and 55–70 are either so small or degraded that their persistence is uncertain. In 2007, the park launched a project to establish a self-sustaining population in Tomales Bay in Marin County, California. In 2008, tidewater gobies were translocated to new locations within a tidal wetland restoration project (Giacomini Ranch Wetland Restoration) in partnership with the U.S. Geological Survey. Initial assessments of these transplants are starting; preliminary data indicate low survivorship. The U.S. Geological Survey will produce a report summarizing the efficacy of translocation activities in 2009. The park is working with the California Academy of Science to produce a public display including an audio program on tidewater gobies to increase awareness of the endangered species.

Santa Monica Mountains National Recreation Area (CA).

A vegetation mapping project documented the changes in vegetation composition in the recreation area over the past 70 years in relation to fire history. This project funded the collection of field data at historic vegetation plot locations using methods originally employed in the 1920s and 1930s to create vegetation maps. In FY 2009, the park's fire GIS specialist will recheck and analyze these data and produce a report and article for publication summarizing the observed changes in vegetation in relation to fire history.

Resource Protection and Restoration

Craters of the Moon National Monument and Preserve (ID) and **Raven's Eye Wilderness Study Area (ID)**. NPS staff partnered with

the Bureau of Land Management (BLM) to perform aerial mapping of the Raven's Eye WSA to detect new leafy spurge infestations. Helicopter crews located 73 infestations and landed to treat six with biological controls (*Aphthona* sp.). Crews on foot remapped, monitored, and treated previously mapped infestations on BLM lands and mapped, described, and treated new infestations on NPS lands. Crews inventoried more than 1,000 acres and treated 30 small sites.

Haleakala National Park (HI). The Manawainui area of the Koa Forest encompasses the biologically richest lands in the park, hosting at least eight endangered plant species, two endangered bird species, and numerous other rare plants and animals. An invasion of feral goats, pigs, and axis deer from adjacent lands threatened this stronghold of biodiversity. To protect the old growth areas of the Koa Forest, the park continued to remove feral animals from the Manawainui area. In 2007, park staff fenced off the area. In 2008, they continued removal of the exotic animals from the area within the fence.

Indiana Dunes National Lakeshore (IN). In conjunction with The Nature Conservancy, the park began a project to increase the presence of state-listed plant species, including establishing 18 new populations of eight state-listed species through plant propagation, out-planting, and seed dispersal, and increasing the existing population size of 16 species through habitat modifications. Species included *Lathyrus japonicus*, *Cypripedium candidum*, *Thuja occidentalis*, *Carex atherodes*, and others.

Evaluation

Wildlife Disease Diagnostics & Support. The Wildlife Health and Management Program performed diagnostic investigations into the causes of mortality from 391 wildlife cases submitted from parks in six NPS regions. In addition, the WHP collaborated with the NPS Office of Public Health on diagnosis of diseases that could be transmitted to humans, including two case investigations of a wildlife link to human plague (**Greater Yellowstone Area [ID, MT, WY]** and **Grand Canyon National Park [AZ]**), one of which was fatal. Staff collaborated with the NPS Office of Public Health and Risk Management Division on an additional

component to Reference Manual 50B titled Safe Work Practices for Employees Handling Wildlife to benefit personnel throughout the NPS. The Wildlife Health Program provided direct support for the management of plague in prairie dogs at **Badlands and Wind Cave National Parks (SD)** and **Florissant Fossil Beds National Monument (CO)** as well as consultation on plague management at numerous other park units in the western U.S.

Stones River National Battlefield (TN). The park partnered with a graduate student at Middle Tennessee State University (MTSU) to evaluate the effectiveness of conservation practices in a rare calcareous glade community. The project included monitoring at three types of sites: glade edges that have not been invaded by Chinese privet (*Ligustrum sinense*), glade edges that have been invaded by Chinese privet where removal was conducted after initial monitoring, and glade edges that have been invaded by Chinese privet where removal will not be conducted. Soil samples were collected in each area; the data will be analyzed by the MTSU student. Additional work to be conducted by MTSU includes re-establishment of glade monitoring plots set up in 1995 and photo point monitoring.

GEOLOGIC RESOURCES PROGRAM

The Geologic Resources Program focuses its efforts in six broad categories: geologic processes and features, geologic education and outreach, disturbed lands restoration, geologic resource evaluation, soil resources inventory and management, and minerals management.

In FY 2000, the Geologic Resources Program received a Natural Resource Challenge increase of \$695,000, which allowed the program to add six geologic specialists in the areas of cave and karst resource management, coastal geology, disturbed land restoration, geologic hazards management, and paleontology, complementing the expertise of existing program staff. In the years following that increase, however, budget erosion due to an essentially flat budget and increasing costs have reduced that support capability to just two of those specialists. The remainder of the increase has been redirected to cover cost increases for the entire program. The program

currently has 18 permanent staff that provide technical assistance and policy and regulatory support, and present NPS geologic education and outreach to the public. The program supplements paid staff with partner employees, interns, and volunteers. Partnerships with geologic organizations and funds from other NPS sources permit the program to accomplish many of its projects.

In FY 2008, funding for the Geologic Resources Program totaled \$2,872,000. The examples below describe some of the FY 2008 efforts in each of the program's focus areas. Following these examples is a detailed look at additional projects facilitated by the Geologic Resources Program in FY 2008.

Geologic Processes and Features

The program provides cave and karst, coastal geology, geologic hazard, and paleontology expertise. The National Park Service manages at least 128 parks containing cave and karst features; the program supports Servicewide efforts for cave conservation, management, protection, and science. Coastal geology staff provide technical support and programmatic guidance for the almost 100 NPS units with coastal and lakeshore geology concerns, assisting park staff with such concerns as hurricane and storm impacts, restoration, and coastal resource inventory and monitoring. The program also helps parks assess and evaluate geologic hazards, which occur when natural processes conflict with development or other human activities. For the 14 NPS units that include fossils as a park purpose or primary resources and the 208 parks with documented fossil resources, program staff coordinate the reporting of paleontology goals and the preparation and publishing of I&M network paleontological resource summaries, work with other federal agencies on the proposed Paleontological Resources Preservation Act, and provide policy and regulatory advice on paleontological resource protection and preservation issues. In FY 2008, paleontology staff completed paleontological resource I&M reports for five networks, comprising 33 parks, and performed literature research and prepared park narratives for seven additional networks, encompassing 69 parks.

Geologic Education and Outreach

Program staff began education and outreach

efforts in 1996 to increase park and public awareness of the unique geologic resources in national parks and to engage the professional geology community and earth science educators in assisting parks with geologic resource management and research issues and in using parks for teaching geology. Many national parks depend on program staff for assistance in developing and maintaining high-quality geologic education and outreach materials and in collaborating with the geosciences community to assist park resource management.

Program staff manage the Geoscientists-in-the-Parks program, which links professional geologic organizations and the academic community to parks in an effort to address the backlog of geoscience needs. In FY 2008, 42 geoscience participants worked in 25 parks and two central offices, helping parks meet critical needs in natural resource management, research, public safety, and formal and informal education. Participants directly reached tens of thousands of park visitors through geologic outreach and education programs, and many more benefited through improvements to park websites.

Disturbed Lands Restoration

Program staff prepare technical guidance, review park work plans for technical adequacy, and provide oversight on cost accounting and accomplishments reporting for the NRPP Disturbed Lands Restoration program (see Chapter IV). Staff also oversee the implementation of the Department of the Interior Inspector General's recommendations for dealing with human health and safety issues at abandoned mine lands on NPS sites, found in the *Audit Report: Abandoned Mine Lands in the Department of the Interior* (2008). The program administered \$789,100 to 14 park projects in FY 2008.

Geologic Resource Evaluation

The Geologic Resources Inventory (GRI, formerly known as the Geologic Resource Evaluation, or GRE) is funded by the Natural Resource Challenge through the I&M Program and provides digital geologic maps and geology-related information to parks. Program staff help managers integrate the use of geologic resource information in resource management decisions through the use of three main products: an on-site scoping

meeting with park staff and geologic experts to evaluate and discuss the park's geologic resources and related resource management issues, a comprehensive digital geologic map, and a comprehensive geologic report. By the close of 2008, program staff had held scoping meetings in 202 parks and, with the assistance of partners, completed digital geologic maps for 138 parks. In FY 2008, 18 new reports were distributed to parks, networks, and regions.

Soil Resources Inventory and Management

The Natural Resource Challenge also funds the Soil Resources Inventory and Management (SRI) project through the I&M Program. Geologic resources staff manage this project, which provides digital soil maps and soil resource management information to parks. Through a partnership with the U.S. Department of Agriculture's Natural Resources Conservation Service and the National Cooperative Soil Survey, the SRI helps park managers obtain the information needed to sustainably manage soil and to protect water quality, wetlands, vegetation, and wildlife habitats. In FY 2008, SRIs for 32 I&M parks and four non-I&M parks were completed.

Minerals Management

Thirty-two NPS units contain nearly 750 active private mineral exploration or development operations. With expertise in mining and oil/gas development technology, regulations and policy, impact mitigation, geology, reclamation, and mining claim validity examinations, Geologic Resources Program staff help managers effectively protect park resources and values from the adverse effects of past, current, and future mining within and adjacent to NPS units. Staff ensure that operations conform to oil and gas regulations, which require operators to use the technologically feasible methods least damaging to park resources and to reclaim their sites to prior conditions after operations. In FY 2008, staff reviewed 10 new oil and gas proposals covering 49 operations in seven parks.

Geologic Resources Program Accomplishments

Discovery

Badlands National Park (SD), Guadalupe Mountains National Park (TX), and Glen Canyon National Recreation Area (AZ, UT). Staff initiated soil resources inventories for

these parks and held scoping sessions to begin the process of information gathering. When the inventories are complete, the key products will be digital maps of park soils; data about the physical, chemical, and biological properties of these soils; metadata; and information products such as fact sheets and image galleries.

Glacier Bay National Park and Preserve (AK), Golden Gate National Recreation Area (CA), Gulf Islands National Seashore (FL, MS), and Sleeping Bear Dunes National Lakeshore (MI). With the U.S. Geological Survey, program staff convened a multi-agency workshop to clarify the needs of a Servicewide marine mapping program and identified and implemented pilot marine mapping projects in these sites.

Glen Canyon National Recreation Area (AZ, UT) and Richmond National Battlefield Park (VA). Two Geoscientists-in-the-Parks participants conducted geohazards assessments at these NPS units.

Learning and Understanding

The Cave and Karst Program coordinator provided technical advice to 14 park units and other federal, state, and local agencies, including reviewing and commenting on the U.S. Fish and Wildlife Service's *Bexar County Karst Invertebrates Draft Recovery Plan* for listing endangered cave-dwelling species in the San Antonio, Texas, area. He served on a NPS working group and a U.S. Fish and Wildlife Service committee looking into white-nose syndrome, a new and potentially deadly fungus found on hibernating bats within caves in four northeastern states.

Geologic Resources Program staff provided technical expertise to seven parks concerning the assessment and evaluation of geologic hazards. Examples include the identification of hazardous areas for rockfall instigated by seismic activity at **Acadia National Park (ME)**, assessment of rockfall potential in the vicinity of popular climbing routes at **Devils Tower National Monument (WY)**, evaluation of a landslide with tsunami potential at **Glacier Bay National Park (AK)**, and appraisal of a rockfall that threatened archeological resources at **Walnut Canyon National Monument (AZ)**.

Big South Fork National River and Recreation Area (KY, TN) and Joshua Tree National Park (CA). Park staff will use soil resources inventories to address current and future management issues regarding limitations for equestrian and mountain bike trails and off-road vehicles in Big South Fork and to identify soil physical properties to be used in an ecological model to determine critical habitat for the desert tortoise in Joshua Tree.

Buck Island Reef National Monument (USVI). The Geologic Resources Inventory team integrated a U.S. Geological Survey terrestrial map of St. Croix Island and the monument with benthic habitat maps from the National Oceanic and Atmospheric Administration. This was the first map of its kind for the inventory.

Buck Island Reef National Monument (USVI), Canaveral National Seashore (FL), Cape Lookout National Seashore (NC), Point Reyes National Seashore (CA), and San Juan Island National Historical Park (WA). Shoreline maps, which incorporate landforms, vegetation, soil, and coastal processes, were completed for these areas. These maps were developed using new protocols developed by the National Park Service in collaboration with the U.S. Geological Survey, state surveys, and academic institutions.

Padre Island National Seashore (TX). Geologic Resources Program staff revised the seashore's oil and gas development scenario to reflect current increases in oil and gas drilling as well as environmental impacts not anticipated in the site's *Oil and Gas Management Plan*.

Sharing

Boston Harbor Islands National Recreation Area (MA), Cape Lookout National Seashore (NC), Cumberland Island National Seashore (GA), Fire Island National Seashore (NY), Pu'ukohola National Historic Site (HI), Saugus Iron Works National Historic Site (MA), and Salem Maritime National Historic Site (MA). Coastal Geology Program staff gave 15 presentations to park staff, visitors, and neighbors in seven parks. Eighty-three park staff and 188 visitors and residents attended these sessions, which covered basic coastal process and storm dynamics, current and recent storm events, and potential changes in local parks and

regional coastal areas. Materials developed for the presentations were left with park staff for future use with park visitors.

Cape Hatteras National Seashore (NC) and Gulf Islands National Seashore (FL, MS).

Geologic Resources Program staff published a paper in the *George Wright Forum* entitled "Protecting Cultural Resources in Coastal U.S. National Parks from Climate Change," which describes the impact of climate change at Cape Hatteras and management actions at Fort Massachusetts in Gulf Islands.

Mammoth Cave National Park (KY). Two local teachers, funded by the National Association of Geoscience Teachers as part of the Geoscientists-in-the-Parks program, prepared three interpretive trail guides for the park and used the knowledge they acquired during the summer to enhance the science curricula at their schools. They communicated information about research methods and appreciation of the park's unique cave resources to students and the local community. Due to the success of the program, the association pledged its support to the park for an additional two years.

Resource Protection and Restoration

Fort Bowie National Historic Site (AZ).

Geologic Resources Program staff assisted with the clarification of CFR regulations for a mining claim operator whose proposed access through the park could adversely affect historic Native American resources and the historic Butterfield Overland Mail Route.

Gulf Islands National Seashore (FL, MS).

Program staff provided extensive technical support on the environmental and policy implications pertaining to the development of a science-based barrier island restoration strategy for inclusion in the U.S. Army Corps of Engineers *Draft Mississippi Coastal Improvement Program Comprehensive Plan and Programmatic Environmental Impact Statement*. The restoration strategy, developed cooperatively with other federal agencies, addresses specific actions to mitigate substantial erosion and land loss on the barrier islands caused by frequent intense storms, sea level rise, and a deficit in the sediment budget attributed to the dredging of sand from navigation channels near the island.

Program staff administered 14 disturbed lands restoration projects, including restoration of prairies in five NPS units within the **Southern Plains Network**, restoration of two prominent volcanic buttes in **Lava Beds National Monument (CA)**, restoration of paleodunes and climbing dune dynamics in **Point Reyes National Seashore (CA)**, restoration of habitat in off-trail areas in **Carlsbad Caverns National Park (NM)**, restoration of soils and vegetation at Running Eagle Falls in **Glacier National Park (MT)**, and wetland restoration in the Johnson Ferry Unit in **Chattahoochee River National Recreation Area (GA)**.

WATER RESOURCES PROGRAM

The Water Resources Program provides leadership for the preservation, protection, and management of the water and aquatic resources of NPS units. As with all natural resource issues today, water resource issues are complex, including such topics as water quality, water rights, planning, floodplain management, erosion and sediment control, protection of wetland and riparian habitats, watershed condition, fisheries management, and ocean and coastal resources. The Water Resources Program helps parks address these issues through five main areas: water resource projects, water quality vital signs monitoring, watershed condition assessments, water resource protection – aquatic resource professionals, and water resource technical assistance.

Base funding for the Water Resources Program in FY 2008 was \$12,316,000. In FY 2008, the Water Resources Program continued to deliver a high level of support to parks in addressing a wide variety of water and aquatic resource-related issues. The Program provided services directly to parks through a broad range of programs: Water Resource Protection Projects, Water Quality Monitoring, Watershed Condition Assessments, Water Resource Protection–Aquatic Resource Professionals, and Technical Assistance. Each of these focus areas is highlighted below, followed by a detailed look at some of the projects facilitated by the Water Resources Program in FY 2008. Appendix D provides a complete listing of all Water Resources Program projects for FY 2008.

Water Resource Projects

Water resource projects fall into two categories: water resource protection and cooperative academic fisheries projects. The Natural Resource Challenge funds water resource protection projects that involve data collection and analyses used to describe surface and ground water flow regimes and investigate the dependence of park resources upon water. These efforts are targeted toward development of scientific information that will contribute to decisions that protect or restore surface or ground water systems. Studies are conducted by scientists with expertise in fields that are appropriate for the park resources being examined. The majority of FY 2008 project funds were used to support ongoing studies designed to characterize surface or ground water flow systems. Project funds are also used to study the relationships between water quantity and flow timing and water-dependent park resources. Studies of water-dependent resources included riparian/wetland vegetation, fish migration, anchialine ponds (land-locked ponds with an underground connection to the ocean), and geomorphology.

A small amount of Water Resource Program base funding is used to develop and increase cooperative relationships between the academic community and the NPS fisheries program. These projects help introduce top caliber fisheries students to NPS programs as well as expanding the level of fisheries expertise available to parks. FY 2008 water resources base funding was not adequate to support a third project category, competitive projects, through which many park-based activities were previously funded.

Water Quality Vital Signs Monitoring

The National Park Service supports the Department of the Interior strategic goal to significantly reduce the number of stream and river miles and acres of lakes and marine areas that do not meet water quality standards. The National Park Service also strives to protect unimpaired water quality in parks from future impairment. The Service works with state Clean Water Act programs and takes appropriate management actions to support the restoration of impaired water bodies. Presently, about 120 NPS units have one or more water bodies that do not meet state water quality standards for one or more

pollutants on approximately 1,800 miles of rivers and streams and 1,066,000 acres of lakes, reservoirs, estuaries, and marine areas. Because water quality is a key vital sign in determining overall aquatic ecosystem health, the Water Quality Vital Signs Monitoring Program continues to be implemented in full integration with the NPS Park Vital Signs Monitoring Program. Fully integrating these programs creates considerable cost savings in staffing, planning and design, administration, implementation, data management, and reporting.

Watershed Condition Assessment Program

The Watershed Condition Assessment Program (WCAP) provides technical guidance and accountability oversight to assess watershed resource conditions in parks. By FY 2014, the WCAP hopes to fund a natural resource condition assessment project for each of the 270-plus parks in the NPS Vital Signs Monitoring Program. Parks receiving these assessments will be in an improved position to define natural resource conservation indicators and targets via park planning and to report to overall resource condition performance accountability measures (e.g., land health goals in the Department of Interior's Strategic Plan). Relying on existing data from multiple sources and best professional judgment, each assessment provides an interdisciplinary synthesis and report on current condition status, critical data gaps, and existing or emerging vulnerability/risk factors for important natural resources. Assessments also strive to develop overall condition ratings for park areas at the geographic scale requested by the receiving park (e.g., by park watersheds, habitat types, or management zones).

In FY 2003, the WCAP began an effort to assess coastal water resources and watershed conditions in 53 parks with significant ocean and Great Lakes resources by FY 2014. Since FY 2003, the WCAP initiated assessments in 47 coastal and Great Lakes parks; final reports have been published for 27 parks. Reports from these assessments characterize the relative health or status of upland, wetland, riparian, marine, estuarine, and Great Lakes resources within the National Park System.

In FY 2008, the WCAP also 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.

Water Resource Protection—Aquatic Resource Professionals

Through the Natural Resource Challenge in FY 2002–2003, the National Park Service received \$1,205,000 to fund aquatic resource specialists in the field. Fifteen positions were fully funded in FY 2008, although three of the positions were vacant for part of the fiscal year. The positions are supported through a cost-share arrangement between the Water Resources Program (Natural Resource Challenge funding) and local park and/or regional offices. Twelve of the positions are duty-stationed in parks and one each is located in the Sonoran Network Office, Center for Urban Ecology in the National Capitol Region, and Utah State Office. This network of highly trained professionals provides park managers with field-level expertise that would otherwise not be available to address their highest priority aquatic resource needs in areas such as fisheries biology, marine and aquatic ecology, and groundwater hydrology.

Water Resources Technical Assistance

Prior to the Natural Resource Challenge, the Water Resources Technical Assistance Program was the fundamental component of the Water Resources Program; it has not been expanded by Natural Resource Challenge funding. Through the technical assistance effort, the Water Resources Program provides direct assistance to parks on high-priority needs using a combination of its own staff and expertise acquired through cooperative agreements. More than 170 parks obtained technical assistance from the Water Resources Division in FY 2008.

Water Resources Program Accomplishments Discovery

Fort Frederica National Monument (GA). The Southeast Coast I&M Network received funding from the Water Resources Program for a baseline water quality inventory at the monument.

Learning and Understanding

Water Resources Program staff facilitated the creation of the Wild and Scenic Rivers Pro-

gram Steering Committee and provided leadership for the development and implementation of a program action plan.

The Water Resources Program established an Ocean and Coastal Resources Branch to provide overall leadership and coordination in ocean resource stewardship within the National Park Service. The program supports coastal watershed assessment and management; coral reef, ocean, and coastal habitat mapping, protection, and restoration; and marine fisheries and recreational uses management.

The field-based aquatic resource professionals assisted parks with many projects in FY 2008. They collaborated with Intermountain Region facilities management engineers to develop a statement of work and engineering estimate for a new water supply well at Tucson Mountain District at **Saguaro National Park (AZ)**, developed a status report of water quality and water supply issues and made recommendations regarding management of the water supply system at **Fort Bowie National Historic Site (AZ)**, monitored nearshore water quality at **Sleeping Bear Dunes National Lakeshore (MI)** and evaluated potential causes for avian botulism outbreaks, assisted with re-licensing of operations of the Saluda Dam affecting **Congaree National Park (SC)** by attending stakeholder meeting to develop an ecologically sustainable flow prescription for the dam, and provided site assessments, biological opinions, hydrologic evaluations, and storm-water management suggestions to **National Capital Parks – East** regarding flooding of urban communities outside the park boundaries.

Olympic National Park (WA). Natural resource condition assessments were initiated at 35 parks and supplemental funding was provided to four park assessments started in previous years. Coastal resource assessments were initiated in four coastal parks and supplemental funding was provided to assessments started in previous years in four other parks. The coastal resource assessment report for Olympic National Park was published.

Bering Land Bridge National Preserve, Denali National Park and Preserve, and Yukon-Charley Rivers National Preserve (AK). These NPS sites contain many shallow lakes that

provide important wetland habitat. Aquatic resource professional staff implemented monitoring plans for 15 lakes in Bering Land Bridge, 92 lakes in Denali, and two lakes in Yukon-Charley.

The Water Resources Program enhanced learning and understanding of water resources in parks. Technical support and funding aided in the development of the *Emergency Prevention and Response Plan for Viral Hemorrhagic Septicemia* within the Lake Superior Basin and the *Quagga Mussel Planning and Response Guide for National Park Service Units* in the Intermountain and Pacific West regions. Program staff completed and published the *Katmai National Park and Preserve/Alagnak Wild River Water Resources Information and Issues Overview Report*; the *Guadalupe Mountains National Park Physical Resources Stewardship Report*; and *Hydrogeology and Water-Supply Wells, Grand Teton National Park*. Staff also completed a functional assessment and suggested desired conditions for the Pueblo Colorado Wash riparian zone at **Hubbell Trading Post National Historic Site (AZ)** and performed on-site evaluation of three large wetland systems, their hydrology, and the potential to enhance the wetland functions of each area at **Richmond National Battlefield Park (VA)**.

Sharing

In 2008, the National Park Service completed national and regional-level ocean park stewardship action plans that call for increasing the agency's scientific and organizational capacity to manage ocean and coastal resources, in concert with federal, state, and local partners.

Water Resources Program funds supported the development of a Servicewide water quality data management program within the U.S. Environmental Protection Agency STORET national water quality database. Four water quality research associates and a student worked to support database development, management, and reporting activities through cooperative agreements with Colorado State University. The Servicewide STORET database has served as the starting point for most network water quality data compilation and analysis efforts and also the program's baseline water quality data inventory and analysis

reports. In addition to data from states and other entities, this archive now hosts more than 3.45 million results for 1,800 different physical, chemical, or biological characteristics from 26,570 monitoring locations in support of 882 different projects conducted in or near 227 units of the National Park System. Use of NPSTORET increased among other government entities, including the U.S. Geological Survey, U.S. Agency for International Development, and Northwest Indian Fisheries Commission.

Resource Protection and Restoration

The Water Resources Program offered a high level of support to parks for many resource protection and restoration projects in FY 2008. Technical support and funding were provided for wetland restoration projects in several NPS units, including **Channel Islands National Park (CA)**, **Fire Island National Seashore (NY)**, **Grand Teton National Park (WY)**, **Lewis and Clark National Historical Park (OR)**, **Point Reyes National Seashore (CA)**, **Rocky Mountain National Park (CO)**, and **Sequoia National Park (CA)**. The Big Lagoon Wetland Restoration Project, Surfer Parking Lot restoration planning, Crissy Marsh Expansion Project, and Giacomini Wetland Restoration at **Golden Gate National Recreation Area (CA)** benefitted from the assistance of program staff. Staff initiated a project for fish and habitat restoration at **Point**

Reyes National Seashore (CA), improving aquatic habitat through the removal of non-native riparian vegetation and restoration of stream bank habitat. Staff provided oversight to a project for the removal of non-native fish species in several lakes in **North Cascades National Park (WA)**, trained park staff to recognize and delineate wetlands in **Prince William Forest Park (VA)**, provided technical assistance regarding a proposal to restore wetland/spring habitats at Travertine Springs in **Death Valley National Park (CA)**, and assisted **Whiskeytown National Recreation Area (CA)** in restoring a rare salt spring that provides the only known habitat for the endemic Howell's alkali grass (*Puccinellia howellii*). Staff also assisted **Niobrara National Scenic River (NE)** with continuing a partnership with the state of Nebraska to protect instream flows in the Niobrara River.

Great Sand Dunes National Park (CO) and **Saguaro National Park (AZ)**. Waters rights issues continue to be an important focus for the Water Resources Program. Program staff worked to secure a water right decree from the Colorado Water Court that protects groundwater within Great Sand Dunes National Park. Since the claim was filed in 2004, Water Resources Program staff have assisted the park with identifying data needs and providing quality assurance for data collected by gauging streams and monitoring wells. Plans are

The Ocean and Coastal Resources Branch provides leadership and coordination to protect ocean resources such as this coral in National Park of American Samoa.



underway to drill an additional 10 monitoring wells along the park boundary to administer the water right. The Water Resources staff also completed scientific studies to support water right claims filed with the state of Arizona for Rincon Creek at the request of Saguaro National Park. Obtaining the water right for instream flow maintenance on Rincon Creek would protect the water and associated animals and plants, including the only riparian forest in the park, from large non-NPS water diversions.

Mount Rainier National Park (WA). Over the past few years, the park experienced several instances of severe flooding that damaged park facilities. The Water Resources Program identified flood hazards in the park and worked to mitigate them.

Sequoia and Kings Canyon National Parks (CA) and Great Smoky Mountains National Park (TN, NC). Water Resources Program staff provided technical and policy support for 18 floodplain statements of findings that included Halstead Meadows Road Reconstruction at Sequoia and the Oconaluftee Visitor Center at Great Smoky Mountains.

Yellowstone National Park (ID, MT, WY). The National Park Service has worked with the Montana Bureau of Mines and Geology since 2006 to complete planning, data collection and well closure activities for a geothermal well believed to be hydrologically connected to a hydrothermal water complex near Mammoth, Wyoming. Because the NPS interest involved the protection of Yellowstone National Park water rights, the Water Resources Program provided funds to cover the additional cost associated with the selected plugging method. The 421-foot-deep well was declared plugged on August 5, 2008.

Zion National Park (UT). With support from network monitoring results, North Creek was removed from the state list of impaired waters after it was shown that high salt concentrations are a natural result of underlying geology. Under the Clean Water Act (CWA), states must identify all waters that do not meet or are not expected to meet water quality standards. These waters have become known as “303(d)” water bodies after the CWA section in which the requirement is contained.

Evaluation

Santa Monica Mountains National Recreation Area (CA) and Valley Forge National Historical Park (PA). A number of projects within the Water Resources Water Quality Vital Signs Monitoring Program addressed the evaluation of park water quality monitoring activities. The Mediterranean Coast Network established a cooperative agreement with California State University of Los Angeles to evaluate the sampling strategy included in the draft water quality monitoring protocol for Santa Monica Mountains, among other activities. A cooperative agreement between the University of Virginia and the Mid-Atlantic Network will develop water quality and quantity monitoring objectives for Valley Forge and review and evaluate existing water quality monitoring programs and protocols.

ENVIRONMENTAL QUALITY PROGRAM

Federal law requires the National Park Service to make informed decisions that promote the conservation of park resources unimpaired for current and future enjoyment. That requirement comes from two key statutes: the 1916 Organic Act (see Chapter I) and the National Environmental Policy Act of 1969 (NEPA). NEPA requires all federal agencies to prepare studies of the impacts of and alternatives to proposed actions, use those studies in deciding whether to proceed with the actions, and diligently attempt to involve the affected public before any decision is made.

The Environmental Quality Program helps fulfill this requirement in two ways. The Environmental Compliance Program helps parks comply with NEPA and related statutes, and the Environmental Response, Damage Assessment, and Restoration Program helps parks address resource injuries caused by incidents such as oil spills and hazardous substance releases.

Environmental Compliance Program

The Environmental Compliance Program provides policy development, technical assistance, training, and project management to parks in the areas of impact analysis and conservation planning under NEPA and related statutes. Specifically, this program is intended to assist parks with complex, controversial, and potentially precedent-setting NEPA analyses and decisions; this

assistance is generally not available at the park or regional levels. In FY 2008, the Environmental Compliance Program managed more than \$5.2 million of NEPA project work in 27 parks. Many of these projects are multi-year efforts that also involve the Department of the Interior Office of the Solicitor, Department of Justice, state governments, and the public.

Environmental Response, Damage Assessment, and Restoration Program

The Environmental Response, Damage Assessment, and Restoration Program (ERDAR) provides policy development, technical assistance, training, and case management to parks to address incident-caused injuries to resources. Under the Park System Resource Protection Act; Oil Pollution Act; Park System Resources Protection Act (16 U.S.C. 19jj); and Comprehensive Environmental Response, Compensation, and Liability Act, the National Park Service is authorized to take actions to prevent or minimize injuries, assess and seek recovery of compensatory damages, and restore injured resources that are associated with discharges of oil, releases of hazardous substances, and other incidents that injure NPS resources. ERDAR helps parks apply these authorities since this assistance is highly specialized and generally not available at the park or regional levels. In FY 2008, ERDAR recovered more than \$6.8 million in compensatory damages for 19 parks and managed more than \$580,600 of restoration project work. Most of these cases and projects are multi-year efforts that involve a variety of other agencies, both at the federal and state levels.

NATURAL SOUNDS PROGRAM

The Natural Sounds Program was established in 2000 to provide parks with assistance, guidance, and a Servicewide approach to managing acoustic environments (or soundscapes) in a way that balances the expectations of park visitors with the protection of park resources and values. The Natural Sounds Program protects, maintains, and restores 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 to implement the National Parks Air Tour

Management Act. Specifically, the Natural Sounds Program provides technical assistance to parks by monitoring acoustic conditions, collecting and analyzing data, developing ambient acoustic baseline information, and providing planning assistance including drafting and reviewing park plans and NEPA documents.

Given the increased understanding of the important role the acoustic environment plays in overall ecosystem health as well visitor enjoyment and wilderness management, the Natural Sounds Program has seen a significant increase in interest from parks and regions over the past year and, therefore, a significant increase in workload and accomplishments. In FY 2008, the Natural Sounds Program assisted 25 parks with 49 specific projects; the following examples highlight some of these projects.

Learning and Understanding

Natural Sounds Program staff completed acoustic monitoring at 20 parks, finished acoustic monitoring reports for three parks, trained park staff on acoustic monitoring protocol and equipment at six parks, and initiated the process for assessing noise source issues (e.g., energy development, watercraft, ORVs, construction equipment, motorcycles). Three of the monitoring projects took place at **Great Sand Dunes National Park and Preserve (CO)**, **Mount Rushmore National Memorial (SD)**, and **San Antonio Missions National Historical Park (TX)**.

Great Sand Dunes National Park and Preserve (CO). Because an energy development project is proposed for the adjacent Baca National Wildlife Refuge, the Natural Sounds Program was asked to capture baseline ambient sound measurements in the park. This will allow the park to better identify noise impacts if the energy development project begins. Acoustic technicians collected and analyzed data, completing an acoustic monitoring report for the park and for staff from Baca National Wildlife Refuge for use in the environmental assessment proposing the development. The monitoring effort discovered that the acoustical environment in Great Sand Dunes was exceptionally quiet—one of the quietest locations ever monitored by the Natural Sounds Program. Ambient levels this low are extremely rare and thus extremely vulnerable

to impacts from noise sources.

Mount Rushmore National Memorial (SD).

The importance of regulating low-flying air tours is readily apparent at Mount Rushmore National Memorial, where interpretive talks are regularly interrupted by air tours: acoustic monitoring at the Grand View Terrace, the promenade below the faces at Mount Rushmore, indicates that almost every 45-minute interpretive talk is interrupted at least three times by low-flying air tours. These figures echo complaints received by park managers from visitors regarding the noise from air tours. The National Park Service continues to try to work with the Federal Aviation Administration to regulate air tours consistent with the congressional mandate of the National Parks Air Tour Management Act of 2000, which is designed to prevent or mitigate impacts to national park resources and visitor enjoyment from low-flying air tours.

San Antonio Missions National Historical Park (TX). The Texas Department of Transportation recently issued a Finding of No Significant Impact for the extension of one of the runways at Stinson Municipal Airport, which is immediately adjacent to Mission San Juan. The goal of this monitoring effort was to capture baseline ambient measurements

prior to the completion of the runway expansion. The park is concerned about increasing aircraft overflights and their impacts on interpretive programs and visitor enjoyment of the historical site. Over a one-month period, the Natural Sounds Program monitored acoustics; collected sound pressure level, audio, and wind speed data; and conducted on-site listening exercise to aid with sound source identification. A preliminary monitoring report was sent to the park, with a detailed report to be sent when complete.

Sharing

Natural Sounds Program planning activities included making progress on air tour management plans for **Mount Rainier National Park (WA)**, **Haleakala National Park (HI)**, and **Hawaii Volcanoes National Park (HI)**; assisting **Zion National Park (UT)** and **Minuteman National Historical Park (MA)** with soundscape management plans; developing a quantitative framework for analyzing noise impacts to wildlife, visitor experience, ethnographic resources, and soundscape for the **Grand Canyon National Park (AZ)** Overflights Environmental Impact Statement; reviewing and commenting on the draft Federal Register notice for clarifying the definition of substantial restoration of natural quiet and draft impact thresholds for the Grand Canyon National Park Overflights Environmental Impact Statement; and providing assistance to

Low-flying air tours impact on-the-ground visitor experience at Mount Rushmore National Memorial (SD).
NPS Photo



parks on other planning efforts such as GMPs, wilderness plans, transportation management plans, and resource stewardship plans.

The Natural Sounds Program continued to provide education and outreach efforts. The Natural Sounds Program held a soundscape planning workshop in the Alaska Region; provided acoustic equipment and interpretative materials to Global Explorers (Connecting Kids to Parks), a non-profit, for use in their Leading the Way programs; developed a key resource information and issues handbook for park interpreters as part of an interpretative toolbox; developed a brochure about the Natural Sounds Program; worked with the Arthur Carhart Wilderness Training Center to develop a soundscape module as part of a wilderness training course; and provided information for articles and interviews for several magazines.

RESOURCE PROTECTION PROGRAM

In its seventh year of funding from the Natural Resource Challenge, the Resource Protection Program supports projects that propose innovative approaches involving natural resource specialists, protection rangers, researchers, and partners from other agencies to focus on resources at risk. In FY 2008, the Resource Protection Program distributed \$282,000 for such projects. The following examples highlight some of the FY 2008 Resource Protection projects.

Learning and Understanding

Organ Pipe Cactus National Monument and Coronado National Memorial (AZ). The Department of Homeland Security constructed five miles of “pedestrian fence” along the international border with Mexico at Organ Pipe and two miles of fence at Coronado. To assess the effects of these fences on hydrologic flow patterns, the parks hired a contractor for the installation of channel geomorphology transects, which will allow measurement of changes in channels. The contractor provided a written report, electronic versions of all photo points, GPS data on transect locations, and an electronic database to track changes over time. The parks continue to use the transects to re-read the channels after rain events.

Pictured Rocks National Lakeshore (MI). Staff continued a project to assess the status of rare dune forest plant communities, determine ecological and anthropogenic threats to the long-term viability of key species, and prepare ecological and law enforcement monitoring plans. Highlights of the project include documentation of numerous populations of the state-threatened Lake Huron tansy (*Tanacetum huronense*) and two state species of concern, American dune (*Elymus mollis*) and blue wild rye (*Elymus glaucus* Buckley), in 20 miles of surveyed shoreline, and documentation of numerous bryophyte and lichen surveys previously unreported in the lakeshore. Both monitoring plans and the interpretive component were initiated and will be completed following analysis of collected field data. A cooperative agreement with Northern Michigan University will extend field work through a fourth field season (FY 2009), which will provide a more complete data set and more useful final product.

Sharing

Biscayne National Park (FL). The park continued to work toward reversing the observed decline in fisheries resources and reducing the number of fisheries violations through increased visitor education and fisheries enforcement. Staff launched an innovative “Fisheries Awareness” class for individuals who receive citations related to fishing regulation violations. Class attendance (including among non-cited participants) continues to increase, and the U.S. Magistrate Court agreed to use the class as mitigation for a visitor’s first fisheries citation. Additional outreach efforts included fish identification classes for law enforcement staff at Biscayne and Everglades National Park and the Florida Keys National Marine Sanctuary and a program for campers. Enforcement activities include more stops to check anglers’ catches, “ride-alongs” by resource management staff to aid in fish identification, and law enforcement ranger participation in bi-weekly fish creel surveys.

Katmai National Park and Preserve (AK). Natural Resource Protection funds were combined with park base funds to create a backcountry bear safety education program. The program included purchasing GPS units to document food-related trash locations, funding increased backcountry patrols in

bear-viewing and sport-fishing areas, purchasing six bear-resistant food containers for visitors on multi-day river trips, printing several thousand “Best Bear Viewing Practices on the Katmai Coast” brochures, and producing a backcountry bear safety orientation movie. The brochure and movie will be distributed at 2009 commercial use authorization meetings; commercial operators will be asked to show the movie to clients before entering the park. To measure project success, backcountry rangers will document bear-human problem areas before and after program implementation.



Chapter VI: Financial Details

This chapter presents financial details for Servicewide natural resource programs. Information in Chapters I–V describe program accomplishments and highlight which of the programs have benefited from the Natural Resource Challenge funding increases provided between FY 2000 and FY 2007 and how the programs were affected. FY 2007 marked the final year of planned Natural Resource Challenge increases, but the programs continued to benefit in FY 2008 from the sustained increases.

The Natural Resource funding is requested as a series of discrete programs, including 14 Servicewide 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 identifi-

able 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. Table 6.1 shows total funding for the parks that received Natural Resource Challenge funding.

Below are details of funding changes by program between FY 2007 and FY 2008. In addition, where appropriate, additional detail is provided regarding how funding within these programs has been allocated.

Researchers at the George Washington Memorial Parkway (VA, MD, DC) conducted surveys of insects. Information from the surveys will provide managers with a better understanding of the park's biodiversity.

Table 6.1

Natural Resource (NR) Funding of Parks Receiving NR Challenge Increases								
Park	FY 2001 or FY 2002 Amount of Challenge Increase	FY 2002 NR Total	FY 2003 NR Total	FY 2004 NR Total	FY 2005 NR Total	FY 2006 NR Total	FY 2007 NR Total	FY 2008 NR Total
Acadia NP	345,000	849,827	794,395	755,087	752,395	695,273	726,254	728,833
Antietam NB	150,000	319,965	316,723	314,900	353,000	350,000	420,000	421,360
Appalachian National Scenic Trail	142,000	263,638	256,603	258,337	298,642	299,453	310,919	316,667
Big Cypress NPr ¹	399,000	1,033,640	1,010,000	1,108,140	1,108,140	1,085,907	1,104,663	1,050,220
Buck Island Reef NM ²	100,000	270,000	216,450	216,000	216,000	216,000	216,000	216,000
Catoctin Mountain Park	89,000	254,400	231,900	232,200	272,414	174,867	200,594	204,976
Channel Islands NP	498,000	1,406,622	1,406,622	1,440,607	1,891,222	1,891,222	1,891,222	2,255,648
Coronado NMem	60,000	94,993	105,231	95,236	108,000	60,000	60,000	60,000
Curecanti NM	141,000	657,500	690,600	719,300	724,000	731,700	741,900	859,100
Dinosaur NM	189,000	501,800	559,375	568,874	571,152	524,200	627,280	772,738
Gates of the Arctic NP&Pr	148,000	362,401	363,039	349,164	377,345	357,517	342,014	534,945
Great Basin NP	126,000	331,450	315,756	375,939	367,080	382,600	454,600	483,157
Great Sand Dunes NP	180,000	291,700	287,500	281,300	281,300	323,400	332,000	325,300
Great Smoky Mountains NP ³	402,000	1,245,100	1,152,700	1,003,200	1,231,700	476,000	353,200	2,258,200
Haleakala NP	480,000	1,561,660	1,372,200	1,196,400	1,196,400	1,404,882	1,458,403	1,492,557
Homestead NM of America	82,000	104,500	104,500	81,198	82,460	82,353	87,731	77,244
Hopewell Culture NHP	105,000	95,000	79,322	103,047	99,953	109,519	106,024	106,332
Jewel Cave NM	50,000	168,500	168,500	167,140	159,203	153,330	161,422	170,571
John Day Fossil Beds NM	95,000	129,000	130,000	115,000	127,101	119,000	129,000	129,000
Kalaupapa NHP ⁴	211,000	549,000	549,000	549,000	499,000	534,000	549,000	787,000
Lake Clark NP&Pr	147,000	321,500	319,810	250,000	262,600	245,800	261,032	259,900
Little River Canyon NPr ⁵	85,000	182,426	174,027	112,900	171,275	95,898	96,371	111,941
Mojave NPr*	470,000	1,264,000	1,219,073	1,177,488	1,178,297	1,165,193	1,160,397	1,147,303
Monocacy NB*	118,000	120,000	116,000	116,000	116,000	116,000	116,000	116,000
Obed W&SR	195,000	245,000	193,318	188,775	188,775	188,775	195,000	182,751
Padre Island NS	95,000	408,000	403,825	543,000	471,896	600,200	589,492	547,307
Pictured Rocks NL	55,000	194,650	207,000	211,000	237,000	238,832	243,664	266,547
Rock Creek Park*	163,000	436,522	393,168	359,104	299,000	376,300	307,977	305,881
San Juan Island NHP	95,000	124,600	125,050	124,600	124,600	116,837	101,200	123,230
Saugus Iron Works NHS	58,000	58,000	58,000	69,900	58,000	58,000	58,000	58,000
Sequoia & Kings Can- yon NPs ⁶	112,000	1,446,000	1,424,400	1,424,400	1,457,400	1,563,600	1,590,600	1,885,200
Stones River NB ⁷	132,000	132,000	137,100	127,924	132,000	208,277	188,182	267,954
Sunset Crater, Walnut Canyon, & Wupatki NMs	100,000	166,762	171,227	186,341	191,683	196,426	208,661	204,024
Theodore Roosevelt NP	133,000	302,500	292,500	282,500	281,500	264,660	301,400	332,600
Virgin Islands NP ⁸	399,000	1,077,234	1,002,726	941,500	877,234	877,234	399,000	399,000
Zion NP ⁹	246,000	536,300	515,872	518,774	485,274	518,774	467,101	492,344
Totals	6,595,000	17,506,190	16,863,512	16,564,275	15,047,667	16,802,029	16,556,303	19,162,997

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 from Coral Reef Initiative in FY 2001.

³ Also received a non-Challenge \$367K base increase in FY 2001.

Table 6.2

Air Quality Program	
FY 2007 allocation	8,692,000
Classified Pay Increase	44,000
Net FY 2007 Decrease	
Total available in FY 2007	8,736,000
FY 2008 allocation	8,736,000
Classified Pay Increase	75,000
Net FY 2008 Decrease ¹⁰	-138,000
Total available in FY 2008	8,673,000
Change from FY 2007	-63,000

Table 6.3

Air Quality Program Funding by Categories	
Program Management & Implementation	1,266,000
Air quality monitoring, projects, and analysis	5,005,000
Collaboration & Outreach	329,000
Technical assistance	2,073,000
Total available in FY 2008	8,673,000

Table 6.4

Biological Resources Management Program	
FY 2007 allocation	8,401,000
Classified Pay Increase	44,000
Base adjustment ¹¹	368,000
Invasive species increase	750,000
Highly Pathogenic Avian Influenza	375,000
Total available in FY 2007	9,938,000
FY 2008 allocation	9,563,000
Classified Pay Increase	97,000
Highly Pathogenic Avian Influenza	375,000
Net FY 2008 Decrease ¹⁰	-159,000
Base transfer ¹²	-111,000
Total available in FY 2008	9,765,000
Change from FY 2007	-173,000

⁴ FY 2008 includes \$238K from Coral Reef Initiative.

⁵ Figures shown for FY 2001 and 2002 reflect a correction to those reported in last year's report.

⁶ Received NRC money in FY 2002 (\$498K for Santa Cruz Island restoration) and in FY 2005 (\$477K for island fox recovery).

⁷ Also received in FY 2008 one time Flexible Park Base Funding in amount of \$333,000 to address scorecard issues, not reflected in total.

⁸ Figures shown for FY 2001 and 2002 reflect a correction to those reported in FY 2007 report.

⁹ FY 2008 does not include natural resource projects funded through the SCC (\$213,702).

¹⁰ Reflects FY 2008 across-the-board rescission.

¹¹ Transferred from I&M Program funding.

¹² Transferred to Natural Resource Data and Information Program.

Table 6.5

Biological Resource Management Program Funding by Categories	
Biological Resource Projects—National Level Support	583,000
Natives Branch	376,000
Ecological Restoration	275,000
Endangered Species Program	425,000
Exotic Plant Management Program	5,594,000
Integrated Pest Management Program	275,000
Invasive Animal Program	275,000
Invasive Plant Program	280,000
Migratory Bird Program	175,000
Vegetation Mapping	250,000
Wildlife Management and Health Program	925,000
Base funding in FY 2008	9,433,000
Highly Pathogenic Avian Influenza	332,000
Total available funding in FY 2008	9,765,000

Table 6.6

Cave and Karst Research Institute	
Funding allocation in FY 2007	328,000
Classified Pay Increase	
Total available in FY 2007	328,000
FY 2008 allocation	328,000
Classified Pay Increase	0
Net FY 2008 Decrease ¹⁰	-5,000
Total available in FY 2008	323,000
Change from FY 2007	-5,000

Table 6.7

Cooperative Ecosystem Studies Units—National Network Support	
Total allocation/available in FY 2007	127,000
FY 2008 allocation	127,000
Net FY 2008 Decrease ¹⁰	-2,000
Total available in FY 2008	125,000
Change from FY 2007	-2,000

Table 6.8**Cooperative Ecosystem Studies Units Funding Distribution**

FY 2001 or 2003 funding

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 ¹³	

Table 6.9**Geographic Information System Program**

Funding allocation in FY 2007	1,255,000
Base Change	0
Net FY 2007 Decrease	0
Total available in FY 2007	1,255,000
FY 2008 allocation	1,255,000
Net FY 2008 Decrease ¹⁰	-20,000
Total available in FY 2008	1,235,000
Change from FY 2008	-\$20,000

Table 6.10**Geologic Resources Program**

Funding allocation in FY 2007	2,672,000
Classified Pay Increase	40,000
Base adjustment ¹¹	150,000
Total available in FY 2007	2,862,000
FY 2008 allocation	2,862,000
Classified Pay Increase	85,000
Net FY 2008 Decrease ¹⁰	-46,000
Total available in FY 2008	2,901,000
Change from FY 2007	\$39,000

¹³ Name changed to Great Rivers CESU.

Table 6.11

Geologic Resources Program Funding by Categories	
Cave & Karst	102,000
Coastal Geology	296,000
Disturbed Lands/AML	580,000
Geologic Hazards	116,000
Geologic Resource Evaluation	647,000
Minerals Management	855,000
Paleontology	102,000
Soil Resources	203,000
FY 2008 Total	2,901,000

Table 6.12

Inventory and Monitoring Program	
FY 2007 Allocation	43,124,000
Classified FY 2007 Pay Increase	169,000
Programmatic Increase	1,000,000
Net FY 2007 Decrease ¹⁴	-518,000
Total Available in FY 2007	43,775,000
FY 2008 allocation	43,775,000
Classified Pay Increase	508,000
Base Transfer ¹⁵	261,000
Net FY 2008 Decrease ¹⁰	-708,000
Total available in FY 2008	43,836,000
Change from FY 2007	61,000

Table 6.13

Inventory and Monitoring Program Funding by Categories	
Natural Resource Inventory Projects	10,776,675
Vital Signs Monitoring	27,504,380
Information Management	2,454,590
Regional Coordinators	910,000
Program Administration	2,190,355
Total available in FY 2008	43,836,000

¹⁴ Transfer of I&M funding (\$518K) to Biological Resource Management Program (\$368K) and Geologic Resources Program (\$150K) to support vegetation mapping, soil mapping, and geologic mapping inventories.

¹⁵ Transferred from Mammoth Cave National Park prototype I&M program to the Cumberland Piedmont Network.

Table 6.14

Allocation of Funding among Basic Natural Resource Inventories	
Air Quality Related Values	319,900
Geologic Resource Inventories	1,850,600
Soil Surveys	
Alaska	295,300
Outside of Alaska	2,556,000
Water Resource Data	137,700
Vegetation Mapping	
Alaska	492,200
Outside of Alaska	4,183,600
Species Lists	103,177
Other Natural Resource Inventories	838,198
Total	10,776,675

Flying squirrel captured during East Stroudsburg University's mammal inventory of the Appalachian National Scenic Trail from Pennsylvania to Connecticut.



Table 6.15**Allocation of Monitoring Funding among Networks and Prototypes**

Network	FY First funded	FY 2008 Amount
North Coast and Cascades	2001	758,000
Northeast Coastal and Barrier	2001	773,640
Heartland	2001	715,360
Sonoran Desert	2001	679,530
Cumberland/Piedmont	2001	952,740
Central Alaska	2002	1,224,790
National Capital	2002	757,000
Northern Colorado Plateau	2002	983,900
San Francisco Bay Area	2002	763,300
Greater Yellowstone	2002	734,360
Appalachian Highland	2002	424,275
Mediterranean Coast	2002	312,250
Southwest Alaska	2002	1,445,300
Northeast Temperate	2003	784,560
Southern Colorado Plateau	2003	1,213,100
Pacific Island	2003	1,566,580
Great Lakes	2003	1,307,675
Gulf Coast	2004	929,370
Rocky Mountain	2004	638,680
Sierra Nevada	2004	660,235
Eastern Rivers and Mountains	2004	653,640
Klamath	2004	1,559,680
Arctic	2005	802,290
Southeast Coast	2005	1,272,340
Upper Columbia Basin	2006	526,160
Southern Plains	2006	392,975
Mojave Desert	2006	859,975
Southeast Alaska	2006	1,527,200
South Florida/Caribbean	2006	436,875
Mid-Atlantic	2006	303,100
Chihuahuan Desert	2007	770,200
Northern Great Plains	2007	775,300
Total		27,504,380

Table 6.16

Natural Resources Data and Information Program	
FY 2007 Allocation	1,424,000
Classified FY 2007 Pay Increase	19,000
Total available in FY 2007	1,443,000
FY 2008 allocation	1,443,000
Classified Pay Increase	37,000
Net FY 2008 Decrease ¹⁰	-23,000
Base Transfer ¹⁶	414,000
Total available in FY 2008	1,871,000
Change from FY 2007	428,000

Table 6.17

Natural Resources Preservation Program (NRPP)	
FY 2007 Allocation	8,229,000
Base Change	0
Net FY 2007 Decrease	0
Total available in FY 2007	8,229,000
FY 2008 allocation	8,229,000
Net FY 2008 Decrease ¹⁰	-129,000
Total available in FY 2008	8,100,000
Change from FY 2007	-129,000

Table 6.18

Allocation of NRPP Among Project Categories and Projects Funded		
	Allocation	Projects
Alaska Projects	467,000	11
Disturbed Land Restoration	790,000	13
Natural Resource Management	3,140,000	33
Regional Block Allocation	1,303,000	74
Servicewide	764,000	25
Small Park	933,000	62
Threatened & Endangered Species	467,000	11
USGS/BRD Technical Assistance	236,000	

¹⁶ Base transfer from Biological Resource Management (\$111,000), Natural Sounds (\$236,000), and Social Science Programs (\$67,000).

Table 6.19

Natural Sound Program	
FY 2007 allocation	1,399,000
Classified Pay Increase	5,000
FY 2007 Increase	2,402,000
Total available in FY 2007	3,806,000
FY 2008 allocation	3,806,000
Classified Pay Increase	17,000
Net FY 2008 Decrease ¹⁰	-60,000
Base Transfer ¹⁷	-236,000
Total available in FY 2008	3,527,000
Change from FY 2007	-279,000

Table 6.20

Resource Damage Assessment and Restoration Program*	
FY 2007 allocation	1,344,000
Classified Pay Increase	17,000
Total available in FY 2007	1,361,000
FY 2008 allocation	1,361,000
Classified Pay Increase	34,000
Net FY 2008 Decrease ¹⁰	-22,000
Total available in FY 2008	1,373,000
Change from FY 2007	12,000

Table 6.21

Resource Protection Fund	
FY 2007 allocation	286,000
Total available in FY 2007	286,000
FY 2008 allocation	286,000
Classified Pay Increase	0
Net FY 2008 Decrease ¹⁰	-4,000
Total available in FY 2008	282,000
Change from FY 2007	-4,000

Table 6.22

Water Resources Program	
FY 2007 allocation	12,325,000
Classified Pay Increase	74,000
Total available in FY 2007	12,399,000
FY 2008 allocation	12,399,000
Classified Pay Increase	114,000
Net FY 2008 Decrease ¹⁰	-197,000
Total available in FY 2008	12,316,000
Change from FY 2007	-83,000

¹⁷ Base transfer of \$236,000 to Natural Resource Data and Information Program.

Table 6.23**Water Resources Program Funding by Categories**

Water Resource Projects	
<i>Water Resource Protection</i>	911,900
<i>Other Projects</i>	14,250
Water Quality Monitoring	2,737,900
Water Resource Protection—Aquatic Resource Professionals	1,205,000
Watershed Condition Assessment Program	
<i>Critical Projects</i>	225,300
<i>Coastal Projects</i>	440,300
<i>Natural Resource and Watershed Condition Assessments</i>	1,406,800
<i>Other Projects</i>	381,900
Water Resource Technical Assistance	4,992,650
Total	12,316,000

Table 6.24**Allocation of Water Quality Monitoring Funding**

Network	Number of Parks	FY 2008 Funding
Central Alaska	5	94,200
Heartland	15	78,800
Northeast Coastal and Barrier	8	86,500
National Capital	11	68,200
Cumberland/Piedmont	14	56,700
Appalachian Highlands	4	67,200
Northern Colorado Plateau	16	103,700
Greater Yellowstone	3	68,200
Sonoran Desert	11	61,500
North Coast and Cascades	7	78,800
San Francisco Bay	6	67,200
Mediterranean Coast	3	73,000
Southwest Alaska	5	133,600
Northeast Temperate	10	57,700
Southern Colorado Plateau	19	119,100
Pacific Island	9	145,100
Great Lakes	9	118,200
Gulf Coast	8	85,500
Rocky Mountain	6	58,600
Sierra Nevada	3	60,600
Eastern Rivers and Mountains	9	60,600
Arctic	5	144,100
Klamath	6	73,000
Southeast Coast	17	116,300
Upper Columbia Basin	8	48,000
Southern Plains	10	27,900
Mojave Desert	6	76,900
Southeast Alaska	3	40,400
South Florida/Caribbean	6	141,300
Mid-Atlantic	11	42,300
Chihuahuan	6	70,200
Northern Great Plains	13	77,900
Servicewide Data Management		136,600
Total	272	2,737,900



Smith's Longspur (*Calcarius pictus*) is a species of concern that breeds on National Park and Refuge lands in the Brooks Range, Alaska. The species breeds on well drained slopes in broad glacial valleys within 1 km of creeks or ephemeral runoff.

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	Increase FY 2007	Total through FY 2007
<i>Inventory and Monitoring Resources</i>									
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 usable		1,098							1,098
<i>Fix Critical Problems</i>									
Natural Resource Preservation Program 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
<i>Attract Scientists</i>									
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



Appendix B: NRPP Projects FY 2008

Table B.1

NRPP Natural Resource Management Fully Funded Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
Saguaro National Park	Remove Invasive Exotic Plants from Critical Habitats at Saguaro National Park	196,000	51,000
Amistad National Recreation Area	Survey and Monument 41 Miles of Impacted Park Boundary	123,000	37,000
Big Bend National Park	Protect Big Bend Slider	68,000	33,000
Bryce Canyon National Park	Protection and Restoration of Dark Night Skies	400,000	219,700
Wind Cave National Park	An Evaluation of the Movements and Distribution of Elk at Wind Cave National Park, South Dakota	176,000	88,000
Upper Delaware Scenic & Recreational River	Identify Threatened Bald Eagle Habitat and Develop Management Plan	145,000	30,000
Gateway National Recreation Area	Bathymetric Survey of Bays Parkwide	96,000	96,000
Point Reyes National Seashore	National Academy of Sciences Study of Shellfish Mariculture	37,300	37,300
Jean Lafitte National Historical Park and Preserve	Assessing Fire for Control of Exotic Chinese Tallow in the Marshes of the Barataria Preserve	123,000	65,000
Great Smoky Mountains National Park	Restore Rare Species to the park Wetland Habitats Being Lost to Exotic Plant Invasion	154,000	80,000
Cape Hatteras National Seashore	Study/Research on Shore Birds at Cape Hatteras National Seashore	13,000	13,000
	Transfer to Servicewide Project "Challenge of Climate Change" Component B	50,000	50,000
TOTAL		\$1,581,300	\$800,000

Table B.2

NRPP Natural Resource Management New and Ongoing Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
Kenai Fjords National Park	Estimating the Brown Bear Population on the Kenai Peninsula, Alaska	210,000	5,000
Glacier Bay National Park & Preserve	Investigate Causal Factors of Harbor Seal Decline in Glacier Bay National Park and Preserve	300,000	113,000
Rocky Mountain National Park	Reduce Elk Numbers to Restore a Healthy Ecosystem that Supports Diverse Wildlife	308,300	47,000
Zion National Park	Determine Recreational Impacts to Threatened Mexican Spotted Owls	198,000	137,000
Yellowstone National Park	Management of Introduced Mountain Goats in Yellowstone National Park	198,000	43,000
Canyon de Chelly National Monument	Implement Restoration Prescriptions: Native Seed Collection, Propagation and Revegetation	363,500	100,000
Voyageurs National Park	Assessing the Effects of the Namakan Reservoir Operations on Lake Sturgeon Ecological Habitats	297,000	105,000
Badlands National Park	Assess Long Term Viability of Swift Fox in Badlands NP and South Dakota	342,000	131,000
Midwest Regional Office	Determine Invasion Status and Ecological Impacts of an Exotic Zooplankter in Great Lakes Parks	190,000	80,000
Indiana Dunes National Lakeshore	Restore the Biological Resources of the Cowles Bog Wetland Complex: Phase II—Fen Recovery	250,983	103,000

Bush clover at Indiana Dunes National Lakeshore (IL).

NRPP Natural Resource Management New and Ongoing Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
National Capital Regional Office	To Weed or Not to Weed? An Economic Decision Support Tool for National Capital Region Parks	310,000	150,000
Cape Cod National Seashore	Monitoring Spawning Horseshoe Crabs	172,000	94,000
Cape Cod National Seashore	Cape Cod Shoreline Change and Resource Protection	177,000	65,000
Kalaupapa National Historical Park	Exclude Ungulates From Northern Unit of Puu Alii Plateau	422,000	194,000
Point Reyes National Seashore	Control Exotic Deer	686,000	261,000
Channel Islands National Park	Eradicate Dense Fennel and Facilitate Eradication of Feral Pigs	456,000	128,000
Hawaii Volcanoes National Park	Control Alien Weeds & Restore Rare & Endangered Plants	222,360	112,000
North Cascades National Park	Eradicate Non-native Trout from Seven Lakes	383,134	126,000
Canaveral National Seashore	Create Hydrologic Model of Mosquito Lagoon at CANA	280,000	90,000
Mammoth Cave National Park	Optimal Lighting in the National Park Service Caves	239,047	187,000
Dry Tortugas National Park	Dry Tortugas Research Natural Area Implementation	282,000	69,000
TOTAL		\$6,287,324	\$2,340,000

Table B.3
NRPP Threatened and Endangered Species Fully Funded Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
Organ Pipe Cactus National Monument	Sonoran Pronghorn Captive Breeding	150,000	58,000
Presidio of San Francisco	Restore Habitat for Two Federally Listed Plant Species	149,070	38,400
Mojave National Preserve	Lake Ecology and Population Dynamics of Mohave Tui Chub	149,947	56,000
Ebey's Landing National Historical Reserve	Implement Recovery Plan for Threatened Golden Paintbrush	96,397	32,700
Kalaupapa National Historical Park	Habitat Use and Foraging of Endangered Monk Seal	95,531	32,400
Hawaii Volcanoes National Park	Begin Recovery of Mauna Loa Silversword in Park Addition	62,789	25,400
Big South Fork National River and Recreation Area	Propagate and Augment Federally Listed Mussels in BISO	144,000	80,000
TOTAL		\$847,734	\$322,900

Table B.4

NRPP Threatened and Endangered Species New and Ongoing Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
Coronado National Memorial	Protect Mine Roosts of Endangered Lesser Long-nosed Bats	77,544	17,000
Padre Island National Seashore	Establish New Techniques to Protect Increasing Numbers of Endangered Kemp's Ridley Sea Turtle Eggs	150,000	52,000
Saint Croix National Scenic River	Sediment Dynamics in the St. Croix River and the Impact on Federally Endangered Mussels	149,174	46,000
Santa Monica Mountains National Recreation Area	Investigate & Mitigate Pollen Limitation in <i>Pentachaeta lyonii</i>	65,200	29,100
TOTAL		\$441,918	\$144,100

Table B.5

NRPP Disturbed Lands Restoration Fully Funded Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
Zion National Park	Test Riparian Revegetation Methods Along the Virgin River	157,800	31,400
Carlsbad Caverns National Park	Restore Habitat in Carlsbad Cavern Off-trail Areas	25,911	25,900
Hawaii Volcanoes National Park	Restore Kipuka Nene Campground	50,600	15,300
Mammoth Cave National Park	Restoration of 26 Abandoned Water Wells/Cisterns and 3 Dumps	115,900	98,000
TOTAL		\$350,211	\$170,600

Table B.6

NRPP Disturbed Lands Restoration New and Ongoing Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
Big Bend National Park	Restoring Grasslands in Big Bend National Park	91,815	94,000
Glacier National Park	Restore Severely Denuded, Eroding Park Lands in Lunch Creek and Iceberg Lake High Visitor Use Areas	110,737	25,000
Glacier National Park	Restoration of Soils and Vegetation at Running Eagle Falls in Glacier National Park	119,737	20,000
Southern Plains Inventory and Monitoring Network	Restore Prairie at Five National Park Units in Three States	119,789	104,000
Wupatki National Monument	Restore Abandoned NPS Housing/ Maintenance Area at Heiser Springs	97,331	25,000
Point Reyes National Seashore	Restore Paleodune & Climbing Dune Dynamics at Point Reyes Headlands	113,162	214,000
Lava Beds National Monument	Restore Two Prominent Volcanic Buttes at LABE	102,322	70,500
Big South Fork National River and Recreation Area	Plug 8 Abandoned Wells and Perform Associated Surface Reclamation in Big South Fork NRRRA	76,585	42,000
Chattahoochee River National Recreation Area	Support Corporate Wetland Restoration Partnership Initiative in Johnson Ferry Unit	93,890	24,900
TOTAL		\$925,368	\$619,400

Table B.7

NRPP Alaska Special Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
Gates of the Arctic National Park & Preserve	Past and Present Habitat Use by Muskoxen	61,450	30,600
Yukon-Charley Rivers National Preserve	Using Radiotelemetry to Assess Genetic Variation in Wolves of Yukon-Charley Rivers National Preserve	53,971	26,300
Alaska Regional Office	Mapping and Scientific Management of Off-Highway Vehicle Trails in Alaska -Implementing BMPs	200,790	54,800
Denali National Park and Preserve	Inventory the Bryophyte and Lichen Flora of Denali, YUCH, and WRST	90,920	37,200
Wrangell-Saint Elias National Park and Preserve	Inventory and Protection of Paleontological Sites (Dinosaurs) in Denali NP	197,005	98,800
Gates of the Arctic National Park and Preserve	Evaluating Nutritional Condition of Arctic Ungulates	48,480	24,400
Lake Clark National Park and Preserve	Airborne Digital Photography for Estimating Caribou Populations	21,120	21,330
Wrangell-Saint Elias National Park and Preserve	Evaluating the Genetic Structure of Dall's Sheep in Wrangell St. Elias National Park and Preserve	147,359	72,900
Denali National Park and Preserve	Inventory and Protection of Paleontological Sites (Dinosaurs) in Denali NP	50,200	26,100
Wrangell-Saint Elias National Park and Preserve	Paired-catchment study of ATV impacts on water quality in Wrangell-St. Elias NP&P	50,000	25,100
Wrangell-Saint Elias National Park and Preserve	Evaluate natural resources affected by ORV trails along the Nabesna Road.	63,825	44,800
TOTAL		\$985,120	\$462,330

Table B.8

NRPP Small Park Block Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
Grand Portage National Monument	Determine Population Structure and Distribution of Beaver in Grand Portage National Monument	15,025	14,000
Fort Union Trading Post National Historic Site	Protect Park from Losing 10 Feet of Land Along ½ Mile Boundary Annually to Erosion	14,400	10,250
Bent's Old Fort National Historic Site	Restore Eight Acres of Short-grass Prairie Adjacent to the Fort	92,638	12,500
Sunset Crater Volcano National Monument	Inventory & Map Unique Volcanic Features	39,482	19,500
Kings Mountain National Military Park	Conduct Survey of Odonata and Lepidoptera	37,560	12,100
Bent's Old Fort National Historic Site	Assess Results and Refine Strategies During Implementation of an Integrated Pest Management Plan	22,272	4,100
Chattahoochee River National Recreation Area	Stream Assessments and Stormwater Impacts in Tributaries of the Chattahoochee River	22,033	21,200
Herbert Hoover National Historic Site	Rehabilitation of Disturbed Land in Prairie Management Unit 1 (PMU 1)	14,662	10,555
Sand Creek Massacre National Historic Site	Develop Pilot Resources Stewardship Plan	20,000	20,000
Stones River National Battlefield	Development of Local Genotype Plant Source For Rehabilitation Of Forested Lands	25,000	23,100

NRPP Small Park Block Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
Chickamauga and Chattanooga National Military Park	Control Exotic Plants on Chickamauga Battlefield	25,000	23,500
Pea Ridge National Military Park	Mitigate And Rehabilitate Eroded Sections in Visitor Use Areas and Along Historic Traces	17,547	1,500
Grand Portage National Monument	Site Assessment and Management Recommendations for Conifer Regeneration along GRPO Trail Corridor	17,995	5,452
Sitka National Historical Park	Conduct Benthic Invertebrate and Algae Investigations to Determine Biological Water Quality Indexes	39,000	9,405
Florissant Fossil Beds National Monument	Develop Database for Paleontological Collecting Localities and Upgrade Inventory-Monitoring Database	11,776	3,000
Fort Necessity National Battlefield	Control Exotic Honeysuckle within a 25-Acre American Woodcock Habitat (Phase II, ref. PMIS#99577)	338,910	20,000
City of Rocks National Reserve	Canadian Invasion: To Defend and Protect Significant Riparian Corridors from Attacking Weeds	22,776	11,351
Devils Tower National Monument	Control/Eliminate Exotic Invasive Plant Species	40,000	37,900
Boston Harbor Islands National Recreation Area	Restore Natural Biodiversity to Boston Harbor Islands	52,810	16,700
Hagerman Fossil Beds National Monument	Would You Like Salt With Your Cedar? Tamarisk Eradication at Hagerman Fossil Beds NM	24,110	23,000
Fort Davis National Historic Site	Develop A Flood Mitigation Plan To Lower Threat To Life And Property	30,000	10,000
Cedar Breaks National Monument	Survey Rare Plants and Establish Compliance with Conservation Agreement (2-Year Project)	39,981	20,000
Hubbell Trading Post National Historic Site	Integrate Newly Introduced Agricultural Activity with Natural Resource Management at HUTR	40,000	20,000
Coronado National Memorial	Close Hazardous Mines to Improve Employee and Visitor Safety	20,000	20,000
Pipestone National Monument	Inventory/Define Upland Vegetation Conditions and Implement Disturbed Lands Restoration	14,787	13,900
Fort Scott National Historic Site	Control Invasive Species and Increase Diversity in Tallgrass Prairie Restoration	14,775	21,589
Grand Portage National Monument	Initial Butterfly Survey and Interpretive Program Development for Grand Portage National Monument	2,900	2,970
Midwest Regional Office	Development of Park Natural Resource Programs	163,600	40,000
Marsh-Billings-Rockefeller National Historical Park	Evaluate Vernal Pool Use by Amphibians	20,950	14,250
Richmond National Battlefield Park	Conduct Natural Heritage Surveys at High Priority Park units	9,000	6,650
George Washington Memorial Parkway	Inventory Insects in Turkey Run and Great Falls Parks	30,000	10,000
White Sands National Monument	White Sands National Monument Monitoring Wells	3,900	3,900
Vicksburg National Military Park	Determine Effects of Battlefield Restoration through Enhanced Monitoring Program	24,000	22,200
Timucuan Ecological and Historic Preserve	Control Non-Native Plants on NPS Uplands and Islands	22,008	20,300

NRPP Small Park Block Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
Muir Woods National Monument	Control Invasive Plants to Protect Coast Redwood Ecosystems	32,050	16,300
Carl Sandburg Home National Historic Site	Correcting Trail Drainage and Erosion at Carl Sandburg Home NHS	14,580	13,800
Fort Donelson National Battlefield	Continuation of Exotic Plant Management: Fort Donelson National Battlefield	15,000	13,900
De Soto National Memorial	Condition Assessment of Mangrove Community	24,725	23,100
War in the Pacific National Historical Park	Assessing and Mitigating the Environmental Impacts of Off-Road Vehicle Use at War In The Pacific NHP	23,450	23,450
Kings Mountain National Military Park	Monitor Invasive Exotic Plant Populations and Retreat Resprouts	86,000	11,000
Fort Pulaski National Monument	Shoreline Dynamics In Response To Physical Forcing Along the north shoreline of Cockspur Island	24,800	16,000
San Juan Island National Historical Park	Implement Native Prairie Restoration at EBLA and SAJH	60,000	39,000
Klondike Gold Rush National Historical Park	Inventory Lichens in Klondike Gold Rush NHP	19,600	9,405
Timpanogos Cave National Monument	Establish Bat Species Baseline through Echolocation Monitoring Stations	38,950	20,000
Canyon de Chelly National Monument	Determine Distribution and Abundance of Threatened Mexican Spotted Owls on North Rim	37,900	18,000
Lyndon B. Johnson National Historical Park	Inventory Listed Species and Potential Indicator Species at Newly Acquired Land at Pecos National Historical Park	37,934	19,500
Walnut Canyon National Monument	Acoustic Monitoring in Walnut Canyon National Monument	29,700	20,000
Scotts Bluff National Monument	Treat Exotic Plants at Scotts Bluff National Monument Using an Integrated Approach	29,878	14,070
Jewel Cave National Monument	Upgrade and Complete Photomonitoring System Along Cave Tour Routes	7,857	7,386
Mount Rushmore National Memorial	Evaluate Short-Term Effectiveness of Rehabilitation Treatments for Burned Slash Piles at MORU	29,315	13,870
Hot Springs National Park	Monitor Radon in Spring Waters to Manage Access to Facilities at Hot Springs National Park	3,810	3,772
Arkansas Post National Memorial	Inventory, mapping and control of exotic plants	20,350	11,929
John Muir National Historic Site	Yellow Star Thistle Project	30,000	31,200
Harpers Ferry National Historical Park	Survey of Karst Features	9,700	9,000
Richmond National Battlefield Park	Treat Exotic Infestation at Newly Acquired Riparian Zone	45,000	28,270
Morristown National Historical Park	Establish a Forest Demonstration Plot at Morristown NHP	36,865	2,800
Muir Woods National Monument	Develop methods and control Ehrharta erecta in Muir Woods	30,000	15,000
Lava Beds National Monument	Replace Old Trail/Cave Counters with TRAFx Advanced Counting Systems	6,710	1,206
Morristown National Historical Park	Monitor & Assess Native Plant Restoration & Treatments	7,000	7,000
Valley Forge National Historical Park	Revision of Field Management Plan	2,500	2,500

NRPP Small Park Block Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
Northeast Regional Director's Staff	Support Invasive Plant Management at Northeast Small Parks	6,670	6,670
Saugus Iron Works National Historic Site	Feasibility Study for restoration of Phragmites-dominated wetlands below SAIR Turning Basin	10,000	10,000
TOTAL		\$2,049,241	\$933,000

Table B.9

NRPP Regional Program Block Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
San Antonio Missions National Historical Park	Control of Non-Native Vegetation	33,600	19,590
Fort Scott National Historic Site	Control Invasive Species and Increase Diversity in Tallgrass Prairie Restoration	14,775	18,611
Chattahoochee River National Recreation Area	Develop and Implement IPM Program	20,535	17,631
Fort Bowie National Historic Site	Analyze and Rehabilitate Apache Spring Watershed	35,213	6,857
Alaska Regional Office	Natural Resource Employees Professionalization and Technical Competency Enhancement	156,661	11,636
Alaska Regional Office	Alaska Park Cooperative and Technical Assistance Projects (Regional Block Grant)	131,150	32,475
Alaska Regional Office	Produce Alaska Park Science Journal	434,882	8,429
Alaska Regional Office	Alaska Scientific and Technical Reports	54,000	15,035
Buffalo National River	Revise River Use Management Plan	18,000	16,600
NCR Regional Office	Photo-interpretation and Accuracy Assessment for Vegetation Classification in NCR	95,700	2,200
Delaware Water Gap National Recreation Area	Measurement of Land Cover/Use Change Trends in the Upper Delaware River Basin and Growth Projection	21,250	11,170
Mojave National Preserve	Wildlife Monitoring in Mojave National Preserve	92,920	16,685
Denali National Park & Preserve	Implement Regional Integrated Pest Management (IPM) Program to Ensure Health of Natural Resources	48,600	6,345
Alaska Regional Office	Arctic Park Science Symposium 2007–2008	29,837	16,685
Stones River National Battlefield	Rehabilitation of Four Wetland Sites: Removal of Invasive Plants and Revegetation with Natives	22,951	25,400
Olympic National Park	Improve Razor Clam Management at Olympic National Park by Predicting Pathogen Outbreaks	70,557	6,400
Voyageurs National Park	Assess Impact of Colonial Waterbirds to VOYA Resources: Movement Ecology and Demographics	17,460	7,500
Gateway National Recreation Area	Bathymetric Survey of Jamaica Bay and Other Bays Parkwide: Closing a Gap in the Saltmarsh Loss Model	112,000	8,400
Great Basin National Park	Re-establish Three Species of Extirpated Native Fish - Restore Entire Aquatic Community	73,638	11,500
Great Smoky Mountains National Park	Analysis of Aquatic Invertebrate Diversity in an Imperiled High Elevation Watershed	20,680	20,000
North Cascades National Park	Status and Distribution of the Marbled Murrelet in NOCA	65,425	19,300

NRPP Regional Program Block Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
Indiana Dunes National Lakeshore	Improve Rare Prairie Resource	18,000	23,000
Zion National Park	Determine Impacts from Encroaching Development to the Threatened Desert Tortoise Population in Zion	34,605	10,000
Rocky Mountain National Park	Identify and Survey Habitat for the Mexican Spotted Owl in Rocky Mountain and Great Sand Dunes NP.	40,000	22,400
Walnut Canyon National Monument	The Influence of Water Availability on Wildlife Communities in Walnut Canyon	24,006	6,734
Sleeping Bear Dunes National Lakeshore	Eliminate Recently Established Deer to Protect Unique South Manitou Island Vegetation	13,908	31,435
Isle Royale National Park	Conduct an Inland Lakes Creel Census at Isle Royale National Park	12,437	10,000
NCR Regional Office	Providing Opportunities for Professional Development for NCR Natural Resources	78,700	8,200
Catoctin Mountain Park	Investigate Ecological Succession in Forest Blowdowns Associated with Hurricane Ivan	26,600	4,120
George Washington Memorial Parkway	Inventory Seven Groups of Insects in Turkey Run and Great Falls Parks, Virginia	29,800	30,000
Prince William Forest Park	Determine Community Structure, Movement Patterns, and Conservation Concerns for Carnivores of PRWI	29,900	7,000
Gulf Islands National Seashore	Conduct Prescribed Burn to Reduce Fuel Loading from Hurricane Dennis and Katrina	23,750	7,700
Glen Canyon National Recreation Area	Develop Resource Assessment Protocols for Grazing Allotments	39,100	10,000
Mammoth Cave National Park	Restoration of Damaged Calcite and Gypsum in Crystal Cave, Mammoth Cave National Park	23,600	20,000
SER Regional Office	Purchase Boat and Electrofishing Equipment to Support Park Technical Assistance Requests in the SER	23,220	10,000
Devils Tower National Monument	Restore a 50 Acre Shortgrass Meadow and Control Exotic Invasive Plant Species	40,000	20,000
Congaree National Park	Determine Source(s) Of Fecal Contamination in Toms Creek Watershed Entering Congaree National Park	25,000	19,900
Carl Sandburg Home National Historic Site	Treat Hemlock Trees for Infestations of Hemlock Woolly Adelgid and Elongate Hemlock Scale	28,560	23,499
Jean Lafitte National Historical Park and Preserve	Eradicate Exotic Chinese Tallow and Restore Native Vegetation at the Historic Chenier Grand Coquille	23,900	20,200
Petrified Forest National Park	Inventory Paleontological Resources On Newly Acquired Park Lands For General Management Plan	37,308	23,500
Glacier National Park	Assess and Restore Native Habitat	144,000	44,363
Manassas National Battlefield Park	Post Clear Cut Plant and Aquatic Community Monitoring	12,200	700
Cedar Breaks National Monument	Prevent Degradation of Native Mountain Meadows	39,850	65,140
Badlands National Park	Expand Park Paleontological Database to Cover all of the Cedar Pass Area	18,000	16,290

NRPP Regional Program Block Projects

PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
Prince William Forest Park	Identify Orchid-Fungi Relationships for <i>Isotria medeoloides</i>	30,000	7,273
Fire Island National Seashore	Impacts of Beach Scraping and Artificial Dune Creation on the Natural Resources	80,852	31,176
Haleakala National Park	Remove Feral Animals To Protect Rare High Elevation Koa-Ohia Forest Community	140,470	23,000
Isle Royale National Park	Determine Status of American Marten at Isle Royale National Park	17,995	12,861
Apostle Islands National Lakeshore	Determine Population Dynamics of Archipelagic Deer Population Needed for Harvest Management	17,910	22,100
Buffalo National River	Protect Arkansas' Most Important Gray Bat Hibernaculum	18,000	3,600
Shenandoah National Park	Remove Non-native Plants from a Globally Rare Community—Monitor Rare and Non-native Species Extent	43,500	7,400
Arkansas Post National Memorial	Inventory, Mapping, and Control of Exotic Plants	20,350	9,440
Upper Delaware Scenic & Recreational River	Determine Status of State-Endangered Bridle Shiner in Delaware River and Selected Tributaries	40,000	21,720
Catoctin Mountain Park	Create a Protocol for the Analysis of Deer Browse Data at Catoctin Mountain Park	11,500	45,700
Denali National Park and Preserve	Develop High Resolution Climate Maps for the Alaska Region	42,692	28,700
Alaska Regional Office	Volunteer Crew for Invasive Plant Removal in DENA, KATM, KEFJ, and WRST	132,968	25,000
Carlsbad Caverns National Park	Replace Wooden Barrier to Left-Hand Tunnel in Carlsbad Cavern	5,240	25,000
Harpers Ferry National Historical Park	Survey of Karst Features	9,700	13,275
Sleeping Bear Dunes National Lakeshore	Protect Federally Endangered Piping Plover through Predator Control	17,850	18,003
Shenandoah National Park	Status and Trends of Park Fisheries—A Pilot Initiative for Reporting Monitoring Information	36,000	18,200
NCR Regional Office	Supporting Science Informed Decision Making in NCR Parks	75,000	10,000
NCR Regional Office	Integrating Science with Resource Management through Collaborative Approaches	71,900	10,000
Delaware Water Gap National Recreation Area	Suppress Alien Invasive Plants in Regenerating Hemlock Forests in Delaware Water Gap NRA	42,400	24,400
Assateague Island National Seashore	Digitize Historic Post-Storm Map to Enhance Resource Interpretation and Management	11,170	20,000
Manassas National Battlefield Park	Prepare Natural Resource Planning Documents	10,000	9,300
Wrangell-Saint Elias National Park and Preserve	Evaluate Natural Resources Affected by ORV Trails Along the Nabesna Road.	63,825	23,000
Hawaii Volcanoes National Park	East Rift Rain Forest Rare Plant Project	78,580	17,000
Cape Cod National Seashore	Evaluate Common Eider Die-Off at Cape Cod National Seashore	25,400	8,950
Alaska Regional Office	Contract Wildlife Section of Invasive Plant Management Plan EA	8,605	5,200

NRPP Regional Program Block Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2008 FUNDING
Klondike Gold Rush National Historical Park	Install Gauge & Measure Flow on the Taiya River for Natural Resources Monitoring and Visitor Safety	13,130	12,839
Rocky Mountain National Park	Provide Access to a Bighorn Sheep Mineral Lick	40,000	16,685
Shenandoah National Park	Sustain Repression of Mile-a-Minute Weed by Applying Pre-emergent Herbicide	5,200	20,200
Mesa Verde National Park	Sources of Mercury Deposition to Mesa Verde National Park, Colorado	25,000	19,900
Effigy Mounds National Monument	Control and Survey New Garlic Mustard Populations	15,000	16,177
Fire Island National Seashore	Resource Management Technical Assistance	30,000	7,900
Gateway National Recreation Area	Coastal Studies and Monitoring at Sandy Hook	20,000	18,871
All Regions	Regional Assessments	17,500	17,500
TOTAL		\$3,556,515	\$1,303,000

Table B.10

NRPP Servicewide Projects		
PARK	PROJECT TITLE	FY 2008 FUNDING
NRSS	Serving as NPS Senior Scientist for ADNRSS and Director	50,000
NRSS	Director's Annual Natural Resource Awards	30,000
	Barrier Island Project	25,000
	SCB Support	10,000
	Frontiers in Eco/Envir	10,000
	Print New Owners Manual	9,600
	RPRS Training	8,000
	Research Learning Center (RLC) Support	25,000
	Sierra Nevada Nutrient Project	20,000
BIRE	Support Collaboration Bison Reintroduction Efforts and NPS Bison Conservation	75,000
BIRE	Initiate and Implement Critical Migratory Species Data Compilation and Program Development	35,000
	Park Science	60,000
GERE	Monitoring and Compliance Assistance for Parks Managing Non-Federal Oil and Gas Operations	17,000
	FY08 Cave & Karst Program	35,000
	Emergency Response Program	35,000
WARE	NRPC Assist Parks with Planning	40,000
	ID of Ext & Mineral Project	35,000
	READ Program to Support Incidents	35,000
	Enhance Views of the NP Program	35,000
	NCSE Conference Support	5,000
	Challenge of Climate Change (\$50K from NRPP-NRM Funding Source)	85,000
	Web/Non-Web Des NRPC	23,000
	Support for Ocean/Coral Reef In	70,000
BIRE	Support and Development for Bioblitz and All Taxa Biotic Inventory Efforts Servicewide	10,000
	Facilitation on Biological Col	10,000
TOTAL		\$792,600



Appendix C: Biological Resource Projects—National Level Support

Table C.1

Park	Project Title	Project Total	Funded Amount
Congaree National Park	Conduct Acoustic Sampling To Detect Endangered Bird Species	\$50,000	\$25,000
Craters of the Moon National Monument	Locate and Control Leafy Spurge in Wilderness Study Area	\$49,700	\$19,400
Glacier National Park	Control Backcountry Invasive Weeds	\$50,000	\$17,000
Golden Gate National Recreation Area	Establish Endangered Tidewater Goby Population	\$50,000	\$30,000
Grand Canyon National Park	Supplemental Feeding Station for Improving Wild Condor Reproduction & Reducing Lead Poisoning	\$50,000	\$15,000
Grand Teton National Park	The Invasive New Zealand Mudsail vs the Candidate Threatened Jackson Lake Springsnail	\$49,900	\$13,300
Great Basin National Park	Sage Steppe & Fuels Management: Building the Knowledge Base	\$46,600	\$18,200
Great Sand Dunes National Park	Limber Pine Restoration in the Presence of an Exotic Pathogen	\$50,000	\$50,000
Rocky Mountain National Park			
Great Smoky Mountains National Park	Protection of American Chestnut Landscape through Detection and Development of a Native Resistant Strain	\$50,000	\$25,000
Haleakala National Park	Remove Feral Animals To Protect Rare Koa-Ohia Forest Community	\$50,000	\$25,000
Hawaii Volcanoes National Park	Assess Habitat Use & Investigate Causes of Adult Nene Mortality	\$49,920	\$31,440
Indiana Dunes National Lakeshore	Enhance State Listed Species Through Habitat Modifications and Introductions	\$50,000	\$10,200
Indiana Dunes National Lakeshore	Restore Endangered Karner Blue Butterfly to East Unit of Indiana Dunes National Lakeshore	\$35,690	\$14,080
Lake Clark National Park and Preserve	Conserving Sustainable Northern Pike Populations	\$46,300	\$6,600
Mammoth Cave National Park	Restoration of Tall Grass Prairie	50,000	\$22,000
Mount Rainier National Park	Mortality Risk of Western Toads from Roads/Trails at Tipsoo Lake	\$49,580	\$38,434
National Park of American Samoa	Rehabilitate Disturbed Lands on Alva Ridge	\$39,100	\$24,800
Santa Monica Mountains National Recreation Area	Using Historic Plot Data to Assess Vegetation Change	\$36,600	\$36,600
Stones River National Battlefield	Restoration of Cedar Glades and Barrens Designated State Natural Area	\$50,000	\$50,000
Voyagers National Park	Improve Limited Knowledge of Ecology and Population Status of Threatened Canada Lynx	\$50,000	\$19,900
Wind Cave National Park	Develop Long Term Management Strategy to Protect Genetically Pure Bison Herd	\$50,000	\$25,000
Wind Cave National Park	Development of a Forage Production and Allocation Model	\$50,000	\$50,000
Yellowstone National Park	Develop Techniques to Evaluate Effectiveness of Grizzly Bear Management Areas	\$50,000	\$16,700
Total funding for FY 2008			\$583,654

National Park Service staff collect accuracy assessment data at a high elevation Mojave Desert scrub site in Joshua Tree National Park (CA).



Appendix D: Water Resource Protection Projects— FY 2008

Table D.1

Water Resource Protection Projects			
Park	Region	Project Title	FY 2008 Funding \$(000s)
ALL	ALL	Support to the Office of the Solicitor	190.0
CHIC	IMR	Hydrologic Data Collection	13.6
WICA	IMR	Groundwater Study	59.9
MOCA	IMR	Hydrologic Data Collection for the Verde River Adjudication	63.4
LAME	PWR	Hydrologic Data Collection and Groundwater Modeling	29.7
MEVE	IMR	Hydrologic Data Collection	1.6
KAHO	PWR	Investigation of Hydrology and Water Dependent Values	82.8
GRSA	IMR	Hydrogeologic Data Analysis	120.6
BIBE	MWR	Collection of Hydrologic Data	28.7
DEVA	PWR	Participation in Groundwater Model Development	75.4
GRTE	IMR	Investigation of Hydrology of the Gros Ventre River	14.4
GRBA	PWR	Investigation of Hydrogeology and Hydrologic Data Collection	124.4
TUZI	PWR	Hydrogeology Study	27.5
NIOB	MWR	Investigation of Water Dependent Resources	50.0
OBED	SER	Investigation of Water Dependent Values	20.0
ALL	ALL	Technical Support to All Projects and Technical Assistances	9.9
TOTAL			911.9

Table D.2

Natural Resource Condition Assessment Projects				
Region	Agency, Cooperator/Partner, or Contractor	State	Parks	FY 2008 Funding \$(000s)
Alaska	Pacific Northwest CESU/Saint Mary's University of Minnesota	AK	WRST	174.0
	Desert Southwest CESU/Arizona-Sonora Desert Museum, Sonoran Institute	AZ	CHIR, CORO, FOBO	190.0
Intermountain	Colorado Plateau CESU/Natural Heritage New Mexico, University of New Mexico	NM	PECO, FOUN	94.3
	Rocky Mountain CESU/Utah State University	WY	GRTE (supplemental funding)	25.0
Midwest	Upper and Middle Mississippi Valley CESU/University of Missouri	MO, AR	GWCA, WICR, PERI	193.8
National Capital	Chesapeake Watershed CESU/University of Maryland	MD, VA	MONO, MANA, ANTI	53.2

Subsistence harvested sockeye salmon drying on a rack, Sixmile Lake, Lake Clark National Park and Preserve (AK).
Photo: Reilly Newman

Natural Resource Condition Assessment Projects				
Region	Agency, Cooperator/Partner, or Contractor	State	Parks	FY 2008 Funding \$(000s)
Northeast	Chesapeake Watershed CESU/Penn State University	PA	VAFO, HOFU	80.2
	Southern Appalachian CESU/ Conservation Management Institute at Virginia Tech	VA	RICH, PETE	78.7
	Humboldt State University	CA, OR	REDW, WHIS, ORCA (supplemental funding)	20.0
Pacific West	Northwest Management, Inc.	ID, MT	BIHO, CIRO, CRMO, HAFO	57.0
	Californian CESU/University of California Santa Barbara	CA	SAMO, PINN, JOMU	102.0
	Yosemite National Park	CA	YOSE, DEPO	40.0
Southeast	Pacific Northwest CESU/University of Washington	OR, WA	EBLA, FOVA, LEWI, SAJH	93.0
	Piedmont – South Atlantic Coast CESU/ University of Georgia	KY, NC, SC, TN, VA	BLRI, CUGA, BISO, KIMO, COWP, NISI	205.6
Total			39 parks	1406.8

Table D.3

Coastal Watershed Condition Assessment Projects				
Region	Agency, Cooperator/Partner, or Contractor	State	Parks	FY 2008 Funding \$(000s)
Northeast	North Atlantic CESU/ University of Maine, Orono, University of Rhode Island	MA, RI	BOHA, CACO, SAIR (second-year and supplemental funding)	77.3
	North Atlantic CESU/ University of Maine, Orono	MA	ACAD (supplemental funding)	8.0
	Chesapeake CESU/University of Maryland Center for Environmental Science	MD	ASIS	100.0
Midwest	Great Lakes-Northern Forest CESU/ University of Wisconsin, Stevens Point	WI	ISRO	90.0
Southeast	South Florida – Caribbean CESU/ Florida Tech	FL	CANA	90.0
Pacific West	Contracting services – Fung & Associates	HI	KALA	75.0
TOTAL			8 parks	440.3

Table D.4

Watershed Condition Assessment High Priority Projects				
Region	State	Park	Project Title	FY2008 Funding \$(000s)
Intermountain	AZ	ORPI	Emergency Actions to Stabilize Quitobaquito Pond, and Related Activities	13.4
Intermountain	NM	PECO	Remove Artificial Levee and Connect Glorieta Creek to its Recently Restored Floodplain at Pecos National Historical Park	5.9
Intermountain	MT	YELL	Closure of Geothermal Well Located Within the Yellowstone Controlled Ground Water Area	35.0
Intermountain	WY	YELL	Application of Stable and Radioactive Isotope Sampling to Determine the Sources of Water that Recharges the Talus Aquifer and Discharges at Mammoth Crystal Springs	14.0
Midwest	MI	Multiple	Develop a VHS Prevention and Response Plan for Lake Superior Parks	15.0
Midwest	MI	SLBE	Preliminary Water Balance Model for the Glen Lake and Crystal River Watershed	2.0
Midwest	MI	SLBE	Factors Contributing to Large-Scale Outbreaks of Type E Botulism at Sleeping Bear Dunes National Lakeshore	12.5
Midwest	MI	SLBE	Benthic Habitat Mapping at Sleeping Bear Dunes National Lakeshore	20.0
Midwest	IA	EFMO	Integrating NPS Science and Planning in Developing a Resource Stewardship Strategy for Effigy Mounds National Monument	38.0
Pacific West	CA	WHIS	Oversee Construction of Caltrans Mitigation Measures for Damage to Rare Salt Spring Habitat and Monitor Effectiveness	9.0
Pacific West	CA	SEKI	Repair Erosional Features Prior to Planting at the Upper Halstead Meadow Pilot Restoration Project	8.0
Pacific West	CA	SEKI	Sunset Meadow Headcut Treatment at Sequoia and Kings Canyon National Parks	6.5
Pacific West	CA	GOGA	Rodeo Beach Wetland Complex Final Restoration Design, Golden Gate National Recreation Area	15.0
Servicewide		Multiple	Funding for USGS-NPS Liaison to Facilitate Interagency Partnerships and Project Support	20.0
Servicewide		Multiple	NPS Regulation and Policy Handbook for Superintendents of Ocean and Coastal Parks	11.0
Total		12 + Parks		225.3

D.5

Cooperative Academic Program for Fisheries Project				
Region	State	Park	Project Title	
Intermountain	WY	GRTE	Assessment of Cutthroat Survival and Growth in Irrigation Ditches Off the Gros Ventre River and Population Connections to the Snake River	



Appendix E: USGS—Biological Resources

Table E.1

POBS REPORTS FOR FY 2008

Project Title

Description

Predicting Spread of Invasive Exotic Plants into De-Watered Reservoirs Following Dam Removal on the Elwha River, Olympic National Park (WA)

Removal of two high-head dams on the Elwha River in Olympic National Park will expose 276 ha of barren soil in the de-watered reservoirs. Preventing the establishment of invasive exotic plants by prioritizing areas for control and removal is the highest management priority for the reservoirs. This project facilitates achieving this goal by updating a past survey for exotic plants, spatially modeling spread from known sources, and identifying unexplored potential sources of priority species. During FY 2008, researchers conducted field work to update and expand the geographic extent of previous exotic plant surveys. The locations and population sizes of exotic plant species have been compiled in a database and entered in the park's geographic information system (GIS). In addition, species have been prioritized for modeling, and references on seed properties and dispersal dynamics of priority species have been accumulated and incorporated in the species database. Researchers are developing wind dispersal models summarizing wind records during seed dispersal periods and designing alternative conceptual models for integrating wind models with GIS spatial data layers. During FY 2009, researchers will develop the wind dispersal model and predict the spread of current populations of appropriate exotic species as well as develop dispersal models for birds and ungulates. Models will be used to identify source areas for exotics that may not have been surveyed yet. Products will include maps of known invasion sites and potential new sources. In addition, the wind model will be made available in a form that can be calibrated to actual wind measurements during dam removal to provide more accurate predictions.

Use of Molecular Techniques in Surveying Infectious Diseases of Gray Wolves in Yellowstone National Park (WY, MT, ID)

This research aims to better understand (i) spatial and temporal patterns of selected pathogens in Yellowstone National Park wolves, (ii) impacts of disease on wolf survival, and (iii) the potential role of domestic dogs and sympatric carnivores in pathogen persistence in the park. In 2007-08 researchers addressed each goal using techniques ranging from serological and molecular assays to computer simulation models. The study has used polymerase chain reaction (PCR) to survey for pathogens actively circulating in the park. Researchers completed a pilot study using PCR to screen wolf fecal material (scats) for canine parvovirus (CPV) and canine adenovirus (CAV-1), both present in the park (based on previous serological work) and capable of causing pup mortality. After testing to verify that the cooperating laboratory's assays were sufficiently sensitive to detect small quantities of viral genetic material, researchers screened over 250 wolf scats collected from 13 packs during summer 2007. Because all these scats tested negative for these viruses, researchers have continued collecting additional wolf scats during fall, winter, and spring and will have them screened to test the possibility that the appropriate season for CPV and CAV-1 transmission was previously missed. Researchers are preparing a manuscript that will summarize the spatial and temporal patterns of pathogen exposure in wolves and coyotes using serological data.

Technical Assistance in Determining Population Abundance And Composition Of Non-Native Deer and Elk During Phased Population Reductions at Santa Rosa Island, Channel Islands National Park (CA)

The privately owned, non-native elk and mule deer at Santa Rosa Island, Channel Islands National Park are to be removed by the end of 2011 under a court-mandated settlement agreement. Removal is to be accomplished by a 4-year step-down in abundance of each species between December 2008 and December 2011. Currently, numbers of each species are estimated via a simple total aerial count of animal numbers each December. This project is intended to provide statistically reliable estimates of the variability in estimates of elk and deer abundance. FY 2008 work involved assessing such abundance estimation methods as ground and aerial line transects, aerial block counts, and double counts and participating in the simple total aerial counts, ground surveys throughout Santa Rosa Island, and review of a number of existing sampling methodologies. A simultaneous double count sampling protocol was selected, with implementation of the counts scheduled for mid-February 2009. Data analyses of these counts will follow methodologies being developed for simultaneous double counts at other national park units. A technical report evaluating the December 2007 total aerial count and population composition estimates was provided to the park in May 2008.

USGS researchers are studying human/black bear interactions in Canyon de Chelly National Monument (AZ) to inform the park and Navajo Nation efforts to develop a cooperative management strategy.

POBS REPORTS FOR FY 2008

Project Title	Description
Determine the Effects of Food Quality on Juvenile Unionid Mussel Survival and growth in the St. Croix National Scenic Riverway (WI)	<p>This research, initiated in FY 2008 and to be completed in FY 2010, assesses relationships between nutrient conditions and mussel food quality in the river corridor and within the four sub-basins of Lake St. Croix and relationships among seston and benthic food quality and the survival and growth of juvenile mussels in the river versus the lacustrine habitats of contrasting water quality. During a 28 day summer field exposure involving juvenile mussels in the St. Croix River, the study deployed a total of 48 cages at 4 riverine and 4 lake locations, with six cages per location and two mussels (one each, <i>Lampsilis cardium</i> and <i>L. siliquoidea</i>) in each cage. Upon termination, all cages and juvenile mussels were recovered, with 95% mussel survival. During the mussel deployment, researchers collected a total of 425 samples of food resources available to the mussels at each location, which included sediment, water nutrient, and seston samples. These samples will be analyzed for essential fatty acids, carbon, nitrogen, total and volatile suspended solids, total nitrogen and total phosphorus, soluble reactive phosphorus, ammonia nitrogen, nitrate-nitrite nitrogen, and chlorophyll a. In October, researchers met with NPS outreach specialists, managers, and scientists to discuss ways to better communicate our scientific results to the public. Researchers also presented an update of this work at the 20th Annual St. Croix River Research Rendezvous. Researchers are currently processing food and tissue samples.</p>
Tracking Nene Movements across Park Boundaries	<p>The federally endangered Nene (<i>Branta sandvicensis</i>), or Hawaiian Goose, was reduced to as few as 30 individuals by 1952 due to the combination of unregulated hunting, introduced mammalian predators, and large-scale habitat degradation. Recovering Nene subpopulations on Hawai'i Island may now be in the process of reestablishing traditional movement patterns and migration routes. The objectives of this project are to use satellite telemetry devices to gain a broader understanding of incipient island-wide migration patterns and to facilitate further management and restoration of seasonal Nene habitat within Hawai'i Volcanoes National Park (HI). Researchers have secured all necessary state and federal threatened and endangered species permits, the services of an attending veterinarian, and approval for animal handling protocols. The receipt of satellite transmitter devices was delayed by requisition processing and the manufacturer's production cue. In the interim, researchers monitored the identities and nesting status of banded Nene in conjunction with wildlife managers at the park throughout fiscal year 2008. This monitoring has identified candidates for transmitter attachment. Researchers received six transmitters in January 2009. Working in conjunction with NPS wildlife managers, researchers plan to attach transmitters to male Nene of three different families with goslings in early February. Researchers will closely monitor these subjects for three weeks. Habitat selection studies will commence at this time. A committee will evaluate the effects of transmitter attachment prior to deployment of additional units. A total of 13 birds will be monitored with satellite transmitter devices during the course of this study.</p>

POBS REPORTS FOR FY 2008

Project Title	Description
Does Acadia National Park (ME) Need a Sea Run Brook Trout Management Plan? Detecting Marine Habitat Use by Stream-Dwelling Trout in a Coastal Stream	<p>Historic records indicate that searun brook trout (<i>Salvelinus fontinalis</i>) were present in many streams within Acadia National Park. The current status of these populations is largely unknown. While anecdotal angler reports indicate that searun brook trout still exist in coastal Maine streams, there is a paucity of scientific information regarding current population sizes, movement strategies, and factors influencing or hindering movement. This project seeks to determine the range of movement strategies exhibited by brook trout in Stanley Brook and examine the impact that various movement strategies have on survival and growth. To help answer these questions, researchers have been individually marking brook trout in Stanley Brook with passive integrated transponder (PIT) tags since 2006. The use of PIT tags allows both identification of individual trout in subsequent electrofishing surveys and also continuous monitoring of fish movements through the use of PIT tag antennas. Researchers conducted electrofishing samples in each of May and September, 2008. Over the course of the two samples researchers handled ~2,000 brook trout; about half of which were previously untagged. All fish collected were measured (length and weight), the location of capture was noted (river kilometer from brook/ocean confluence), scales were taken to determine age, and fin clips were collected for later genetic analysis. These field data, when coupled with PIT tag antenna data, will allow researchers to identify what movement strategy individual trout are exhibiting and what the consequences to growth and survival are. In October 2008, an antenna array was installed at the brook/ocean confluence to monitor fish movements between the fresh water and marine environment. A conductivity/temperature/depth data sonde was also near the antennas to monitor seawater intrusion into the brook. Since that time, 91 individual brook trout, representing about 8% of the study population, have been detected moving from freshwater towards the marine environment. Although data collection and analysis are ongoing, preliminary results indicate that individual trout captured during electrofishing surveys over the entire length of the 2 kilometer study reach are being detected by the antennas at river kilometer 0. Researchers have also observed some trout moving from upstream locations to river kilometer 0 repeatedly for brief periods of time (days), while other trout that moved downstream, were detected by the antennas briefly and then not detected again (potentially, because they moved to the marine environment and will return to the brook in the spring).</p>
Black Bear Population Size and Distribution in Glacier National Park (MT)	<p>No information exists on the status of Glacier National Park's black bear (<i>Ursus americanus</i>) population. Black bears were sampled in 2004 using noninvasive hair collection methods as part of a 7.8 million-acre study of the regional grizzly bear (<i>U. arctos</i>) population. During microsatellite analysis to identify individual grizzly bears, samples were identified as black bear hair. This project will identify individual black bears, use mark-recapture models to estimate black bear population abundance, and describe density patterns in the greater Glacier National Park area. When analyses for both species are completed, researchers will have a unique opportunity to compare the population density and distribution of these sympatric species. Genetic analysis to identify individuals and gender of the black bear hair samples began in 2008 and will be completed by March 1, 2009. Data analyses, manuscript preparation, and presentation of results will be conducted in 2009.</p>

POBS REPORTS FOR FY 2008

Project Title	Description
The Influence of Water Quality on the Health of Riparian Bird Communities in the Desert Southwest	Riparian woodlands bordering the Santa Cruz River at Tumacacori National Historical Park (AZ) provide habitat for numerous breeding, wintering, and migratory birds. A recent increase in the number of riparian birds exhibiting physical abnormalities (e.g., lesions, tumors) along the Santa Cruz River has raised concerns about the overall health of the park's riparian bird community. Poor water quality in the Santa Cruz River, infectious avian diseases, or an interaction between these two factors may be responsible for the observed abnormalities, but to date, no effort has been made to assess the prevalence or diagnose the cause of the abnormalities. To address these issues, researchers are monitoring breeding populations of riparian birds at the park and Cienega Creek Preserve (the nearby control site) by examining adult and nestling birds for physical abnormalities and collecting tissue samples (e.g., blood, feathers, infertile eggs) for analysis. In 2008, researchers monitored a total of 272 nests of 39 species and examined >200 nestling and >100 adult birds. Physical abnormalities were rare in nestling birds (<0.5%) but more common in adult birds (6.8%) at Tumacacori NHP, including lesions on adult Bewick's Wrens (<i>Thryomanes bewickii</i> ; n = 1), Lucy's Warblers (<i>Vermivora luciae</i> ; n = 1), and Yellow-breasted Chats (<i>Icteria virens</i> ; n = 5). Researchers are currently analyzing tissue samples taken from affected birds to confirm or refute the presence of diseases (i.e., avian pox) within the breeding bird community. Additional tissue samples will be analyzed to determine if elevated levels of environmental contaminants (e.g., heavy metals, DDT) originating from the Santa Cruz River are present in adult and nestling birds. Field work at Tumacacori NHP and Cienega Creek Preserve will resume beginning in April 2009.
Monitoring the Body Condition of Caribou in Late Winter: Developing and Evaluating a "Hands Off" Approach	Body condition may be the most important correlate of survival and reproduction for Arctic and sub-Arctic ungulates. Climate-related changes in forage resources may impair the ability of northern ungulates to establish and maintain body reserves. Because non-invasive techniques to assess body condition are currently lacking, researchers are developing and evaluating a 'hands-off' approach that uses isotopes of nitrogen in urine and fecal samples found on snow to assess the body condition of four caribou (<i>Rangifer tarandus</i>) herds in Alaska. Researchers completed fieldwork in April 2008 and collected an additional 360 excreta samples. Approximately 1,200 urine and fecal samples have been collected since March 2006. The isolation of urinary creatinine from these samples was completed in August 2008 and all samples will be submitted for isotopic analysis by February 2009. Isolation and assessment of urinary urea and fecal fiber residues will be complete by April 2009. Composite fecal samples from 30 sampling sites were submitted to Washington State University for dietary assessment (microhistology) and results are expected in July 2009. Researchers will begin estimating the body condition of each herd for 2006–08 after they receive the complete isotope sets that are necessary to run the model to determine the sources of urea nitrogen in caribou. Regional winter and summer weather data for each herd and year have been acquired, screened for quality, and made ready for correlation analyses with body condition data.

POBS REPORTS FOR FY 2008

Project Title	Description
Habitat Characterization of Juvenile Snook and Other Gamefish in Tarpon Bay, Everglades National Park (FL)	<p data-bbox="841 216 1507 905">This study sampled and characterized the Tarpon Bay part of the Everglades National Park nearshore nekton assemblage with particular interest in young-of-the-year snook (<i>Centropomus undecimalis</i>). The sample design included measuring general water quality, habitat variables, and fish and macro-crustacean populations. Several hydrologic conditions including salinity, Secchi depth, and dissolved oxygen varied by season. Shorelines were dominated by red mangroves (<i>Rhizophora mangle</i>); co-occurring but less abundant vegetation included white mangroves (<i>Laguncularia racemosa</i>), buttonwood (<i>Conocarpus erectus</i>), and sawgrass (<i>Cladium jamaicense</i>). The most common substrate type was a firm peat; however, some areas of Tarpon Bay contained a muddy bottom so unconsolidated that sampling with a seine was not feasible. Forty-three seine hauls collected 9,697 individual nekton (fish and macro-crustaceans) representing 37 different taxa with an average of 225 nekton collected per net, producing a density of 81 nekton per 10 square meters. Anchovies (water-column schooling species that have a clumped distribution pattern) were by far the most abundant species captured (especially <i>Anchoa mitchilli</i> at 67% of the overall assemblage). <i>Eucinostomus</i> spp. (mojarra) were the second most abundant species (19% of assemblage) and the most frequently captured as they were collected in all 43 samples. Juveniles of six economically/recreationally important species were collected totaling 390 individuals and 4% of the total assemblage. Pink shrimp, <i>Farfantepenaeus duorarum</i>, were the most abundant such species (339), followed by blue crabs (19), gray snapper (15), sheepshead (8), red drum (6), and common snook (3). These data indicate Tarpon Bay shorelines appear to provide good habitat for juvenile pink shrimp which is ecologically important as several juvenile gamefish rely on penaeid shrimp for food.</p> <p data-bbox="841 930 1511 1568">Although young-of-the-year (YOY) common snook were a focus species for the present project, no age-0 fish and only three age-1 snook were collected to date in 2008. Several possible explanations that exist for the absence of these fish are being tested. One possibility relates to the small sample size. To address this possibility, researchers began seining specific shorelines where YOY snook have previously been captured, in addition to the normal random sampling. However, researchers found no juvenile snook in those "known" locations thus far. Additionally, because electro-fishing can cover a considerably larger area, and thus provide a greater probability of locating juvenile snook if they are present, researchers arranged follow-up cooperative work to electro-fish at the end of the wet season (planned for early November 2008 when salinities are traditionally low). Although gear avoidance by YOY snook provides another possible yet unlikely explanation for the lack of YOY snook captures, similar use of seines in Tampa Bay by others have captured YOY snook, suggesting it is unlikely that these nets are ineffective in Tarpon Bay. A third explanation for the absence of YOY snook in 2008 could be poor recruitment. Snook, like many species, exhibit cyclical patterns in juvenile recruitment, meaning that a few weak years may follow a strong recruitment year. Although no dedicated sampling program was underway in Tarpon Bay during 2006, researchers collected a large number of YOY snook for an ancillary project, suggesting a strong year. Perhaps 2007 and 2008 have been the subsequent weak recruitment years following a strong 2006. Scheduled sampling in November 2008 and January and May 2009 may help discern whether the recruitment over the past year was below average and thus provide an answer.</p>

POBS REPORTS FOR FY 2008

Project Title	Description
Baseline Analysis of Floodplain Soils Prior to Dam Removal, Elwha River, Olympic National Park (WA)	<p>Work conducted to date includes collection of field data, laboratory analysis, preliminary data analysis, and development of new collaborations. In August 2007, researchers collected soil, forest floor, and related information from 56 permanent vegetation quadrats along the Elwha River, Olympic National Park. The quadrats represented commonly occurring riparian vegetation patch types within each of three river reaches: downstream of the two large dams on the river, between the dams, and upstream of the dams. Within each quadrat, two points were systematically selected for subsampling at the midpoint of the up- and downstream edges of the quadrat. These two soil samples were composited. Samples were divided into four groups, for different physical, chemical and biological analyses. Soil texture, chemistry, and mycorrhizae were analyzed by USGS and samples made available to collaborators were analyzed for soil microbial communities. The work will quantify baseline conditions prior to the planned dam removals on the Elwha River, to which future sampling can be compared. Following dam removal, now anticipated to occur in 2012, resampling within the same permanent plots will reveal changes to the physical, chemical, and biological character of the soils. Also, the soil characterization will prove useful to NPS resource managers as they plan and implement revegetation of the lands that are currently submerged beneath Lake Mills.</p>
Effects of Invasive Exotic Plants on Habitat Conditions and Performance of the Federally Endangered <i>Astragalus Ampullarioides</i> (Shivwits Milkvech), Zion National Park	<p>The purpose of this project is to provide Zion National Park with scientific information regarding conservation management of the federally endangered <i>Astragalus ampullarioides</i> (Shivwits milk-vetch)—an edaphically restricted plant species that is endemic to southwestern Utah. This report describes work conducted during the third (and final) year of data collection in FY 2008. In September 2007, 62 milk-vetch-centered experimental plots were established to examine effects of the invasive exotic grass red brome (<i>Bromus rubens</i>) on soil biological properties (composition of the arbuscular mycorrhizal fungi [AMF] community and mycorrhizal inoculation potential [MIP]) and on several measures of milk-vetch performance including seedling emergence and mortality, growth rates of adult plants, and reproductive output of adult plants. A final report will be delivered to NPS in 2009. Results of descriptive field studies (2006); predictive habitat modeling and soil seed-bank studies (2007); and field, greenhouse, and laboratory experiments (2008) will be used to inform the development of management strategies and recovery efforts conducted by the NPS, 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 (HI)	<p>Approximately 20 species of invasive ants have been recorded from Hawai'i Volcanoes National Park. The ecological impacts of these species in Hawai'i are poorly documented, but Argentine ants (<i>Linepithema humile</i>) and big-headed ants (<i>Pheidole megacephala</i>) are widely regarded as serious invasive pests outside their native ranges because they form large colonies and are highly aggressive towards other arthropods. Populations of these ant species in the park are discontinuous and interspersed with one another, and their capacity to disrupt native arthropod communities raises concerns about potential impacts on park ecosystems and special ecological management units. The primary goal of this research was to develop control methods for Argentine ants and big-headed ants in the park.</p> <p>Researchers tested the efficacy of three baits for controlling Argentine ants, two baits using acute toxins (Maxforce® and Xstinguish®) and one using a hormone to regulate insect growth (Australian Distance®). Researchers compared the efficacy of four baits in controlling big-headed ants, with two using acute toxins (Amdro® and Xstinguish®), and two using a toxin combined with a growth-inhibiting hormone (Australian Distance® "Plus" and Extinguish Plus®). This research has provided park managers with new tools for protecting critical populations of native arthropods (e.g., native pollinators), plant communities, and special ecological areas from invasive ants. Additional work should focus on increasing the effectiveness of controlling ants over larger areas.</p>

POBS REPORTS FOR FY 2008

Project Title	Description
Movements and Activities of Cougars in High Visitor Use Areas of Zion National Park (UT)	<p>During the last eight years Zion National Park and its neighboring communities have experienced increased sightings of cougars (<i>Puma concolor</i>) near people, people's residences, and park facilities. A similar trend has occurred in nearby Capitol Reef National Park, with sightings of particular concern occurring near campgrounds and park facilities. Park managers requested research to inform them about the movements and behaviors of cougars in and near human-use areas as a basis for management decisions regarding increasing human safety, minimizing human impacts on cougars, and addressing concerns of non-park stakeholders, especially concerns that Zion was a source of potential problem animals. Researchers initiated investigation of cougars in and near Zion during 2006 to document movements relative to park boundaries and create models of cougar habitat use, including effects of nearness to human facilities. During 2007, researchers initiated similar investigations with similar objectives in and near Capitol Reef. From February 2006 through February 2008, researchers operated collars on 9 cougars near the boundaries of both parks: 3 adult females, 1 adult male, and 2 sub-adult males near Zion; and 1 adult female and 2 subadult females near Capitol Reef. Preliminary results show all 5 cougars successfully monitored at Zion extensively used both park and non-park lands and that there was no indication that there was a subpopulation of cougars largely residing within the park, insulated from the effects of sport hunting, and serving as a potential source of dispersers. At Capitol Reef, despite having captured the 3 monitored cougars near, but outside, the park's western boundary, researchers found that only 2 of the animals made even very brief forays into the park. Rather, researchers found almost all cougar activity concentrated in or around higher elevation plateaus (Thousand Lakes Mountain and Boulder Mountain) to the west of the park.</p>
Fishes and Riverine Habitat of Badlands National Park (SD), with Emphasis on the Sturgeon Chub and Other Imperiled Species	<p>The NPS Inventory and Monitoring Program in Badlands National Park lacks information about the unique aquatic habitats including the White River, restored wetlands, constructed ponds, and Sage Creek (a tributary to the Cheyenne River). The White River is naturally turbid due to the sediment load collected from the highly erosive soils of the badlands. Several native fishes, such as sturgeon chub (<i>Macrhybopsis gelida</i>), are rare, threatened, or species of special concern. The objectives of this study were to conduct surveys and collections of fishes and other aquatic fauna, including reptiles, amphibians, zooplankton, and macrophytes, that inhabit Badlands National Park; describe the water quality and limnology of the streams, wetlands, and ponds within the park; and describe the population characteristics of sturgeon chub inhabiting the White River. The study was completed this fiscal year and all objectives were accomplished. A total of 2,855 individual fish at nine sites were sampled on the White River near and within the park. Researchers added the yellow bullhead to the park species list. Only largemouth bass were found in bison ponds, with four ponds being fishless; western silvery minnow and plains minnow were in Sage Creek. Researchers collected 88 sturgeon chub from the White River. Most length intervals for fish ages 1 – 5 years old were represented in the population, thus indicating frequent and successful spawning. Sturgeon chubs seemed to prey exclusively on macroinvertebrates; 91% of their stomach contents being individuals in the family Simuliidae. The final report included water quality data and fisheries data for the White River, Sage Creek, and six bison watering ponds.</p>

POBS REPORTS FOR FY 2008

Project Title	Description
Using Acoustic Sampling of Bat Assemblages to Monitor Ecosystem Trends	<p>Bats are a large fraction of mammal species richness in natural landscapes in western North America. Some species are abundant and provide significant ecosystem services in natural and anthropogenic habitats. Nearly all feed predominantly on insects, and foraging activity is closely coupled to habitat and seasonal variation in secondary productivity. This project addresses methods development for long-term automated monitoring of bat acoustic activity as an indicator of ecosystem trends. In 2008, a third monitoring trial was conducted in six meadows in Yosemite National Park to compare bat activity at meadow center and edge sites. Acoustic monitors were re-deployed in March 2008, periodically downloaded, evaluated and repaired as needed, and removed at the end of the year, completing field work for the project. Data management and analysis continued through the year. Extraction and statistical analysis of species activity data are continuing, and a final report and a draft manuscript will be submitted prior to June 2009. Considerable progress was made in enhancing the capabilities of the Windows analytic software and improving its ease of use during the project. The newest version of the software now incorporates an expanded call parameter set, along with increased flexibility for automatically screening data sets of bat call sequence files. Software capabilities for species labeling and for extracting activity measures are also considerably enhanced. The vast amount of data (roughly 2.5 million acoustic files) collected on the project contribute to better delimiting the call repertoire of western bat species and are contributing to both testing newly implemented filter parameters and improving species identification. Additional development of the program capabilities and species recognition filters will continue through the project end date and these tools, along with selected call examples and the documented data set, will be available to park managers. A relational database to store, manage, and manipulate the collected data is currently in development. This will be included as a product in the final report.</p>
Demography of Sea Turtle Nesting Populations in the Caribbean	<p>The hawksbill sea turtle (<i>Eremochelys imbricata</i>) is a critically endangered species. Its life history stages include large geographic areas and various coastal and marine environments that make it difficult to monitor for status and conservation purposes. Monitoring numbers of nesting females, as well as their nests and hatchlings, is most practical on a large scale. Tagging a large proportion of these females permits monitoring not only nesting population numbers but also developing an estimation of adult female population size and vital rates, which permits assessment of the relative contribution of mortality and recruitment to population dynamics. National Park Service personnel at Buck Island Reef National Monument have been tagging sea turtles and monitoring their nests since 1988. This project includes assisting NPS personnel in the demographic analysis of these tagging data for 1988–2007 and providing recommendations for future monitoring. The preliminary analysis has indicated a stable survival rate over 20 years but substantial variability in probability of breeding. The results are consistent with the hypothesis that neophyte (first-time) breeders skip more years before breeding again than do remigrant (experienced) breeders. Researchers also found evidence that up to two years after nesting, the probability of returning to nest is a function of years since nesting (energy accumulation), but after that it depends more on individual variation. In the next year researchers will work with the park to vet and refine preliminary results and develop monitoring recommendations. Researchers will also work on statistical methods for estimating the number of nesters for species less faithful to a nesting beach (e.g., leatherbacks) and for estimating the total number of adult female turtles (both nesters and skipped nesters). Finally, researchers will work with the park on evaluating their nest translocation management decision process.</p>

POBS REPORTS FOR FY 2008

Project Title	Description
Soil Chemistry Changes Affected by Pine Trees and Exotic Plants in Native and Disturbed Pine Rockland, Everglades National Park (FL)	South Florida pine rockland, considered a globally imperiled habitat, is one of the centers of vascular plant biodiversity in Florida. While Everglades National Park contains the vast majority of the extant pine rocklands, it also contains a sizeable area (~200 ha) of former pine forest destroyed before the land was acquired by the federal government. This project deals with efforts to restore some semblance of pine rockland vegetation to the areas within the park where the rock and soil substrate was disturbed by heavy equipment as part of the farming activity. The objective of the study is to determine the effect of pine trees and non-native vegetation on changes in the chemistry of previously farmed soils. Soils were sampled at three formerly farmed sites that previously were studied in 1975 and three nearby undisturbed pinelands. Researchers also sampled the soil underneath the crown of four pine trees growing in disturbed sites to see if pine litter and throughfall influence soil chemistry. During FY 2009, chemical analyses will be completed on all samples and a report submitted to NPS resource managers.
An Evaluation of the Impact of Two Introduced Cichlids on Native Fish Communities in Everglades Wetlands	Ecological communities consist of multiple predators and prey, in which predators have varied hunting strategies and foraging preferences and the prey have varied anti-predator responses. Multiple predators can combine to have linear or non-linear effects that can either enhance or reduce the risk of predation experienced by prey. How this occurs in novel systems where predators and prey lack a co-evolutionary history, and thus prey may be naïve to predation threats posed by non-indigenous predators, is not well understood. This study examined the predatory effect of two non-native fishes, the African jewelfish (<i>Hemichromis letourneuxi</i>) and the Mayan cichlid (<i>Cichlasoma urophthalmus</i>), and the behavioral responses of a native Everglades prey assemblage. We used an in situ enclosure experiment to compare predation rates and prey selectivity, followed by behavioral trials in the laboratory to examine predator foraging tactics and prey responses to predation (microhabitat use and activity levels). When both predator species were present, researchers found no evidence that native prey experience a release from predation resulting from interference competition. <i>C. urophthalmus</i> exhibited a higher predation rate and different foraging preferences than <i>H. letourneuxi</i> . Overlap in habitat domain of predators and prey was important in predicting prey consumption, as prey were most often consumed when they occupied the same space in the water column as predators. The predators were found to be functionally different, and the behavioral responses of prey varied among species in response to the non-native predators. It is important to examine the behavior of predators and the responses of prey to determine the nature of these multiple predator interactions and the resulting impacts of non-native predators, especially as these predators continue to spread in the Everglades ecosystem. Researchers have presented the results of the study at the Greater Everglades Ecosystem Restoration Meeting in August 2008 (Naples, FL).
Assessing the Distribution and Effects of Chytrid Fungus on Amphibians in Grand Teton National Park (WY)	The pathogen <i>Batrachochytrium dendrobatidis</i> (Bd), which causes the skin disease chytridiomycosis, has been linked to amphibian population declines and extinctions worldwide. Bd has been implicated in recent declines of boreal toads (<i>Bufo boreas</i>) in Colorado, but populations of boreal toads in western Wyoming have high prevalence of Bd without suffering catastrophic mortality. In a field and laboratory study, researchers investigated the prevalence of Bd in boreal toads from the Grand Teton ecosystem in Wyoming and tested the pathogenicity of Bd to these toads in several environments. The pathogen was present in breeding adults at all sites sampled, with a mean prevalence of 67%. In an experiment with juvenile toadlets housed individually in wet environments, zoospores of Bd isolated from Grand Teton caused lethal disease in all Wyoming and Colorado animals within 35 days. Survival time was longer in toadlets from Wyoming than Colorado and in toadlets spending more time in dry sites. In a second trial involving Colorado toadlets exposed to 35% fewer Bd zoospores, infection peaked and subsided over 68 days with no lethal chytridiomycosis in any treatment. However, compared to drier aquaria with dry refuges, Bd infection intensity was 41% higher in more humid aquaria and 81% higher without dry refuges available. The findings suggest that although widely infected in nature, toads from Wyoming may escape chytridiomycosis due to a slight advantage in innate resistance or because their native habitat hinders Bd growth or provides more opportunities to reduce pathogen loads behaviorally than in Colorado. Some of the implications of these results are being investigated further.

POBS REPORTS FOR FY 2008

Project Title	Description
Assessment of Upland Ecosystem Conditions in the Salt Creek Watershed, Canyonlands National Park (UT)	The purpose of this project is to assess the condition of upland ecosystems in the Salt Creek watershed and surrounding portions of Canyonlands National Park. Salt Creek is the only perennial stream in the park 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 to current visitor-use activities, or on-going drought. Field work for this project was completed in 2008, with assessments conducted in conjunction with a companion project funded by The Nature Conservancy (TNC). This TNC project was initiated on Bureau of Land Management (BLM) lands adjacent to the park. Both projects used identical sampling strategies and field methods, and combined analysis of both data sets will greatly improve the capacity to understand patterns of ecosystem condition in relation to past and on-going land-use activities, climate, and soil properties. For example, preliminary analyses suggest that soil stability and ground cover both tend to be higher on lands in the park than on BLM lands. Emerging patterns also suggest that particular soils and types of ecosystems are highly susceptible to long-term dominance by invasive exotic plants. Results of this project will allow NPS staff to evaluate current conditions in relation to management objectives and "desired future conditions" as well as to establish priorities for restoration or other management actions. Data collected on NPS lands will help BLM managers better understand the condition of lands they manage, and data for both companion projects will be used by the NPS Inventory and Monitoring Program, the USDA Natural Resources Conservation Service, TNC, and USGS to better understand ranges of variability in indicators of ecosystem condition and to develop hypotheses concerning the resistance and resilience of particular soils and ecological sites to interactive effects of climate and land-use activities.
Seagrass Condition Assessment Within the NPS North Atlantic Coastal Parks: Site Selection, Training, and Integration with National Programs	The NPS Northeast Coastal and Barrier and Northeast Temperate Networks have identified seagrass condition indicators as a critical component of Vital Signs monitoring within northeastern region national park units. The goal of this project is to develop a feasible and meaningful approach to seagrass assessment that will be applicable to parks with extensive seagrass resources (Acadia National Park, Cape Cod National Seashore, Fire Island National Seashore, and Assateague Island National Seashore). Work in FY 2008 included further development of a prototype monitoring plan for system-wide implementation, training NPS cooperators, and developing mechanisms for data input, management, and integration. In FY 2009, researchers will synthesize monitoring data collected during this protocol development study into a baseline assessment of seagrass condition in regional parks. Researchers will also prepare a protocol for bay-wide monitoring of seagrass condition.
Identifying Factors Driving the Divergent Effects of Disease on Amphibians in Two National Park Ecosystems in the Rocky Mountains	<i>Batrachochytrium dendrobatidis</i> (Bd) is a cause of amphibian declines worldwide, including in North America, but this chytrid fungus is also prevalent in the skin of some species that do not suffer adverse effects. The boreal toad (<i>Bufo boreas</i>) shows both results. It has declined severely in the south (CO, NM) but persists despite high prevalence of Bd in the north (WY, MT). In an earlier study, researchers found that warm temperatures and dry skin restrict the growth of Bd on boreal toads. In 2008, researchers conducted a comparative study of habitat use in WY (Grand Teton National Park) and CO (Zirkel Range and Rocky Mountain National Park) to identify regional differences in average and extreme temperatures achieved by toads and the proportion of time spent in aquatic versus terrestrial environments. Analysis of telemetry, habitat, and temperature data and Bd samples is in progress. In 2009, researchers will experimentally compare "innate" Bd resistance in CO and WY toads to complement the comparison of regional environmental differences and their effects on Bd. This study should help to identify environmental and evolutionary factors enabling amphibians to coexist with Bd, a question of keen interest to both ecologists and managers.

POBS REPORTS FOR FY 2008

Project Title	Description
Human/Black Bear Interactions in Canyon de Chelly National Monument (AZ): Development of a Cooperative Management Strategy with the Navajo Nation	Human/black bear conflict in Canyon de Chelly National Monument is a long-term, unresolved problem that raises concern for human safety; however, no demographic information for the resident bear population is available to help managers develop a strategy to deal with the issue. Additionally, the monument is in the middle of a 10-year restoration project aimed at removing all of the invasive Russian olive (<i>Elaeagnus angustifolia</i>) along the canyon bottoms. Cursory data suggest bears rely on Russian olive as a food source in the monument, thus removal of the olive could potentially increase conflict as bears adjust their feeding habits and movement patterns in response to the loss of this food source, potentially relying more on human crops and livestock. To understand how bears will respond to the loss of Russian olive, this project aims to collect information on feeding habits, movement patterns, and habitat use of bears in the monument. Collection of scat and vegetation data continued during 2008 to determine food habits and availability. Again, a huge percentage (~80%) of scats contained Russian olive, suggesting that the presence of Russian olive could be maintaining the bear population at a higher density than could be maintained by natural foods alone. Further analysis of scat and vegetation data will reveal if the bear population can persist on natural foods alone (once the olive is removed) and the degree to which bears will turn to crops and livestock as alternative food sources (thus creating increased bear/human conflicts). During summer 2008, researchers conducted bear sign surveys (tracks and scat) throughout the monument to determine occupancy rates of bears throughout the monument. Additionally, researchers began live-trapping efforts during summer 2008, fitting bears with GPS collars to obtain location data for habitat use and movement pattern analyses. Currently researchers are tracking one male bear with a collar, and trapping efforts will continue during summer 2009 to fit a total of 6 bears with GPS collars. Researchers also will continue to collect scat and vegetation data and continue discussions with local residents and park managers to develop acceptable and appropriate strategies for dealing with human/bear conflicts in Canyon de Chelly.
The Sugar Pine Dilemma: Prescription Burning and the Management of a Declining Species	Following more than 100 years of fire exclusion, sugar pine trees experience high mortality in response to fire. Managers seek possible cost-effective strategies to protect sugar pine from short-term negative effects of fire. One option, localized removal of fuels from around the base of a tree, can act to alter the effects of fire on mortality of individual trees directly by decreasing the amount of fire-caused fine root damage and stem char or indirectly by reducing the chance of beetle attack on injured trees post fire. In this study, conducted in Sequoia and Kings Canyon National Parks, researchers tested whether the manual removal of fuels from the base of stems could be an effective management approach for reducing fire damage and subsequent beetle activity and thus reducing sugar pine mortality following prescribed fire. Two sites received prescribed burns during Fall 2006 and a third during Fall 2007. In the summer prior to the prescribed fire, tree size and beetle activity were recorded for 223, 83, and 357 sugar pine trees, respectively. Each tree was also assigned a raking treatment of raked (litter and duff removed from around the base of the tree within a 0.5 m radius) or unraked. Within a month after the prescribed fire, percent of crown volume scorched and percent of basal stem circumference charred were measured for each tree. During the summer post fire, the health status of each tree was determined (live or dead) and beetle activity was evaluated. Data were also recorded on health status and beetle activity two summers post fire for two of the sites. Researchers found that pre-fire beetle activity was not associated with post fire mortality one year after a prescribed burn at any of the sites. While raking had no significant effect on sugar pine survival, it did lead to significantly lower fire damage measured by percent circumference of the base of the tree charred during the fire. Beetle activity the summer following the fire was significantly lower in trees that were raked. Although this reduction in beetle activity may lead to lower mortality rates associated with the treatment in subsequent years, mortality rates two years following the fire did not differ significantly between the treatment groups at the two sites surveyed the second summer. Researchers have presented the rationale and results of the work to NPS resource managers and UC Berkeley graduate students. Researchers are creating a report for NPS managers.

POBS REPORTS FOR FY 2008

Project Title	Description
National Park Service Wildlife Disease Reporting Technical Assistance	<p>This project will provide NPS with a Web-based platform for parks to report observations of wildlife disease or mortality using interactive text and geospatial interfaces and to share the information with other systems. Report analyses will assist wildlife disease specialists and regional public health coordinators gain better understanding of disease dynamics and emergence in parks and thus quickly respond to potential health threats. NPS managers also will gain a useful tool to recognize the appearance of exotic microorganisms and institute effective management strategies. Work in FY 2008 involved a complete re-engineering of the database and operating platform from what was originally proposed. This revised system will be much more flexible, allow for data exchange with existing data systems, and allow the production of more sophisticated reports and maps. Additional funding received from other sources will help ensure that the system will be consistent with existing and developing medical and biodiversity informatics standards. Developers anticipate that the enhanced system will be available for trials in mid FY 2009. NPS Biological Resource Management Program staff were involved in a workshop with the Department of Homeland Security National Biosurveillance Integration Center (NBIC) where it was discussed how best to deliver wildlife disease information for NBIC use. The developing system would allow NPS data to be easily incorporated.</p>
Snowy Plovers at Point Reyes National Seashore: Unraveling the Mystery of Mercury	<p>Pacific coastal Snowy Plovers (<i>Charadrius alexandrinus</i>) are designated as threatened. The beaches at Point Reyes National Seashore provide attractive breeding habitat for Snowy Plovers, but a study in 2005 implicated elevated mercury (Hg) at the seashore as a potential contributor to the plovers' demise. If elevated environmental or food web Hg is found to be a definitive problem, management practices may be implemented or reinforced to mitigate harm to Snowy Plovers. This study contributes information to determine if such actions are warranted. The objectives were to determine potential pathways of elevated Hg concentrations to Snowy Plovers, investigate Hg in common prey including invertebrates attracted to periodic strandings of marine mammal carcasses, monitor Hg in addled Snowy Plover eggs, compare Hg in Point Reyes Snowy Plover eggs and invertebrates to those sampled elsewhere along coastal California, examine stable isotopes to determine contribution of marine mammal carcass versus beach-dwelling invertebrates to Snowy Plover food consumption, and recommend possible actions to reduce Hg concentrations in Snowy Plovers. Data collection began in 2006 and continued through FY 2008 with the addition of invertebrate sampling sites along the coastline at San Francisco Bay and the analyses of egg samples from Point Mugu (coastal Southern CA), Alviso (San Francisco Bay, CA), and Point Reyes that were collected in FY 07 or 08. Results indicate that eggs collected from Point Reyes Snowy Plovers have elevated Hg concentrations compared to those from Alviso and Point Mugu. Large variations in Hg concentrations among eggs indicated that some birds are exposed to more Hg than others. Larvae collected from marine mammal carcasses contained higher Hg concentrations than all other invertebrates collected. Hg concentrations in beach-dwelling invertebrates from the seashore were comparable to those from other nearby coastal locations but significantly higher than those from southern California. Although a proposed management practice may be to monitor for and remove or bury all mammal carcasses when detected to prevent a potential bioaccumulation pathway, the mobility of these birds may place them at risk throughout their local range. Researchers will interpret stable isotopes analyses completed in fall 2008 to determine relation of signature in Snowy Plover eggs to that in collected invertebrates. A final report to the National Park Service will be completed in FY 2009.</p>
Developing a Coral Conservation Strategy for the Global Warming Era in the National Park of American Samoa	<p>The study purpose is to identify coral reef habitats, coral species, and coral colony characteristics that increase the resilience of coral reefs and coral colonies to sustained high seawater temperatures. Identification of resistant habitats, species, and colonies can be used to establish a network of marine protected areas that will enhance the conservation of coral reefs in the face of global warming. The final field investigation involved removal of the final long-term transplant experiment investigating the potential for physiological acclimatization of the coral <i>Porites lobata</i> to the environmental extremes of the Ofu back reef and the conducting of a follow-up set of experiments using the back reef coral <i>Acropora hyacinthus</i> to test host thermal tolerance of corals with different clades of symbiotic zooxanthellae. Recovered coral fragments were collected for laboratory analysis. The rest of the year involved completing laboratory analyses of the field experiments.</p>

POBS REPORTS FOR FY 2008

Project Title	Description
An Ecological Approach to Sustainable Control of Italian Thistle	Italian thistle (<i>Carduus pycnocephalus</i> L.) is a rapidly spreading noxious weed in and around Sequoia National Park. The objective of our study is to test two thistle reduction methods and two restoration methods to determine their individual and combined effects on both weeds and native plants. The theory is that long-term control may only be possible where native plants take the place of invasive thistles. The experimental design is a matrix that couples one thistle reduction method (no treatment control, herbicide, or clipping) with one restoration method (no treatment control, sowing native forb seeds, or planting native grass plugs). In spring 2007, researchers completed a pre-treatment inventory of the plants in each plot and then applied the thistle reduction treatments. In spring 2008, researchers repeated the surveys and thistle reduction treatments. USGS and NPS staff and community volunteers collected native forb and grass seeds in the two watersheds in summer 2007. Forb seeds were distributed in the plots in November 2007. Grass seeds were propagated by the NPS horticulturist for one year and then planted in the plots in February 2008. The effectiveness of the thistle control and native plant restoration methods will be assessed in spring 2009, after the plots are re-surveyed by USGS and NPS staff.

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U.S Department of the Interior

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- encourage and provide for the appropriate management, preservation, and operation of the nation's public lands and natural resources for use and enjoyment both now and in the future;
- carry out related scientific research and investigations in support of these objectives;
- develop and use resources in an environmentally sound manner, and provide an equitable return on these resources to the American taxpayer; and
- carry out trust responsibilities of the U.S. Government with respect to American Indians and Alaska Natives.

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The National Park Service is a bureau within the Department of the Interior. We preserve unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations. We also cooperate with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world.



Natural Resource Stewardship and Science
1849 C Street, NW
Washington, DC 20240