



Funding the Natural Resource Challenge

Report to Congress, Fiscal Year 2007



**Cover: Colleen Young, graduate student from Moss Landing Marine Laboratory, conducting observations of harbor seals in Johns Hopkins Inlet, Glacier Bay National Park, 2007.
NPS Photo: Jamie N. Womble**

Funding the Natural Resource Challenge

Report to Congress, Fiscal Year 2007

Natural Resource Stewardship and Science
Washington, DC

U.S. Department of the Interior
National Park Service
Washington, DC



Contents

Executive Summary 5

Chapter I: Funding and Measuring Progress 15

Funding 15
Measuring Progress 16

Chapter II: Park and Regional Resource Management Programs 19

Park Base Funding Increases 19
Regional Resource Management Activities 25
Alaska 25
Intermountain 26
Midwest 27
National Capitol 28
Northeast 30
Pacific West 31
Southeast 32

Chapter III: Network Programs 35

Inventory and Monitoring Networks 35
Exotic Plant Management Teams 46
Cooperative Ecosystem Studies Units 47
Research Learning Centers 54

Chapter IV: The Natural Resource Preservation Program 61

Natural Resource Management Projects 61
Threatened and Endangered Species Projects 65
Disturbed Lands Restoration Projects 66
Small Park Projects 68
Regional Block Allocation Projects 71
Alaska Special Projects 73
USGS Biological Resources 74
Servicewide Projects 74

Chapter V: Servicewide Natural Resource Programs 77

Air Quality Program 77
Water Resources Program 83
Biological Resource Management Program 88
Geologic Resources Program 94
Environmental Quality Program 102
Natural Sounds Program 103

Chapter VI: Financial Details 109

Appendixes 119

Appendix A 119
Appendix B 121
Appendix C 131
Appendix D 133
Appendix E 135

Park Index 147

Geoscientists-in-the-Park (GIP) volunteer Susi Tomsich hiking at Denali National Park and Preserve. In FY 2007 GIPs provided technical expertise valued at \$378,000.



Executive Summary

In August 1916 the United States Congress created the National Park Service to oversee the nation's growing collection of national treasures and protected areas. The Organic Act charged the Park Service with the conservation of "the scenery and 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." For almost 100 years the National Park Service has endeavored to fulfill this mandate.

Even as the National Park System has grown and matured, the pressures on parks and their natural resources have also evolved. Modern park managers must deal with complex issues that their predecessors never dreamed of, such as development, shrinking habitats, and climate change. Through tactical research, increased professional capability, expanded partnerships, support for restoration and protection projects, and greater education and outreach ability—all with an emphasis on cooperation and accountability—the National Park Service endeavors to respond to the complex and dynamic resource issues parks face.

Funding increases associated with the Natural Resource Challenge (2000–2007) are the cornerstone of the agency's improved capacity to address today's complex natural resource issues. To date, Natural Resource Challenge funding has increased professional expertise at both park and central support levels, and increased the Natural Resource Preservation Program (NRPP)—which supports on the ground tactical research, restoration, and protection projects at the parks. The increased funding has also supported cooperative programs connecting geographically linked parks, including establishment of 32 Inventory and Monitoring (I&M) networks, 12 Cooperative Ecosystem Studies Units (CESU), 17 Research Learning Centers (RLC), and 16 Exotic Plant Management Teams (EPMT). These programs enable the National Park Service to develop high quality scientific data, more sophisticated information and tools for improved management, and often, more efficient and cost effective ways of doing business.

Hellbenders (a large, aquatic amphibian) found within the Ozark National Scenic Riverways are mostly older, larger individuals and the population lacks recruitment. Research is providing important genetic information to support recovery and captive breeding efforts. The hellbender is a candidate for listing as threatened or endangered.

While the National Park Service has risen to the Natural Resource Challenge, the work of caring for parks will never be done as long as the American people continue to visit and care about the nation's great system of national parks and protected areas. Natural systems continually change. New information arises to challenge our understanding. New stressors are introduced that disrupt natural systems. Natural resource stewardship is a cycle of activities described by the following stages: discovery, learning, understanding, sharing, resource protection and restoration, and evaluation.

Discovery is the process of finding something new: new information, new species, new patterns. It can come from basic research, baseline inventories, or even observation.

As a result of the Soil Resources Inventory and the All Taxa Biodiversity Inventory, researchers discovered 21 new soil types at **Great Smoky Mountains National Park** as well as 58 new biotic species associated with different soils.

In the fall of 2006, researchers from the University of Maryland Center for Environmental Science-Appalachian Lab, a partner in the Chesapeake Watershed-CESU, discovered a federally endangered Indiana bat in a mist net in a tunnel along the Canal. This was the first sighting of this endangered bat in 27 years in the **Chesapeake and Ohio Canal National Historical Park**. This exciting discovery presented the park with a big challenge because this is a stretch of the Canal being considered for part of the "Rail to Trail" Maryland State project. Facilitated by Urban Ecology Research Learning Alliance and the CW-CESU, new bat monitoring has started at the park, giving park managers valuable information to help them make the decisions related to this highly visible project.

In 2007 NPS researchers discovered quagga mussels, a close relative of the zebra mussel and an exotic species, in Lake Mead. This discovery at **Lake Mead National Recreation Area** represented the first detection of this species in the western U.S. and lead to an immediate response by the National Park Service

to increase monitoring, detection, prevention and treatment activities in waters of other western U.S. parks. The response planning effort was led by an All Risk Incident Management Team, and was fully coordinated with other agencies and the Western States.

Discovery leads to . . .

Learning, which is tactical research, monitoring, or study that gathers data in scientifically sound manner in order to examine causes, effects and implications.

The Western Airborne Contaminants Assessment Project (WACAP) evaluated ecological impacts of airborne contaminants in national parks using a network of sites to provide spatially extensive, site specific, and temporally-resolved information on the exposure, accumulation, and impacts of airborne toxic compounds. The National Park Service is concerned about airborne contaminants because they can pose serious health threats to wildlife and humans, as some of these compounds tend to “biomagnify” in the food chain. The U.S. Environmental Protection Agency, the U.S. Geological Survey, the USDA Forest Service, the University of Washington, and Oregon State University are working with the NPS Air Resources Division on this assessment. Analyses of snow, vegetation and fish samples were finished in FY 2007, and most of the statistical interpretations of raw data were also accomplished during that time. The WACAP database—constructed from data submitted by nine different laboratories, with space for approximately 100 variables for more than 2,000 samples—will be publicly available by early 2008.

Ozark National Scenic Riverways. *Genetic Analysis of the Hellbender (*Cryptobranchus alleganiensis*), A Candidate Endangered Species:* The purpose of this project is to provide important genetic information to support recovery and captive breeding efforts for the hellbender, a large, aquatic amphibian that is currently a candidate species. In the past 20 years, this species has experienced drastic population declines of 70 percent throughout its range. Hellbenders found within the Ozark National Scenic Riverways are mostly older, larger individuals and the population lacks recruitment. With the rate of population de-

cline and lack of juveniles, hellbenders could face extinction. Previous work on hellbenders found the highest recorded genetic variance in mitochondrial DNA between local populations for any species. Preservation of this genetic diversity is essential to their survival. Modern genetic techniques were used to determine if the hellbender can be given protection as a single species representing a monotypic genus, a set of species or subspecies, as Management Units or as Evolutionarily Significant Units within a species. Cellular DNA will be extracted and mitochondrial DNA will be sequenced. If this does not reveal enough information, DNA fingerprinting techniques will be used. Two hundred samples will be analyzed and findings will be summarized in a final report.

Voyageurs National Park. *Improve Limited Knowledge of Ecology and Population Status of Threatened Canada Lynx:* Snowtracking during March through May was limited by poor tracking conditions, however at least one unconfirmed lynx track was located adjacent to the southern edge of the park. More than 150 snowshoe hare pellet transects were completed within and adjacent to the park in the major vegetation community types in May and June 2007. The initial assessment of lynx and snowshoe hare habitat quality via remote sensing information was also started in May. Infrared camera stations were purchased and monitoring stations began collecting data in August 2007. Field work will continue throughout FY 2008. The work was undertaken by the NPS and one CESU partner. Data for at least one of the project deliverables is being analyzed in conjunction with the principal investigators; final reports are expected by the end of FY 2008.

Great Basin National Park. *Sage Steppe & Fuels Management: Building the Knowledge Base:* Sagebrush habitats are one of the most threatened communities in the United States and wildlife species dependent on these habitats have also declined. Conserving four vulnerable sagebrush species: yellow-bellied marmots, Utah mountain kingsnakes, pygmy rabbits, and sagebrush voles is critical. Great Basin National Park staff conducted 340 person hours of surveys to find new populations. Marmots were observed in six new sites. No pygmy rabbits or signs of the same were



Studies at Voyageurs National Park are helping managers understand the habitat needs of the threatened Canada lynx. Photo: Lisa Burdett, University of Minnesota Duluth-Natural Resources Research Institute

found suggesting that pygmy rabbit habitat is extremely limited. No kingsnakes were found within the park although six were found very near during cooperative surveys with the Nevada Department of Wildlife. There is a high likelihood of finding kingsnakes in the park in FY 2008. Researchers spent 7,700 trap nights surveying for sagebrush voles with 4 individuals at 3 new locations. The survey resulted in locating 791 individuals of 14 small mammal species, 1,295 recaptures, 400 isotope samples, and data for completion of a masters thesis were recorded during sagebrush vole surveys.

Night Sky Monitoring Program: One of the key tasks of the NPS Night Sky Program is to inventory night sky quality in parks. In FY 2007, inventories were completed in 3 more parks bringing the total completed to 30. Thirteen more inventories were initiated bringing the total completed or pending to 54. Additionally, night sky data collection methods were peer reviewed and published in 2007. Other important tasks have been to retrofit lighting in parks, advise parks on new facility lighting, and compile a knowledge base

of night sky friendly lighting standards. Partnership with the International Dark-sky Association (IDA) has resulted in the creation of a Dark Sky Park certification program. **Natural Bridges National Monument** was named the first IDA Dark Sky Park, and several other parks are currently pursuing this status.

Klondike Gold Rush National Historical Park. *Field reconnaissance of glacial changes at Klondike Goldrush National Historical Park prompt further study of outburst flood potential:* During a reconnaissance survey two proglacial lakes with moraine dams were identified. There is a concern that the moraines are composed of an ice core and if they were to melt, failure would cause the lakes to drain rapidly. This represents a potential hazard to the City of Skagway, NPS resources and private land in the historical community of Dyea. Outcomes from the reconnaissance survey are to 1) fully characterize the present condition of the glaciers in the park; 2) determine how the glaciers have changed (number, length, area, thickness, volume) since the end of the Little Ice Age and; 3) determine whether the glaciers

possess the potential to be a source of major flooding.

Learning in turn leads to...

Understanding, which is the process of analysis, synthesis, summarization, and critical review of data. This creates information, and then knowledge.

Jean Lafitte National Historical Park and Preserve. *Characterize Changes in the Fisheries Population at the Barataria Preserve:* The objectives of this study were to assess changes in the composition and distribution of fish communities in the Barataria Preserve. The project documented the presence of newly introduced rare, threatened, endangered or non-native fish species that may require special management action. Researchers compiled scientific information on the changes in the fish fauna that can be used as a foundation for advising stakeholders.

Improving Visibility: Long-term air quality monitoring in numerous parks documented widespread visibility degradation. The data convinced the EPA to require all the States to develop plans for improving visibility in "Class I" areas—including most of the major national parks and wilderness areas. The plans, which were due at the end of 2007, must show 'rea-

sonable progress' toward restoring natural visibility conditions, consistent with the national goal established by Congress in the Clean Air Act. The plans must specifically include requirements for retrofitting older facilities that contribute to visibility impairment with modern pollution control equipment. The NPS has been working in partnership with regional planning organizations over the past few years to ensure states have the information they need to produce effective plans. Plans will be due every decade and must continue to show progress toward the visibility goal.

Richmond National Battlefield Park. *Slope instability study at Drewry's Bluff:* Drewry's Bluff is eroding and as a result, three of the four batteries (cannons) formerly lining the top of the bluff have been lost. The exterior wall of the fort is now on the edge of the bluff, which is fenced off from visitors for safety reasons. The park is concerned that allowing unabated erosion to continue at Drewry's Bluff will result in the loss of a large portion of the unit's historical resources and significance. In June 2007, the park convened a workshop to discuss three previous studies of the site, all of which had differing conclusions for the cause of instability as well as different design solutions. Based on a brief site visit during the workshop, it was concluded that the site is a slide complex with varying mechanisms caus-

Erosion threatens the fort at Drewry's Bluff in Richmond National Battlefield Park. The Geoscientist-in-the-Parks program provided the park with the technical expertise to evaluate proposed solutions and move forward with an engineering solution.



ing erosion and warranted further efforts in dealing with the instability. As a result, a Geoscientist-in-the-Parks (GIP) was acquired to analyze past studies, perform field reconnaissance of the site, and perform a geotechnical review of existing data. The basic findings of the GIP report provided enough information that the park is pursuing an engineering solution to the issue.

Comprehensive park-based Natural Resource Condition Assessments were initiated in 21 parks in 2007, in cooperation with the Cooperative Ecosystem Study Units. These assessments involve summarizing and synthesizing research, inventory data, and monitoring results about park natural resources and drawing generalized conclusions about the overall condition of fundamental park resources and the factors that influence those conditions. These condition assessments, which draw heavily from information compiled through the Inventory and Monitoring Program, represent an investment in the synthesis and interpretation of scientific data for direct use in park-based planning and natural resource management.

Understanding then gains relevance through...

Sharing, where the information is disseminated to peers, partners and the public.

The *Park Flight Migratory Bird Program* works to protect shared migratory bird species and their habitats in U.S. national parks. The program also develops bird conservation and education projects, and creates opportunities for technical exchange and cooperation between U.S. national parks and protected areas or parks in Canada, Latin America, and the Caribbean. Park Flight is a partnership between the National Park Service, National Park Foundation, American Airlines, National Fish and Wildlife Foundation, and the University of Arizona.

Wrangell-St. Elias National Park and Preserve, Carl Sandburg Home National Historic Site, Harpers Ferry National Historical Park, Chesapeake and Ohio Canal National Historical Park, and Catoctin Mountain Park. *Partnership with Chicago Botanic Garden:* Interns with the Chicago Botanic Garden completed projects

at five national parks. At Wrangell-St. Elias an intern worked with Alaska's exotic plant management team surveying the backcountry for exotic plants and manually eradicated infestations of oxeye daisy, yellow toadflax, common dandelion, and Siberian peashrub. The intern at Carl Sandburg Home documented and removed exotic species such as Japanese honeysuckle and oriental bittersweet. Projects also included restoration of the historical view and park firebreak by clearing brush, monitoring almost 400 hemlock trees infested by hemlock woolly adelgid, and treating 100 hemlock seedlings with insecticidal soap. The park will use the treated seedlings to replace adult trees that die from the pest infestation. Another intern worked in three parks in the Washington, DC area. The intern surveyed trees damaged by gypsy moths and conducted wetland surveys at Harpers Ferry. At Catoctin Mountain Park the intern monitored vegetation and mushrooms and prepared a draft revegetation manual. In addition, she assisted with the restoration of harperella, an endangered plant, at the C&O Canal.

Rocky Mountain National Park. *Reducing Stress on Ecosystems:* Twenty years of monitoring and research at Rocky Mountain has produced a large body of peer-reviewed, park-based scientific information documenting unnatural and harmful effects on park ecosystems because of nitrogen deposition. There were no legal or regulatory mechanisms that would require reductions in nitrogen emissions located outside park boundaries. Armed with a compelling case for action, the Park Service began working with Colorado, the EPA, and other stakeholders to develop a nitrogen deposition reduction plan, which is the first of its kind in the country and may serve as a template for addressing ecosystem impacts from deposition in other natural areas. The goal of the plan is to attain a park-identified nitrogen "critical load" for park aquatic resources over the next 25 years. The plan's framework will accommodate new information and advances in technologies as progress is made toward achieving the park's resource management goals.

NPS Training and Natural Resource staff developed and presented a series of interagency broadcasts to introduce the Department of the Interior's Adaptive Management Guide.

Three broadcasts were made that provided an overview to the guide and adaptive management process, detailed explanations of select steps, and discussions of case studies within the Department. DOI staff tuning into the broadcasts were able to interact with presenters during and after the broadcasts.

Sharing in turn creates knowledge, which is used for...

Resource Protection and Restoration, where managers take action, based in sound science, to meet mission goals.

Petrified Forest National Park. Excavation of Threatened Fossil Bone-bed: The purpose of the project was to conduct excavations of a fossil bone-bed with objectives of protecting scientifically relevant specimens being destroyed by erosion. Other components of this project included preparation and curation of fossils collected from the site as well as the publication and presentation of results. Initial and ongoing findings include salvage and recovery of several scientifically important specimens including partial skeletons of Triassic Period reptiles. The fundamental project goals of salvaging and stabilizing threatened fossils have been successfully completed.

Buck Island Reef National Monument. Re-introduce Endangered St. Croix Ground Lizard: The purpose of the one-year project was to conduct the translocation of the endangered endemic St. Croix Ground Lizard (*Ameiva polops*) to Buck Island Reef National Monument. Translocation of *Ameiva* will mitigate the potential for catastrophic loss of remaining populations and increase species range into a high quality habitat in a federally protected natural area. In March 2007, the National Park Service hosted the multi-agency *Ameiva* working group to develop the Project Implementation Plan for university collaboration on the translocation project. In August 2007, the National Park Service established a Cooperative Agreement with Texas A&M University. Dr. Lee Fitzgerald, Herpetologist, and his research team will guide the *Ameiva* translocation project, provide guidance, and select a master's student to conduct the project, thus ensuring a high degree of scientific rigor in the project design and outcome. Researchers were granted Virgin Islands-Department of

Natural Resources permits for *Ameiva* work. In November 2007, a 15-person multi-agency, university, and volunteer group conducted a 4-day site visit. All three remnant *Ameiva* populations were visited, capture methods tested, existing habitat conditions assessed, translocation plot design developed, and prey abundance assessed. The working group had consensus on all aspects of the project. The Park Service and the Department of Planning and Natural Resources-Division of Fish and Wildlife will collaborate on public education efforts. In December 2007, the Environmental Assessment will be completed and researchers will conduct population surveys, test capture/tagging methods, and construct Buck Island translocation enclosures. The first translocation of *Ameiva* is scheduled for March 2008.

Dry Tortugas National Park. Marine Protected Area: In January, 2007, the Dry Tortugas Research Natural Area was established in cooperation with the state of Florida. This ecological preserve creates a fully-protected 46 square-miles that provides a sanctuary for species affected by over-fishing and habitat loss.

Carlsbad Caverns National Park. Cave Management Policies: Unique microbes in every pool studied in Lechuguilla Cave, some with potential medicinal values, changed management policies on where researchers, employees, and volunteers working in Lechuguilla Cave could go and what was expected of them in order to protect these very fragile native microbial communities.

Guadalupe Mountains National Park. Analysis of sand and gravel management at Guadalupe National Park results in best management practices for roads and trails: The roads and trails at Guadalupe Mountains National Park are based on old game trails, Native American traces, stock trails, old ranch and mine roads and the 1981 trail building program. Since 1981, only minor changes and repair have occurred to the more than 80 miles of hiking trails. In 1978, Congress designated 46,850 acres of the park as wilderness. This designation recognized the pristine qualities of more than 60 percent of the park. Most of the park's trail system lies within this designation. In 2007 a plan was developed on the premise that through best management practices, the



One of the newest members of the Big Cypress Florida Panther family is kitten K-275. Ongoing research at Big Cypress National Preserve will provide critical information about habitat and the genetic diversity of the current population.

Photo courtesy of Ralph Arwood

A St. Croix Ground Lizard (*Ameiva polops*) captured on Ruth Cay, St. Croix, Virgin Islands.

amount of sand and gravel needed for roads and trail maintenance could be minimized, thus reducing the potential impacts so that the natural, scenic, and cultural values of the area could be preserved. This can be achieved through conservation of material and using appropriate road and trail system design. To achieve the plan objectives, the roads and trails will need to be consistent with management policies and best management practices. As funds become available, the park is upgrading existing roads and trails and installing erosion control treatments to upgrade them to storm-proof conditions.

Once decisions are made and actions taken, responsible managers then conduct. . .

Evaluation, which, depending upon the results can lead managers back to any of the previous stages of the process. Evaluation is critical. . .

Big Cypress National Preserve. *Capture and Biomedical Sampling of Endangered Florida Panthers:* The Florida Panther is an endangered species that exists only in south Florida. The ongoing loss of habitat on private lands will likely result in Big Cypress becoming the core habitat for the remaining population. The objectives for the ongoing panther capture work are to determine the current panther population status and future carrying capacity of Big Cypress. In order to achieve this goal, the Park Service will attempt to capture, collar, sample, and monitor as many panthers as possible to determine panther home ranges and dispersal, assess habitat suitability within the preserve, determine genetic diversity within the population, and manage potentially population limiting diseases. By evaluating these parameters the National Park Service will assist in the ultimate restoration and preservation of this endangered species.

Mount Rainier National Park. *Assess Status Of Native Bull Trout & Cutthroat Populations:* The purpose of this project was to confirm native char and trout stock presence in Mount Rainier National Park and to determine the extent of hybridization in three watersheds in the park. The specific objectives of this project were to obtain a baseline genetic profile and species delineation; provide a comparison of genetics within and among basins; provide

information essential to meet National Environmental Policy Act mandates for specific construction projects; and to incorporate knowledge gained in this study into the state-wide and regional information base to facilitate better understanding of the status of these species including native char distribution and the range-wide distribution of Dolly Varden and bull trout in the state. During the first year of this project Mount Rainier National Park field crews surveyed 81 streams throughout the park. Eighty-nine fin clips were obtained from native char in 14 streams. Two-hundred-fifteen fin clips were obtained from trout in 42 streams. Fin clips were preserved labeled and logged and shipped to the U.S. Fish and Wildlife Abernathy Fish Lab and to the U.S. Geologic Survey Western Fisheries Research Center for char and trout identification, respectively, using DNA analysis.

Channel Islands National Park: *Establish Baseline Ecological Conditions of Newly Established Marine Reserves:* This project will expand the park's existing kelp forest monitoring program through establishment of 16 new fixed sites to ensure adequate inside/outside reserve baseline data to properly evaluate the effectiveness of the new marine reserves. This project collected 3 years of baseline data for 70 taxa or categories of algae, fish and invertebrates from 24 fixed sites in and adjacent to 4 of the newly established Marine Protected Areas in Channel Islands National Park. This baseline data is currently being analyzed and will be used to evaluate the effectiveness of the Marine Protected Areas.

In 2007 intensive monitoring was initiated in the newly established Research Natural Area at **Dry Tortugas National Park** to determine the species response to the management actions created in conjunction with the establishment of the preserve. Monitoring was a coordinated effort between the National Park Service, U.S. Geological Survey, and the National Oceanographic and Atmospheric Administration. The evaluation of monitoring data will provide a basis for any future adjustments to the management of the area.

In FY 2007 Congress completed what it began in 1999 with the enactment of the final planned **Natural Resource Challenge** funding increases. While funding the Natural Re-

source Challenge may be completed, the work of caring for parks continues. As the National Park Service approaches its 2016 centennial, park managers must anticipate new challenges. Climate change, marine conservation, energy development, increased urbanization, and a “shrinking” globe that allows for easy disease transmission and non-native species invasions are all daunting challenges that put at risk the very nature of the parks the American public so treasures. National Park Service funding increases for natural resource programs in the past eight years have provided for significant improvement in the stewardship of the national parks. Through tactical research, increased professional capability, expanded partnerships, support for restoration and protection projects, and greater education and outreach ability—all with an emphasis on cooperation and accountability—the National Park Service endeavors to ensure that America’s national parks are unimpaired for current and future generations to enjoy. However, it will take commitment from Congress, the National Park Service, a wide range of partners, and the American public to provide the stewardship of America’s natural treasures for the next 100 years.



Chapter I: Funding and Measuring Progress

Funding

This report responds to directions in the House Report 106–22 for the FY 2000 appropriations for the National Park Service and other Department of the Interior and related agencies. In the House report, the National Park Service was requested to provide information concerning the expenditures and related accomplishments resulting from a series of increases to Natural Resource Stewardship Programs begun in FY 2000 and completed in FY 2007 known as the Natural Resource Challenge. This report addresses FY 2007 expenditures and accomplishments for all Natural Resource Stewardship Programs, exclusive of Everglades Restoration and Glen Canyon Adaptive Management Program, and communicates the successful implementation of the final year of the Natural Resource Challenge.

A detailed history of the Challenge is included as Appendix A.

The Natural Resource Challenge included a series of requests for new funding that were designed by field superintendents and subject matter experts to meet future natural resource management needs. Many of the increases resulted in accelerating or expanding earlier programs, while a few resulted in entirely new activities. The table below shows the funding for Servicewide Natural Resource Stewardship Programs, distinguishing those affected by Natural Resource Challenge funding, and identifies the funding level for FY 1999, the year before the first Challenge increases, and FY 2007. Most of the differences where increases are shown were as a result of the Natural Resource Challenge.

NPS Natural Resource Stewardship Programs¹			
Program Components	FY 1999	FY 2007	Change
<i>Natural Resource Challenge-Affected Programs</i>			
Air Quality Program	6,285	8,736	2,451
Biological Resource Management Program ²	0	9,938	9,938
Cooperative Ecosystem Studies Units ³	0	127	127
Geologic Resources Program	1,918	2,862	944
Inventory and Monitoring Program ³	5,787	43,775	37,988
Natural Resource Data and Information Program	1,424	1,443	19
Natural Resource Preservation Program	5,432	8,229	2,797
Research Learning Centers (15 Centers established) ³			
Resource Damage Assessment & Restoration Program (includes Oil Spill Pollution Act)	873	1,361	488
Resource Protection Fund	0	286	286
Water Resources Program	4,754	12,399	7,645
Subtotal	26,473	89,156	62,683
<i>Programs Not Affected by Natural Resource Challenge</i>			
Cave and Karst Research Institute	0	328	328
Everglades—Comprehensive Restoration Plan (CERP)	0	4,662	4,662
Everglades—Critical Ecosystem Studies Initiative	1,200	3,864	2,664
Everglades Task Force Support	800	1,307	507
Geographic Information System (GIS) Program	1,336	1,255	-81
Glen Canyon Adaptive Management Program ³	0	100	100
Natural Sounds Program (formerly Overflight Program)	200	3,806	3,606
Subtotal Non natural Resource Challenge Programs	3,536	15,322	11,786
Subtotal—Servicewide Natural Resource Programs	30,009	104,478	74,469
National Park System Units, Other Field Units, and Central Office Natural Resource Stewardship Programs	64,408	111,012	46,604
Total Natural Resource Stewardship	94,417	215,490	121,073

¹All numbers shown in thousands of dollars

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

³Reflects program funding after transfers to parks or regions

Twenty years of monitoring and research at Rocky Mountain National Park have produced a large body of peer-reviewed, park-based scientific information documenting unnatural and harmful effects on park ecosystems because of nitrogen deposition. The Park Service is working with Colorado, the EPA, and other stakeholders to develop a nitrogen deposition reduction plan, which is the first of its kind in the country and may serve as a template for addressing ecosystem impacts from deposition in other natural areas.

The table below shows FY 2006 funding and changes resulting from FY 2007 increases and other actions for all of the programs affected by the Natural Resource Challenge.

Measuring Progress

The National Park Service, like most governmental organizations, is increasingly being charged with reporting performance in a mea-

asurable way. The Government Performance and Results Act (GPRA) formalizes reporting requirements and stresses measuring performance by tracking outcomes. For the natural resources of the National Park System, the desired outcome is resources in good condition, as defined by the desired condition, usually identified in a planning document.

FY 2007 Changes to Natural Resource Stewardship Programs¹			
With Natural Resource Challenge Contributions Highlighted			
All numbers in thousands of dollars			
Service-wide Natural Resource Programs	FY 2006	FY 2007 Increases	FY 2007
Air Quality Program	8,692		8,736
Challenge contribution	2,800		2,800
Biological Resource Management Program ²	8,401		9,938
Challenge contribution	7,985		7,985
Cooperative Ecosystem Studies Units ³	127		127
Challenge contribution	1,993		1,993
Geologic Resources Program	2,672		2,862
Challenge contribution	696		696
Inventory and Monitoring Program	43,124		43,775
Challenge contribution	40,403	1,000	41,403
Natural Resource Data and Information Program	1,510		1,443
Challenge contribution	1,098		1,098
Natural Resource Preservation Program	8,229		8,229
Challenge contribution	3,499		3,499
Research Learning Centers ³			
Challenge contribution	2,698		2,698
Resource Damage Assessment & Recovery Program (includes Oil Spill Pollution Act)	1,344		1,361
Challenge contribution	500		500
Resource Protection Fund	286		286
Challenge contribution	300		300
Water Resources Program	12,325		12,399
Challenge contribution	7,985		7,985
Cave and Karst Research Institute ⁴	328		328
Everglades Research and Restoration ⁴	9,746		9,833
GIS ⁴	1,255		1,255
Glen Canyon Adaptive Management ⁴	95		99.7
Natural Sounds Programs ⁴	1,399		3,806
National Park System Units, Other Field Units, and Central Office Natural Resource Stewardship Pro- grams	108,975		111,012
Challenge contribution	6,595		6,595
Natural Resource Stewardship Programs	208,883		215,490
Challenge contribution	76,552		77,552

¹ Includes across-the-board reductions and other changes to base, so FY 2007 changes added to FY 2006 will not equal the FY 2007 final funding

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

³ Reflects program funding after transfers to parks or regions

⁴ Programs not affected by Natural Resource Challenge

During fiscal year 2007 the National Park Service completed its transition to the performance goals identified in the Department of the Interior 2007–2011 Strategic Plan. As a result, a number of goals previously reported were eliminated and others were modified. The changes are intended to streamline the goals and bring the National Park Service into better alignment with Departmental goals.

Goal BUR Ia3A measures air quality in parks and replaces the previously reported goals Ia3B/PEM 1.010 and Ia3C/PEM 1.011 which have been discontinued. This year, 129 of 145 reporting parks met the air quality goal with a resulting performance measure of 89 percent. Thus, the annual air quality performance goal was exceeded this year. In FY 2007, the number of reporting park areas increased compared with previous years because the analysis included more data representative of park areas that was collected by state air pollution control agencies and other national programs.

While goal BUR Ia1B remained unchanged from previous fiscal years, the technical field guidance for reporting invasive plant work was updated and revised in 2007. Definitions were clarified and modified to become consistent with other federal agencies, bureaus within DOI and the national standards for the inventory and monitoring of invasive plant species.

In 2000, the National Park Service identified and organized 270 parks with significant natural resources into a system of 32 bioregional networks. These networks provide a means to measure resource condition and performance in connection with resource stewardship. Through the Natural Resource Challenge, these networks were funded in incremental stages beginning in FY 2001 with the final two networks receiving funding in FY 2007. As of September 30, 2007, all 270 (100 percent) of parks have identified their vital signs, 197 parks (73 percent) have designed monitoring plans and implemented vital signs monitoring, and 157 parks (58 percent) have completed at least one year of field data collection and are able to estimate current condition for specific vital signs. Four networks are at least one year ahead of schedule in designing and implementing their long-term monitoring program. The Service's performance goals for vital signs monitoring have been met or exceeded every year since FY 2001.

The following table shows the relationship of natural resource programs to selected Department of the Interior 2007–2011 Strategic Plan goals.

FY 2007 Strategic Plan Goal Targets	
NPS Goal Targets for FY 2007 (NPS number/DOI number)	Servicewide Natural Resource Program Supporting Park Performance
<i>Goals relating to strategies to restore, maintain, sustain and protect resources:</i>	
BUR Ia3 Air quality in 68 percent of NPS reporting park areas has remained stable or improved. Actual 89 percent. (exceeded)	Air Quality
BUR Ia1B Invasive Species: 0.69 percent of acres (4,795 of 697,313 acres) infested with invasive plants being maintained as free of invasive plants. Actual 1.3 percent (9,205 acres). (exceeded)	Biological Resource Management
BUR Ia2A. 41.6 percent (490 of 1,177) of park populations of native species of management concern that are managed to desired condition. Actual 37.2 percent (385). (approaching)	
BUR Ia9 38.3 percent (1,534 of 4,007)of paleontological localities in good condition. Actual 39.6 percent (1,588). (met)	Geologic Resources
BUR Ia4A Water quality: 72.4 percent (104,800 of 144,811) of surface water stream miles in Parks that meet State and Federal water quality standards as defined by the Clean Water Act. Actual 91.5 percent (132,469). (exceeded)	Water Resources
BUR Ia4B Water quality: 79.8 percent (4,400,677 of 5,513,876) of surface waters acres in Parks that meet State and Federal water quality standards as defined by the Clean Water Act. Actual 90.6 percent (4,994,927). (exceeded)	
<i>Goals related to strategy to improve information base, resource management and technical assistance</i>	



Chapter II: Park and Regional Resource Management Programs

Americans love their national parks; they have answered the call to care for and protect parks time and again. As the National Park Service approaches its centennial in 2016, Congress is initiating the Centennial Challenge to ensure that the current generation has the opportunity to enjoy and care for parks. Citizen stewards across the country are partnering with their parks to protect resources, provide educational and recreational opportunities, and prepare parks for 2016.

The Centennial Challenge is not the first time that Congress and the American people have responded to the NPS Organic Act's call to ensure that parks are "unimpaired for current and future generations." In 1956 Congress supported the Mission 66 program to prepare parks for the National Park Service's golden anniversary. In 2000 Congress launched the Natural Resource Challenge. Where Mission 66 sought to provide improved access to parks, the Natural Resource Challenge endeavored to ensure that parks continue to be worth visiting.

A key strategy of the Natural Resource Challenge was to improve the capacity of NPS resource managers at every level to address emerging complex resource issues. Base funding increases for 36 national parks in FY 2001 and FY 2002 were directed at invasive species control, threatened and endangered species restoration and recovery, native species efforts, and basic natural resource capability for small parks. Regional programs also benefited from increased capacity. Natural Resource Challenge funding provided for the establishment of park-based aquatic resource professionals and other specialists. Strategically locating these highly skilled professional allows for multiple parks to benefit from their knowledge and skills. After seven years the Natural Resource Challenge increases have been fully integrated into park and regional resource management programs.

PARK BASE FUNDING INCREASES

The Natural Resource Challenge base funding increases continue to provide tangible benefits to parks. In the case of smaller parks

like **Monocacy National Battlefield** and **Hopewell Culture National Historical Park**, the Challenge funding established natural resource management programs where none previously existed. Prior to funding increases these parks relied on the specialists from the regional office, neighboring parks, or like **Saugus Iron Works National Historic Site**, on staff from other disciplines such as law enforcement or education to conduct natural resource management activities.

The benefits of the Natural Resource Challenge were not limited to smaller parks; funding increases also enhanced the capabilities of parks with pre-existing resource management programs to address critical issues such as threatened and endangered species and invasive plants and animals. Many parks report that Natural Resource Challenge funding continues to provide increased capacity and flexibility and has helped to establish and strengthen partnerships that enhance productivity and foster creativity in addressing problems and mutual concerns.

While parks continue to report overall increased capability and tangible benefits of the Natural Resource Challenge base funding increases, many parks are also noting an erosion of these gains. At **Sequoia and Kings Canyon National Parks** erosion of base funds by fixed-cost increases means the parks are losing the capacity to provide critical follow-up control on past projects. **Theodore Roosevelt National Park** reports that significant gains made through the initial base increase are threatened by relatively small but persistent erosion of base funds and annual cost-of-living increases.

Unlike Mission 66 or the Centennial Challenge, the Natural Resource Challenge has no end date. Climate Change, invasive species, and other complex issues continue to emerge and threaten parks and the wildlife within. Natural Resource Challenge park base funding increases improved the capacity of the 36 benefiting parks to discover, learn, understand, share, protect and

Park visitors viewing numerous brown bears with a commercial operator on the coast at Katmai National Park and Preserve.
NPS Photo: Peter Hamel

restore resources, and evaluate the results of management actions.

Discovery

Rock Creek Park. *Bioblitz*: In partnership with the National Geographic Society, the park conducted an all species Bioblitz in May. Approximately 100 scientists descended on the park to conduct an all taxa 24-hour inventory of species. More than 600 species were recorded for the park with some species yet to be identified. The event was well attended by the public.

Great Basin National Park. *Cave Biological Inventories*: Biological Resource Management Program funding combined with Natural Resource Challenge funds have allowed the park staff to inventory for little known cave adapted biota. With more than 42 wild caves, a wild cave entry permit program and the heavily visited Lehman Caves, this project was essential for development of a cave management plan. During the second year of a two year study, park staff continued monthly cave biota monitoring in Lehman Caves to provide an entire year of data that can be analyzed to determine if seasonality, impact, distance from entrance, and/or distance from trail affect the distribution of cave biota. A CESU agreement with the Illinois Natural History Survey allowed park staff to work in close cooperation with cave biologists to assist with cave biota collections. A new genus and several new species to science have been discovered as a result of this project. In the spring 2007, the first report of the new genus was published in "Cave Millipedes of the United States. V. The genus *Idagona* *Buckett & Gardner* (Chordeumatida, Conotylidae, Idagoninae)" in the online journal *Zootaxa*. In July, six alpine caves were visited, with all containing more diverse and abundant biological populations than expected. The Principal Investigator is refining identification of specimens collected, sending them to taxonomic experts as necessary, and preparing a final report to be completed by September 2008. The findings of this project will allow planning for cave visitation and monitoring of visitation to preserve these unique populations.

Catoctin Mountain Park. *Monitoring Air Quality*: Catoctin operated a National Atmospheric Deposition Program (NADP) monitoring

station in cooperation with NPS Air Quality Program. This station samples wet deposition to monitor air quality as part of the National Trends Network. The station has been on-line since May 2003. Samples are collected and analyzed weekly by park staff, then forwarded to a contract lab for detailed analysis. This project provides specific air quality data for the park as well as providing information pertinent to the entire region.

Learning and Understanding

Dinosaur National Monument. *Distribution and ecology of invasive New Zealand Mudsnaail*: In 2005 Dinosaur National Monument staff began working with Utah State University researchers to study the distribution and ecology of invasive New Zealand mudsnaail in the Green River and its effects on native invertebrates. This project addresses a new invasive animal, but findings will also be integrated with the river ecology research. Researchers will use the data to formulate predictions about susceptibility of Western rivers to future invasion and potential effects on native aquatic biota. Work conducted in 2006 revealed that the New Zealand mudsnaail has begun to invade Dinosaur National Monument via the Green River (Canyon of Lodore). A final report for this project was accepted in May, 2007. The park management is seeking technical assistance to determine appropriate response. Partners in this project included the U.S. Fish and Wildlife Service, Bureau of Land Management, Utah Division of Wildlife Resources, and Utah State University.

Kalaupapa National Historical Park. *Habitat use and Foraging of Endangered Monk Seal (Monachus schauinslandi)*: Endangered Hawaiian monk seals that inhabit Kalaupapa National Historical Park play a major role in the greater Main Hawaiian Islands population of seals. Approximately 40–50 percent of the monk seal pups born annually in the Main Hawaiian Islands are born at the park. The primary agency responsible for management of this species is the National Oceanographic and Atmospheric Administration (NOAA) endangered species division. The park works closely with NOAA personnel to document seal distribution and abundance. The Molokai community is sensitive to marine fisheries issues, and the role that the NOAA and Kalaupapa play in seal management. This concern

has the potential to negatively affect local fisheries resources and may strain relations between the park and community. Therefore, a cooperative study with NOAA was initiated in 2007 to satellite tag at least eight local monk seals residing on Molokai to document their home-range, habitat use, and foraging areas. A total of seven monk seal pups were flipper tagged and measured in cooperation with the endangered species division of NOAA. In August 2007, an additional five monk seals (two adults, one sub-adult, one yearling, and one weaner) were satellite tagged and given a full health assessment. The health assessment included blood samples, tissue samples, swabs of other body fluids, and physical measurements. Coupled with these activities, NPS staff performed or supported three detanglements of monk seals from fishing gear. Marine managers and local fishermen need to determine how Molokai seals use local resources in order to prepare future management plans.

Mojave National Preserve. *Development and Application of RFID Technology to Track Juvenile Desert Tortoise Survivorship:* The Mojave Preserve represents 1.6 million acres including approximately 800,000 acres of Critical Habitat for the threatened desert tortoise (*Gopherus agassizii*). Survival of juveniles to adulthood is also essential for species recovery. The small size of juvenile desert tortoises and long

intervals spent underground makes tracking them difficult. The proposal “Development and Application of RFID (Radio Frequency Identification) Technology to Track Juvenile Desert Tortoise Survivorship” was selected for funding through NRPP-USGS-BRD-Research. A contract is being negotiated with Radargolf Corporation for development of the chip. A study plan was prepared by USGS and peer-reviewed. This technology development will allow researchers to track juvenile tortoises over a period of several years without batteries.

Theodore Roosevelt National Park. *Elk Population Monitoring and Research:* The 2007 elk population revealed the park’s elk population at approximately 750–900 animals and continues to grow relatively unchecked. Indeed, in a paper recently published in the *Journal of Wildlife Management* by Sargeant and Oehler (2007), researchers concluded that the population at Theodore Roosevelt was one of the most productive and healthy herds that has been studied to date. Based on location data from 137 marked elk, the majority of collared elk were found within the boundaries of the park between December and March, and generally traveled outside the park during the summer months. Some of the preliminary conclusions of the collaborative (NPS/USGS) elk monitoring research are as follows:

At Mojave National Preserve researchers are using RFID technology to track juvenile desert tortoises. This juvenile was hatched in a headstart facility similar to one planned for the preserve. NPS Photo: Debra Hughson



- The distribution of elk within the park displayed dramatic seasonal variation. This seasonal variability must be considered when impacts of elk on park resources (e.g., sensitive plants) are assessed.
- Despite unusually dry conditions observed in 2003 and 2004, elk rarely used water developments.
- Elk activity outside the park was patchy and localized. Most occurred within 25 km of the park, within an area that was largely encompassed by exterior boundaries of the Little Missouri National Grassland.
- A substantial portion of elk activity outside Theodore Roosevelt National Park occurs on private lands. Intensive use of private lands occurred in localized areas but was not widespread.

In addition to the ongoing movement and distribution study, a study was completed on the population dynamics of the elk population at the park. That research was also recently published in the *Journal of Wildlife Management*. This and other elk research supported the development of the draft Elk Management Plan/EIS released in 2008.

Sharing

Hopewell Culture National Historical Park.

Native Seed Propagation and Planting: Seed collected from October 2007 was planted in a greenhouse in a partnership with Adena Mansion and Gardens, a unit of the Ohio Historical Society. The Mansion and Gardens provided greenhouse space, growing medium, and use of their watering equipment. A park volunteer tended the plants, such as black-eyed Susans, purple coneflower, butterfly weed and big and little bluestem. Once the plants were established, they were planted at Hopewell Mound Group parking lot (0.015 acres), which lies across the road from the prairie in which the seeds were harvested. The planting was done during a Great American Cleanup event where volunteers helped plant and beautify the area on April 28, 2007.

Dinosaur National Monument. Weed Warriors:

In FY 2007, 482 volunteer Weed Warriors contributed 2,107 person-hours removing invasive tamarisk, Russian olive, perennial pepperweed, and leafy spurge from riparian habitat along the Green and Yampa Rivers in Dinosaur. Efforts in 2007 focused on two primary removal objectives: 1) tamarisk removal

in campgrounds along the Green and Yampa Rivers to enhance visitors' recreational experience and improve public awareness of invasive species impacts, and 2) leafy spurge removal along the Yampa River, several of its tributaries, and the Green River below the confluence as an early detection/eradication strategy. Twenty of 32 river camps were targeted for tamarisk removal; all 20 were completed. No leafy spurge was allowed to set seed in the river corridor in 2007. Dinosaur's volunteer Weed Warrior Program completed an 11th successful season in 2007. Over the program's 11-year history 5,340 volunteers have contributed 20,824 hours with no reportable injuries.

Buck Island Reef National Monument. Visiting

Researchers: The Monument hosts between 5 to 10 visiting researchers per year. In 2007 park staff assisted with several projects, logistics, and support of research activities. These projects included efforts to control invasive exotic plants, inventories of bats and marine invertebrates, several coral studies, and a video mosaic project. Each activity provided Buck Island staff with exposure and training to unique aspects of the park that will help the park more fully meet its goals of understanding the park resources and responding to the needs of park management for threatened and endangered species and exotic species.

San Juan Island National Historical Park.

Education and Service Programs: Examples of specific programs include the park's continuing "Habitat" educational program in partnership with Friday Harbor Elementary School, where park interpreters participate in classroom programs while students investigate natural processes at the park. The park also maintained a partnership program with the Oregon Museum of Science and Industry (OMSI) to provide educational camps at the park that focus on marine and coastal environments. Students and mentors participating in the program assisted park staff in controlling invasive exotic plants, propagating native plants for prairie restoration, and monitoring oak health and regeneration. A variety of other groups assisted the park on similar projects, including Boy Scouts who completed service projects to remove exotic plants, home-school students who assisted with prairie restoration, and EarthCorps crews who worked with park staff to grow nearly 30,000 native plants and



A volunteer tends to native seedlings destined for Hopewell Culture National Historical Park.

plant approximately 15,000 native grasses at disturbed sites in the park in FY 2007.

Resource Protection and Restoration

Curecanti National Recreation Area. Cooper Ranch-Neversink Riparian Restoration Project: Restoration staff continued a project to restore a 155-acre hay field to its pre-existing riparian habitat condition by improving overland flow meanders, floodplain development, and wetland enhancement. This project is part of a basin-wide effort, initiated in 2005, to protect, restore, and enhance the wetland corridor associated with Tomichi Creek and the Gunnison River. The project involved treating invasive weeds including yellow toadflax and Canada thistle in an area approximately 30 acres in size within the overall project area. Nearly 5,000 willow shrubs and cottonwood saplings were planted. Approximately 1.5 acres of riparian habitat was determined to be restored during 2007. The project area is the only publicly-accessible wetland-cottonwood gallery on the Gunnison River in the vicinity. The area has seen significant alteration as a result of past ranching activity. The project was

made possible by NRC funding and a grant from the Colorado Department of Natural Resources, Division of Wildlife.

Channel Islands National Park. Island Fox Recovery: In 2007, island fox recovery at Channel Islands National Park achieved two major milestones as recovering fox populations on San Miguel and Santa Cruz Islands reached levels at which captive breeding and release were no longer required. Accordingly, the captive breeding facilities on those two islands were closed and all foxes released. In 2004 the U.S. Fish and Wildlife Service listed as Endangered the three island fox subspecies in the park (San Miguel Island foxes, Santa Rosa Island foxes, and Santa Cruz Island foxes) as well as the subspecies on Santa Catalina Island. Island fox populations had declined precipitously in the 1990s due to predation by golden eagles. The latter had never bred on the islands until the 1990s, and were supported by alien prey species: feral pigs on Santa Cruz, and mule deer on Santa Rosa. Although captive breeding might have been required for as long as a decade, releases can cease because

golden eagle predation has been mitigated (44 golden eagles were removed from the islands since 1999, feral pig removal and bald eagle introduction makes the islands less hospitable to golden eagles), and because fox populations have increased in the wild. Reproduction and survival of foxes in the wild is so high that fox recovery will now be accomplished more effectively by the wild population itself, rather than by captive breeding and release.

Sequoia and Kings Canyon National Parks.

Exotic Plant Control: Exotic plant control work expanded dramatically as a result of Natural Resource Challenge funding. In FY 2007 compared to FY 2000 (pre-Challenge), weed crews surveyed 9,715 more acres and treated hundreds of thousands more plants. In montane areas, 19.1 acres of bull thistle (*Cirsium vulgare*) and 2.7 acres of woolly mullein (*Verbascum thapsus*) have reached maintenance level after three to five years of treatment. In foothill areas, 1.8 acres of Himalayan blackberry (*Rubus discolor*), 0.6 acres Spanish broom (*Spartium junceum*) and 1.1 acres of Italian thistle (*Carduus pycnocephalus*) have reached maintenance level after three to five years of treatment. A number of highly threatening exotic plant populations that were still in an early phase of establishment were controlled, preventing a future population explosion that would be very difficult and costly to control.

Zion National Park. Peregrine Falcon: Zion continued to monitor peregrine falcons and implemented rock climbing closures during the critical breeding and brooding months. The park also managed aircraft used in management activities to avoid known nesting areas. These efforts have resulted in accurate assessments and successful recruitment of peregrine falcons. Of the 19 historical peregrine falcon territories, 11 were surveyed; 10 of the 11 territories had a breeding pair. Of the 11 breeding peregrine pairs, 9 pairs successfully hatched eggs. A total of 16 young were counted as fledged from 9 territories. The productivity for occupied nesting territories with known outcome was 1.3 young/pair, which exceeds the goal of 1.25 young/pair proposed by U.S. Fish and Wildlife Service in the 1984 Peregrine Falcon Recovery Plan. Staff maintained a page on the park web site to improve timeliness of information exchange with the public climbing community. Each spring, 10 cliffs used by peregrine falcons for breeding are closed to recreational climbers at the beginning of the breeding season. Once the current eyrie location has been confirmed in a falcon territory, the climbing cliff is reopened if climbing activity will not disturb the falcons. If the eyrie is situated so that use of climbing routes on a cliff will disturb breeding, the cliff remains closed to climbers until breeding is complete. Each cliff opening was posted immediately on the web site, ensuring that recreational climb-

Once absent from Great Basin streams, Bonneville cutthroat trout now can be found in five stream systems within the park.



ers had sufficient opportunity to climb in the park, while protecting falcon nesting habitat. This has been well received by the public.

Evaluation

Buck Island Reef National Monument. *Post-eradication Monitoring of Pests:* Monument staff continued post-eradication monitoring for the exotic black rat (*Rattus rattus*) and monitoring of the house mouse (*Mus musculus*) populations. In FY 2007 Buck Island staff conducted biannual monitoring along five trap lines assisted by park volunteers to ensure there has been no accidental reintroduction of rats. Trap lines were set in October and April, 2007, and only the exotic house mouse was observed. The park will continue to monitor for these non-native pest species to ensure no accidental reintroduction of the previously exterminated mongoose (*Herpetes javanicus*) or black rat and for potential impacts to native flora and fauna from the mouse population. During the recent rat trap survey in October 2007 staff observed large quantities of seeds on trees had fallen uneaten to the ground. In years prior to rat control, seeds would have been eaten and never allowed to germinate.

Great Basin National Park. *Extirpated Species Recovery:* At the time of Great Basin National Park's inception in 1986, all native fish species had been extirpated. Anthropogenic causes included: extensive nonnative fish stocking; large scale stream diversions on four fish bearing streams; and other land use practices. In 2002, Resource Management staff initiated a multi-year program to restore all extirpated native fish species to selected stream systems. Reviews of historical information found that Great Basin waters contained suitable but vacant habitat for Bonneville cutthroat trout (*Oncorhynchus clarki utah*), speckled dace (*Rhinichthys osculus*), mottled sculpin (*Cottus bairdi*), and redbreast shiner (*Richardsonius balteatus*). All four of these species have been restored to park waters. Bonneville cutthroat trout occur in five stream systems encompassing 18 miles of stream. Monitoring efforts in 2007 found viable self reproducing populations with an average of 700 fish per mile in each system. As distribution expands into the habitat available over the next ten years, Bonneville cutthroat trout will inhabit more than 50 percent of their historic range within Great Basin. Sculpin, dace and shiner have

been re-introduced to two stream systems and monitoring in 2007 found young of year.

REGIONAL RESOURCE MANAGEMENT ACTIVITIES

Alaska

The *NPS Alaska Regional Science Strategy 2006 and Beyond* outlined five primary resource management challenges that were identified by NPS managers and scientists in Alaska: climate change, global and local contaminants, exotic species, increasing human use, and development within and surrounding parks. Science, resource management, and partnership building activities were underway in each of these areas in 2007, as the following examples indicate.

Climate change: The June 2007 issue of the Alaska Park Science journal was devoted entirely to scientific studies of climate change in Alaska's National Parks. Two photographic studies of landscape change in Southwest Alaska Parks were also completed this year, and they showed remarkably clear evidence of shrinking glaciers and expanding vegetation. The NPS Alaska Region International Polar Year project site provides information about these and other NPS IPY projects: http://www.ipy.org/index.php?/ipy/detail/us_national_park_service_beringian_arctic

Contaminants: Large-scale mining occurs on lands adjacent to some NPS areas and has the potential to affect others. Ore concentrates are transported daily from the Red Dog Mine (the world's largest lead-zinc mine) along a transportation easement through **Cape Krusenstern National Monument**. For many years, a small but significant portion of the lead/zinc/cadmium ore concentrates have escaped as fugitive dust, settling on NPS lands in Cape Krusenstern National Monument and potentially in **Noatak National Preserve**. The National Park Service and U.S. Geological Survey are researching the ecological effects of heavy metal dust contamination from the Red Dog mine in Cape Krusenstern National Monument. The Park Service is also working with the mine's owners, operators, and regulators to contain heavy metal releases and to mitigate impacts. Further north, the Alaska Region is participating proactively in the North Slope Science Initiative (NSSI). The NSSI is currently focused on oil and gas development north of **Noatak**

National Preserve, Cape Krusenstern National Monument, Kobuk Valley National Park, Berling Land Bridge National Preserve, and Gates of the Arctic National Park and Preserve. The National Park Service is also participating in reviews of pre-permitting studies related to the enormous Pebble Mine copper-gold prospect outside **Lake Clark National Park and Preserve.** The Western Airborne Contaminants Assessment Project (WACAP) released preliminary findings this year, indicating that remote arctic areas are not immune to contamination from distant global sources. Final WACAP reporting is expected during FY 2008.

Exotic species: Avian influenza preparedness and monitoring continued during 2007. Following intensive sampling of live and hunter killed birds by partners, and investigations of several suspicious bird mortality events, it remains unlikely that Asian H₅N₁ HPAI (highly pathogenic avian influenza) has reached Alaska or North America. During 2007, basic training and response kit supplies were again provided to the National Park Service and cooperating agency staff in Alaska. The NPS Alaska and Pacific West Regions jointly conducted an avian influenza tabletop exercise in Anchorage, with excellent participation by other federal and state agencies. The Park Service also participated in pandemic flu tabletop exercises organized by Alaska Department of Homeland Security. The Alaska Bird Mortality hotline (1-866-5-BRDFLU, a joint NPS/US-FWS project at the Anchorage Alaska Public Lands Information Center) implemented use of a sophisticated GIS-linked bird mortality database developed by the Park Service during its second year of operation. Surveillance for unusual mortality and morbidity events continued in NPS units region-wide. Specimen retrieval and testing at the USGS National Wildlife Health Center was again based on screening criteria developed by the Alaska Interagency Avian Influenza Steering Committee. The NPS and Alaska Natural Heritage Program also initiated a study of distribution and movement of AI priority bird species in the Alaska NPS units.

Increasing human use: Working from the recommendations of an eight-member science advisory board and others, **Glacier Bay National Park and Preserve** continues to expand research and monitoring into potential

impacts from cruise ships on physical, biological, and sociocultural resources. Results from several new studies will help to inform future management decisions regarding vessel numbers and operations.

Intermountain Region

Extending through an eight state area, the Intermountain Region (IMR) Natural Resource Park and Regional Programs consist of a wide range of park management issues and concerns, as well as, a substantial variety of ecosystems, staff sizes and acreage in its park units. The general state of IMR programs in the parks through 2007 has shown a continued loss of natural resource staff. Most affected are the small to medium size parks which have chosen either (1) not to refill natural resource positions when vacated, (2) to share a single natural resource position among several parks, or (3) natural resource positions have become diluted by having individuals assume part-time responsibilities for other park divisions in order to meet current budget levels. The result has been the loss of time available to cover basic natural resource program duties and/or the assignment of natural resource duties to individuals with little or no natural resource training or background. On a positive note, there has been an increase in parks relying on services provided by the NPS Inventory and Monitoring (I&M) Program. However, the I&M networks have defined roles and functions that do not allow for compensation of the loss of functional natural resource management personnel within the parks.

Both the parks and Intermountain Regional Natural Resource Program are suffering from significantly reduced travel funding. For regional staff this equates to a reduction in the ability to provide technical assistance to parks. For IMR parks, travel funding restrictions have meant a reduction in the ability of resource managers to travel to meetings or to trainings to increase their professional development or to assist with internal and external networking. Project funding remains minimal for natural resources. Parks report difficulty in finding partners for natural resource projects due to the requirement of project selections for three years out. Many potential project partners are hesitant to commit matching funds or their time for projects scheduled for three or more years out.

Several significant resource issues have come to the forefront during 2007. A few examples are provided below:

Grizzly Bear Delisting: On April 30, 2007, the U.S. Fish and Wildlife Service removed grizzly bears in the Greater Yellowstone Ecosystem from the threatened species list under the Endangered Species Act. **Yellowstone National Park** grizzly bears were documented as doing well the first summer (2007) after this delisting. The IMR remains an active partner with the Interagency Grizzly Bear Committee (IGBC) on conservation of the grizzly bear in both the Greater Yellowstone and the Northern Continental Divide Ecosystems. The grizzly remains listed in the Northern Continental Divide, but funding for long-term monitoring of population health and trends remains critical to both ecosystems.

Energy Development: IMR parks experienced significant increases in new energy developments (e.g. oil and gas, coal, uranium) near or adjacent to park boundaries during 2007. This has raised concerns about the potential for undesirable impacts to park resources (particularly for air and water) and to visitor safety and the visitor experience. Regional and park staffs are beginning to work with Servicewide NPS programs and other land management agencies to help define strategies to minimize impacts to resources and park visitors.

Border Impacts: Border impacts have become an increasing issue in both the northern and southern portions of the region. Parks associated with international borders are experiencing difficulties in allocating staff time and funding to adequately address developing border issues. There is concern that border developments may have the potential to impact more sensitive park resources such as threatened and endangered species, fragile desert soils, and cultural resources. The IMR regional natural resource staff and border park staffs are beginning to develop interdisciplinary and cooperative multi-agency approaches to assist in addressing border park resource issues.

Avian Influenza Preparedness: During 2007, the IMR regional natural resources staff assisted priority parks in the development of preparedness and response plans for avian in-

fluenza in wildlife. Regional staff also worked with Servicewide programs to provide priority IMR parks with appropriate protective equipment for collection of suspicious wildlife carcasses.

Midwest Region

With the retirement of the regional Chief of Natural Resource Stewardship and Science, the Midwest Region experienced a year of change. The region has sought to use this time of transition to look for ways to gain greater efficiencies and improve resource management.

The Science Advisory committee composed of park representatives and Natural Resource Stewardship and Science staff conducted a meeting in conjunction with the Midwest Fish and Wildlife conference held in Omaha, December 2006. Representatives discussed how to implement a pre-proposal process to improve the quality of projects that move forward from the Servicewide Comprehensive Call (SCC) to national competition. Through spring 2007, a process was developed and initiated. More than 170 projects were reviewed by panel members with pre-SCC results being submitted to the parks in August. The overall value or success of the effort will be determined as projects go forward for national panels in spring 2008.

The Midwest Region led the Service in distributing the Draft Resource Stewardship Strategy (RSS) handbook/reference manual and the Draft Herbert Hoover Resource Stewardship Strategy. A second project has been initiated at Effigy Mounds in conjunction with a General Management Plan (GMP). The MWR staff assigned to the RSS communicates well with the Water Resource Division to incorporate their needs into RSS efforts.

In the Great Lakes region, the exchange of ballast water in ships which transverse the St. Lawrence Seaway and locks at Sault Ste. Marie has triggered the region to consider how to protect native fisheries within a jurisdictional boundary surrounding Midwest Region park units.

Natural Resource Condition Assessments: The Midwest Region worked closely with the National Parks Conservation Association and

their schedule of “condition assessments” which are the basis for their *State of the Parks* reports. Two meetings were coordinated with NPS staff participating in a NPCA Scoping session for condition assessments and NPCA staff participated in an NPS Condition assessment effort for **Mount Rushmore National Memorial** and **Niobrara National Scenic River**.

The condition assessment effort is coordinated through the NRSS office and led by Carmen Thomson, Midwest Region I&M Coordinator. Staff are coordinating with the MWR Planning and Environmental Quality division to determine where parks may benefit from a Condition Assessment before initiating a GMP or where a GMP is completed and Resource Stewardship Strategies are needed. While a perfect planning cycle is not attainable, various parties need to be present to understand where and how Natural Resource Condition Assessments, Inventory and Monitoring efforts, Fire Effects Monitoring and Exotic Plant Management Team efforts may be integrated to maximize programmatic efficiency.

Pea Ridge National Military Park. *Minimizing Impact of Utility Lines to Park Resources:* The park has a long history of dealing with issues of power lines and utility right-of-ways (or lack of them) within the boundary. These issues were first documented in 1962, but until this year had never been resolved. Through negotiations with the power company, the Park Service was able to come to an agreement that was mutually acceptable by both parties. The park issued a Special Use Permit to the power company for right-of-ways that are outside of, and out of sight of any cultural landscape. The power company agreed to re-route certain power lines and abandon those that run through cultural landscapes. Besides developing this agreement, the park was able to remove 2,600 feet of power lines and poles from the Leetown Cultural Landscape and is in the process of removing 11,000 feet of power lines and poles in the Elkhorn Tavern Cultural Landscape area during winter 2008. Regional Block grant funds were used to contract with the utility company to remove lines and to treat exotic weeds in the utility right-of-way. The poles will be recycled to establish a working telegraph line along Telegraph Road from the Visitor Center to Elkhorn Tavern.

Wind Cave National Park. *Black-footed Ferret Recovery Program:* The black-footed ferret is one of the rarest mammals in the world and has been on the list of endangered species since 1973. In spite of 30 years of recovery efforts, the species is still imperiled due to a lack of suitable recovery sites. On July 4th, 2007, Wind Cave National Park reintroduced the black-footed ferret. The successful release was the culmination of seven years of preparation by park staff. Several prerequisite documents had to be prepared by the park including a Prairie Dog Management Plan, a Black-Footed Ferret Management Plan, and associated environmental assessment. The Black-Footed Ferret Management Plan had to lay out a strategy for ferret reintroductions and long-term management that was consistent with other park and stakeholder needs. The document and project also had to comply with the administrative and legal requirements of restoring an endangered species. The Wind Cave reintroduction site has fewer acres of prairie dogs than what ferret reintroduction sites have historically had; therefore, the park approached the reintroduction effort as an experiment. The park successfully used these unique circumstances to innovatively reintroduce ferrets.

National Capitol

Integrated Pest Management (IPM): The regional coordinator and park representatives continue to participate in IPM. As gypsy moth began made a comeback in the National Capital Region, first noticed at **Catoctin Mountain Park** but now in at least three parks, the program worked cooperatively with USDA and state agencies to assure effective treatment. As always, a major part of the IPM program is the daily consultation between various divisions and the IPM coordinator regarding the best approach to managing pests of all kinds.

Wildlife: Chronic Wasting Disease (CWD) has not been found in any parks in the region yet, but due to its proximity to some parks in the western portion of the region **Antietam** and **Monocacy National Battlefields** are teaming with **Shenandoah National Park** to write an Environmental Assessment for various methods of monitoring for and managing the disease. Parks have been trained on identification and biopsy methods and are working cooperatively with both the NPS Biological Resource

Management Program and their respective state wildlife agencies. Public scoping meetings were held in February 2007 at Antietam and Monocacy National Battlefields. The Park Service and contractor Louis Berger Group produced a newsletter and several posters to share information with the public. A Shepherd University intern worked at Antietam this year conducting regular foot patrols for dead deer and opportunistic sampling continued with eight samples submitted for testing all with negative results during this period.

Sightings of coyotes and black bears are occurring with increasing frequency.

Invasive Exotic Plants: A new invasive exotic was discovered at **Rock Creek Park** during the National Geographic Bioblitz. An expert from the Brooklyn Botanical Garden found the large non-native plant, Japanese angelica tree (*Aralia elata*). It is very close in appearance to the native Hercules Club or Devils Walking Stick (*Aralia spinosa*). Cooperative efforts between the Botanical Garden and the Park Service confirmed it is an exotic species not previously identified in the area. The park, assuming it was the native plant, had been avoiding cutting it along Military Road where it is common at the edge of the woods and creeping into the forested areas. *Aralia elata*, although listed by the USDA Forest Service as an invasive exotic, is generally not understood enough nor widespread enough to fully know the potential impacts to park resources. The park and Exotic Plant Management Team are determining the priority of the removal of this plant as more is learned about its local growth habits.

Park Briefs:

Manassas National Battlefield. *Restoring Historic Grasslands:* In order to restore the historic vista, Manassas National Battlefield is cutting 130 acres of timber. This habitat will become a shrub/grassland which should benefit many species. Park managers are removing another section of tree line in the northeast area of the park with the overall goal of creating a large grassland in that section. The park resource manager continued to adjust hay lease schedule to better accommodate wildlife. Mowing now ends mid-September instead of October to allow for re-growth for winter wildlife cover.

Antietam National Battlefield. *Exotic Plant Control and Scenic Restoration:* Emphasis areas for exotic vegetation control efforts in 2007 were the Otto Farm, portions of the Roulette Farm, East Woods/Miller Farm, Mumma Farm, Sherrick Farm reforestation areas and riparian buffers. The park's GIS/NR Specialist prepared a comprehensive reference this year on the plants of concern located in the battlefield. Antietam conducted its first prescribed burn of about nine acres in 2005. Several debris piles at the Otto and Spong Farms were burned under prescription in 2007 and were the result of some the mechanical removal and scene restoration discussed above. Prescribed fire planning for the Otto Farm and several other sites is underway for 2008.

George Washington Memorial Parkway. *Potomac Gorge Conservation:* A revision of the Vascular Flora of Great Falls Park, Fairfax County, Virginia, accounted for 1014 vascular plant taxa representing 1001 species. Eight varieties and 5 hybrids from 490 genera in 139 families have been documented within the park. The total flora contains 593 taxa that are designated as rare, 148 that are common, and 196 that are uncommon.

The park, in coordination with **Chesapeake and Ohio Canal National Historical Park** and The Nature Conservancy concluded an important phase of the Potomac Gorge Conservation Program, a five year program to address some key stressors to resources in the Gorge and to educate the public about methods they could assist in protecting this area of high biodiversity.

A two-year study of breeding birds at the Great Falls and Turkey Run areas of the George Washington Memorial Parkway was completed with a final report and GIS map showing sampling points and results. Warblers are of specific ecological interest because they are sensitive to both natural and human-induced environmental shifts, especially habitat fragmentation.

Northeast

Base-funded natural resource programs in parks have diminished in the Northeast Region over the past five years as a result of the majority of parks not receiving sufficient annual appropriations to fully cover staff

cost-of-living pay increases, locality pay and other fixed costs. Most of the larger parks in the Region with natural resource programs have lost at least one or two full time natural resource management professionals over the past five years. Seasonal employment for natural resource programs has been reduced. With the loss of employees, the remaining park staff have assumed the responsibilities of the vacated positions.

Despite the overall diminishment of resources and accomplishments, some park superintendents have exhibited exemplary leadership by filling critical natural resource positions when funding became available. For example, the Superintendent of **Shenandoah National Park** made the commitment to replace a base-funded Air Resources Specialist position and a Physical Scientist position with one person to assume the duties of both. Also, the Superintendent of **Valley Forge National Historical Park** filled the park's only natural resource specialist position that had been vacant for more than two years and is refilling a vacant biological technician position.

Ironically, the successes resulting from the hard work of park staff have added to program needs. For example, wetland restoration projects initiated by parks such as **Cape Cod National Seashore** and **Gateway National Recreation Area** also trigger the need to monitor

improvements, a condition of the permits that were secured to initiate the projects. These restorations follow NPS policy and are ecologically critical but parks have not been successful in securing base increases for increased monitoring costs.

The Northeast Region has science base funds that have been used, since the early 1990s, for small resource management and science projects. Smaller parks that were not able to compete successfully for Servicewide NPS natural resource funding tended to be the primary recipients. Regional science funds were also used to provide immediate assistance for critical natural resource planning and research. Over the past several years, the total Regional science base funds have declined from \$500,000 in the late 1990s to less than \$50,000 in FY 2007, due to growing personnel costs, inflation and a Regional funding base that has not grown to meet these needs. Regional science funds no longer are allocated through a fixed base, but through a park assessment process. This has resulted in an unpredictable fund source and fewer small-scale critical resource management and research projects being carried out in the Northeast Region parks than in previous years.

Shenandoah National Park. *Preparing for Chronic Wasting Disease:* Park staff, with assistance from Northeast Regional Office and

A Parula Warbler (*Parula americana*) at the Great Falls area of the George Washington Memorial Parkway.
NPS Photo: Gerhard Hofman



WASO staff, have engaged in the planning process for developing a Chronic Wasting Disease (CWD) Response Plan. The park held internal and public scoping meetings this year. Park staff also participate in an inter-regional science team that is addressing the CWD issue. Shenandoah National Park staff have conducted field surveillance of deer killed on roads in the park. The deer heads are collected, sampled and sent to a lab for testing. So far, 15 to 20 deer have been sampled. All of those samples have tested negative for CWD.

Ocean Park Strategic Plan: Responding to the U.S. Ocean Action Plan and the NPS Ocean Park Stewardship Action Plan announced in December 2006, the Northeast Region formed an Ocean Stewardship Task Force consisting of 12 ocean park superintendents from the Region and Regional Office natural resource staff. In June 2007, the Task Force completed the *Northeast Region Ocean Park Strategic Plan*. The Plan identifies specific goals and action items associated with four major topics. Those are 1) Establish a seamless network of ocean parks, sanctuaries, refuges, and reserves; 2) Discover, map, and protect ocean parks; 3) Engage visitors and the public in ocean park stewardship; and 4) Increase technical capacity for ocean exploration and stewardship. Some of these actions will be completed within months, while others are more complex and will involve longer time frames to fully implement. It is intended that the Strategic Plan will be periodically revised as action items are completed and as additional tasks are identified.

Pacific West

The Natural Resource Challenge has greatly benefited parks in the Pacific West Region. The Pacific West Region also allocated \$686,760 in Regional base funds toward natural resource projects.

The Cooperative Ecosystem Study Units (CESUs) continued to assist the Park Service in building partnerships with academia and other agencies and in leveraging outside funding.

This year parks received funding to cover the full amount of the cost-of-living increases approved by Congress. This was extremely important in reducing the erosion of parkbase budgets. As a result, a few of the Region's

natural resource parkbase programs were better off in FY 2007 than they were in the previous fiscal year, and more of them held steady. However, due to other inflationary pressures on their fixed costs and the demands of other park programs, more than half of the Region's natural resource parkbase programs still lost ground again this year.

Pinnacles National Monument. *Investigating Euproserpinus Sphinx Moth:* In 2007, funding was obtained from NPS-PWR Rotating Resource Base to study a newly discovered primrose sphinx moth at Pinnacles National Monument in the Central Coast Range of California. This moth is in the same genus (*Euproserpinus*) as the only moth in the continental United States protected under the Endangered Species Act. Its short, unpredictable, and in some years nonexistent flight season makes it especially difficult to study. The goal of the project was to collect specimens of the moth for DNA analysis to determine its identity and to gather information on its distribution, abundance, and life history within the Monument.

Although 2007 was generally a poor flight year for this group of moths in California, the Pinnacles population had a strong flight at one site and limited numbers were recorded at several other sites. Time-lapse video was used to document behavior of resting moths and for the first time at Pinnacles female moths were observed laying eggs. A small mark-recapture study was conducted which indicated that simple visual surveys are likely to underestimate population size and that male moths do not have a strong fidelity to particular overnight resting areas.

Because moths were not observed in abundance at multiple sites, impacts on the population were minimized by collecting only three specimens for DNA analysis. Preliminary results from our partner at the University of Hawaii indicate that the Pinnacles population and another one located 80 miles to the southwest are distinct from all other populations and represent a new species to science. However, additional specimens will need to be collected and analyzed in order to further substantiate this conclusion.

Yosemite National Park. Velvet Grass Removal: Velvet grass is a perennial bunchgrass native to Europe that has been quietly invading mid-elevation meadows in Yosemite. The grass can be a highly invasive species because it produces a large amount of seed and is a rapid colonizer of disturbed ground. Velvet grass has the potential to completely overtake the areas it invades. The park conducted an initial survey of velvet grass infestation in fall 2006. More than 2,500 acres were surveyed and 285 acres of velvet grass mapped. Ten high-priority populations were treated using hand-pulling and mowing methods.

Since little information exists about the success of velvet grass treatment in the western United States, the park initiated a study to gauge the success of various treatment methods. Two types of monitoring plots were installed at selected treatment sites. "Transect monitoring" measured velvet grass abundance as well as the presence of associated non-native species. This type of monitoring will show both the response of velvet grass to treatment and whether additional invasive species are colonizing the treated areas. The second type of monitoring compared hand-pulling to mowing in order to show the effect of treatment on velvet grass as well as the effects on other plants in the areas.

Southeast

In 2007, the Southeast Region (SER) continued to engage in initiatives that were outcomes from the Gulf of Mexico hurricanes of 2005. The U.S. Army Corps of Engineers (USACE) continued with their mandate to develop the Mississippi Coastal Improvement Program (MsCIP). The MsCIP is a Congressionally-mandated program led by the USACE to identify actions to protect the Mississippi mainland from future hurricane damage. Part of the program addresses restoring the Mississippi barrier islands in **Gulf Islands National Seashore** via several alternatives involving various sand placement, dune reconstruction, and vegetation restoration options. In cooperation with the USACE and other agencies, the National Park Service has led a multi-agency effort to develop a barrier island restoration alternative for Gulf Islands National Seashore based on science and compliance with NPS Management Policies. This alternative includes restoring East and West Ship Islands

by directly placing compatible sand in the breach between the islands ("Camille Cut"), directly placing sand near cultural resource sites on East and West Ship Islands threatened by erosion, and adding compatible sand to the near-shore area of the islands to recreate the natural sand supply and island-to-island sand transport system that existed prior to navigation channel dredging activities conducted near the islands.

NPS staff have been extensively involved in the MsCIP planning process, and have closely coordinated with the USACE, U.S. Geological Survey, National Marine Fisheries Service, Environmental Protection Agency, National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service, and the MS Department of Marine Resources in the development of a barrier island restoration alternative based upon scientific understanding of regional coastal geomorphic processes. While restoration of Ship Island and protection of significant cultural resources is the most pressing park management issue, the over arching recommendation is to restore the crucial barrier island sand supply and island-to-island sand transport system in the park to a natural state as much as possible given the realities of climate change (sea level rise, increased frequency of storms, etc.) and navigation channel dredging activities.

Park Service review of available scientific information indicates that the multi-agency barrier island restoration alternative is consistent with NPS mandates and Management Policies and represents a viable alternative for the USACE's Draft MsCIP Plan/PEIS. Prior to implementation, any barrier island restoration action will be subject to additional research, monitoring protocols, adaptive management principles, and supplemental NEPA analysis.

A similar effort in Louisiana was of interest to **Jean Lafitte National Historical Park and Preserve**. Congress directed the Army Corps of Engineers, New Orleans District, in partnership with the State of Louisiana, to prepare a report on coastal restoration and Category 5 hurricane protection after hurricanes Katrina and Rita struck coastal Louisiana in 2005. The USACE has completed a preliminary report which identifies and describes a range of possible flood control, coastal restoration, and

hurricane protection measures for coastal Louisiana, which will be submitted to Congress in December 2008. The final alignment and design of a hurricane protection system, and measures taken to restore hydrological and ecosystem function in the Barataria Basin, could have a significant impact on the Barataria Preserve. The modeling demonstrated in the report looks at an array of alignments for a structural hurricane protection system. Some would be built on the inside boundary of the Preserve possibly requiring NPS property for expansion of the levee footprint, along the alignment of the current hurricane levee system. Others would be built gulf-ward of the Preserve, and could profoundly affect Preserve hydrology and ecosystem function, depending upon design and location.

The National Park Service submitted to the USACE in November 2007 a *NPS Vision Statement for the LACPR* (Louisiana Coastal Protection & Restoration) which outlines NPS concerns and proposals. The Park Service is participating in ongoing review of the LACPR as a member of the Habitat Evaluation Team and interagency group providing technical assistance to the Army Corps of Engineers.

In April, 2007, the Region released the *Southeast Region Coastal & Ocean Park Strategy* for the 24 units of the Southeast Region that border ocean/estuarine coasts or encompass marine environments. This document provided a framework for emphasizing critical areas to support the larger goals of the U.S. Ocean Action Plan and the NPS Ocean Stewardship Strategy. A steering committee comprised of senior leadership from the regional office and representative coastal and ocean parks was formed to provide guidance for the overall effort.

A significant regional initiative, the **Gulf of Mexico Alliance**, also began moving to the forefront as the Alliance and the Department of the Interior began to increase dialogue regarding the opportunities for additional collaboration. The Alliance, comprised of the Governors of the five states that border the Gulf of Mexico, has the objective of collaborating across the states to improve the overall health of the Gulf of Mexico. In November, 2007, the Department of the Interior (DOI) and Regional Bureau leadership met with Al-

liance representatives in Tampa, Florida. The purpose of the meeting was to bring together representatives from the Gulf of Mexico States and DOI bureaus in order to develop a deeper understanding of each others' missions, priorities, and resources in order to collaboratively address high priority areas.



GAP
SOUTHWEST
CHOICE



SER I & M

EVERETT

Chapter III: Network Programs

Key to the Natural Resource Challenge are programs intended to serve the needs of biogeographically linked networks of parks. These network programs efficiently and effectively provide service to groups of parks that share common ecosystem characteristics. Thirty-two groups of parks are linked into networks including the Great Plains, Great Lakes, Pacific Islands, Sonoran Desert, Southwest Alaska, Gulf Coast, and Rocky Mountains. Through the network programs, these parks cooperatively accomplish far more than they possibly could individually without huge amounts of additional funding to park bases. Rather than stand-alone, these networks are integrated with park resource programs, the Natural Resource Program Center, state natural resource and wildlife programs, federal agencies, universities, non-profits, and other partners to accomplish shared goals. Yet they were established as separate entities so they remain accountable for fulfilling their purposes and accomplishing their goals. This chapter describes some of the accomplishments of the following network programs within the context of the process of *discovery, learning, understanding, sharing, resource protection and restoration, and evaluation*:

- **Inventory and Monitoring Networks (I&M)** provide parks with *discovery* through baseline inventories of key ecosystem indicators; *learning* through long term monitoring of trends of the indicators; and *understanding* through collaboration with scientists at universities and other agencies. By *sharing* information with park managers, other land managers, and the public, the information can, in time, be used to make science-based *management decisions* to protect the parks. Continued monitoring will provide for *evaluation* of the effectiveness of the actions.
- **Exotic Plant Management Teams (EPMT)** survey to *discover* invasive plant species in the parks, use the latest information to *understand* how to control them using principles of Integrated Pest Management, then *take action* to control problem species to minimize impacts on park's native species.
- **Cooperative Ecosystem Studies Units (CESU)** link parks in with appropriate

subject-matter experts at universities to aid in *discovery, learning, understanding, sharing, and evaluation* about park resources and processes through tactical research and technical assistance that will lead to scientifically sound *resource protection and restoration*.

- **Research Learning Centers (RLC)** provide support and assistance for scientists working through park programs, I&M, CESUs or the Natural Resource Program Center to *discover, learn, understand, share and evaluate*. The emphasis for RLCs is to aid in *sharing* knowledge gained with peers, partners, and the public.

INVENTORY AND MONITORING NETWORKS

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 park natural resources as a basis for making decisions, working with other agencies, and communicating with the public to protect park natural systems and native species. To provide park managers with the information they need, the National Park Service has embarked on a new era of science-based management. The flagship of the Service's efforts to revitalize the natural resource program and to improve park management through greater reliance on scientific information is the Inventory and Monitoring Program (I&M), which provides funding, technical assistance, and coordination for parks to complete 12 baseline natural resource inventories and to monitor the condition or "health" of key vital sign parameters.

The scientifically sound information obtained through natural resource inventories and long-term ecological monitoring will have multiple applications for discovering, learning, and understanding park natural resources; sharing information with the American people; resource protection and restoration; and evaluation. When 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 fund-

Gulf Coast Network GIS Specialist Jeff Bracewell holds a large male Texas Tortoise (*Gopherus berlandieri*) discovered during the initial field survey for development of the network's amphibian and reptile monitoring protocol. The Texas Tortoise, a Texas state species-of-concern, is a key faunal resource at Palo Alto Battlefield National Historic Site and will be monitored by the network at both Palo Alto Battlefield and San Antonio Missions National Historical Park.

ing 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 and has already resulted in numerous examples of improved management and greater efficiencies in natural resource stewardship.

For most parks, funding and staffing support 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 component of an effective natural resource management program. Network staff are involved in numerous activities such as organizing and cataloging data collected by network staff and others, data analysis and synthesis, modeling, providing data and expertise to park planners, providing data and expertise 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.

The primary responsibilities of the small staff of the 32 I&M networks are to (1) facilitate baseline inventories; (2) to collect, manage, analyze and report long-term data for identified vital signs (measurements of resource condition); and (3) to effectively deliver data and information on resource condition to park managers, planners, interpreters, and other key audiences. Parks in each I&M network share core funding and a professional staff that is augmented by funding and staffing from park base accounts and other sources to plan, design, and implement an integrated long-term monitoring program.

Two factors have been key to the success of the 32 I&M networks: (1) the strategy to leverage the limited funding and staffing through partnerships with other programs and agencies, and (2) the explicit link to park management and planning.

1. *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.
- Funding and staffing are closely intertwined between parks and networks for most 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 U.S. Geological Survey (USGS) and other agencies to design a scientifically credible monitoring program based on the best available information.

2. *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 to the success of the I&M program.
- I&M network data and expertise are a catalyst and a key data source for Natural Resource Condition Assessments, Resource Stewardship Strategies, and reporting to Land Health Goals and other GPRA goals.

Natural Resource Inventories

The Inventory component of the National Park Service Inventory and Monitoring Program reports to the strategic planning goal on Natural Resource Inventories that states that by September 30, 2007, acquisition or development of 77.5 percent (2,145) of the 2,767 outstanding data sets identified in 2002 of basic natural resource inventories for all parks will be complete. The I&M Program exceeded its performance goal for developing natural resource inventories in FY 2007 by completing an additional 238 datasets, bringing the total to 2,177 (79 percent) of the outstanding

datasets. The I&M Program has now essentially completed seven inventory data sets for all natural resource parks (natural resource bibliographies, vertebrate and vascular plant species lists, base cartography data, baseline water quality data, water body location and classification, air quality data, and meteorological data) in addition to making progress on the remaining five inventories.

The table below illustrates the number of baseline natural resource inventories completed or projected to be completed by the end of each fiscal year for 270 parks with significant natural resources. The number of inventory data sets that remain to be completed after FY 2008 reflects the number of parks Service-wide with outstanding needs (some parks have acquired some of these data sets and a few parks may not need all 12 sets).

The increased funding for natural resource inventories received through the Natural Resource Challenge since FY 2000 is allowing the National Park Service to significantly increase the rate at which the basic natural resource inventories are completed. By combining Natural Resource Challenge funding with funds previously available for inventories, the Service now estimates that it will complete the basic resource inventories for all 270 natural resource parks over a period of approximately 10–12 years, rather than the 20–25 years projected to complete the inventories prior to receiving the additional Natural Resource Challenge funding.

The natural resource inventories being conducted as part of the Natural Resource Challenge are revealing many new and exciting in-

sights into the natural resources contained in parks. Not only are the investigations increasing our knowledge and understanding about park resources, but the information being provided is also being used to address a wide variety of resource management issues and activities. Profiled below are examples of how inventory results during FY 2007 were used to better understand, manage, and protect park resources.

Chickamauga and Chattanooga National Military Park. *Bewick’s Wren Added to Species List:* As part of its inventory and certification process, Cumberland Piedmont Network staff was able to add the Bewick’s wren (*Thryomanes bewickii*) to the park species list. This species, which was thought to be extirpated from the Appalachian region, has experienced precipitous declines throughout the eastern United States to the point where most states east of the Mississippi list it as “critically imperiled” or “possibly extirpated.” Reports of two adults feeding juveniles at the park represent the first breeding evidence in the region since the early 1980s.

Denali National Park and Preserve. *One Hundred New Lichen Species Documented:* The Central Alaska Network initiated a lichen survey in FY 2007 that resulted in as many as 100 new species to the park and will likely result in at least 1 new species for the state of Alaska. This survey will continue in 2008–09 with Regional Block Grant funds.

Blue Ridge Parkway. *Ecological Diversity:* The Blue Ridge Parkway possesses one of the most diverse assemblages of ecologically significant communities in the eastern United States.

Basic Data Sets	FY 2007 Completed	FY 2008 Projected	Remaining After 2008
Natural Resource Bibliographies	270	270	Completed
Base Cartographic Data	270	270	Completed
Species Lists	270	270	Completed
Species Surveys	200	270	Completed
Vegetation Maps	116	146	124
Soils Maps	140	160	110
Geology Maps	146	204	66
Water Body Locations	270	270	Completed
Baseline Water Quality Data	270	270	Completed
Air Quality Data	270	270	Completed
Air Quality-Related Values	175	200	70
Meteorological Data	270	270	Completed

During vegetation mapping and plant inventories conducted by the Appalachian Highlands Network, 75 distinct plant communities (associations) were documented within the park; 24 of these are considered globally rare and seven are considered globally imperiled. The variety of these communities ranges from very dry/xeric woodland slopes to cloud forests dominated by spruce and fir, to high-elevation wetlands that support boreal relict species as well as extremely rare southern Appalachian endemic species that occur nowhere else.

Sleeping Bear Dunes National Lakeshore.

New Species of Amphibians Discovered: Amphibian surveys revealed four species of reptiles and amphibians new to the park. This work was part of the design phase for long-term monitoring of amphibians at the park and was performed by herpetologists from the Chicago Field Museum.

Delaware Water Gap National Recreation Area and Upper Delaware Scenic and Recreational River. *Fish Inventories Document Rare Species:* The Academy of Natural Sciences of Philadelphia conducted a fish inventory at Delaware Water Gap National Recreation Area and Upper Delaware Scenic and Recreational River. Several species that were previously considered to be rare or of uncertain status appear to be relatively widespread in the two parks (e.g., eastern mudminnow, gizzard shad, northern hog sucker, bluespotted sunfish, bluntnose minnow, comely shiner, swallowtail shiner, and satinfin shiner). Combining 2005 and 2006 observations, bridle shiners, a very rare species, have been found at sites within Delaware Water Gap National Recreation Area and in NJ wildlife management areas.

Craters of the Moon National Monument and Preserve. *Pika Found to Be Using Historic Locations:* In FY 2007, a pika inventory and occupancy modeling study was conducted in the park. Evidence of pika presence was detected at several historic locations and many new locations were recorded. This is significant given the growing evidence that pika may be vulnerable to climate change. Craters of the Moon may support a regionally significant pika population.

Sand Creek National Historic Site. *A New Park adds Natural Treasures to the NPS Chest:* One of the newest additions to the National Park System is Sand Creek National Historic Site, dedicated on April 28, 2007. Various inventories are being completed in this area for the first time with some exciting results. Two prairie dog colonies, with 82 hectares under park protection, are also home to burrowing owls and mountain plover. Other species of concern found within park boundaries include the northern leopard frog, loggerhead shrike, and northern harrier hawk. Suitable habitat exists for swift fox and lesser prairie chickens, raising hope that an intact ecosystem may yet develop.

Fredericksburg and Spotsylvania National Military Park. *Rare plants found:* During vegetation mapping accuracy assessment, botanists from the Virginia Department of Conservation and Recreation found a new occurrence of the federally threatened vascular plant, small whorled pogonia (*Isotria medeoloides*), in Spotsylvania Courthouse Battlefield. This perennial member of the orchid family is among the rarest members of its family due to habitat alteration, collecting, and browsing from herbivores such as deer. This plant may remain dormant underground for as many as 10 to 20 years.

Assateague Island National Seashore. *Bathymetry Inventories Conducted in Northeastern Parks:* Assateague and the Northeast Coastal and Barrier Network partnered with the Maryland Geological Survey to collect bathymetry (underwater depth) and sediment data for the Virginia Coastal Bays. The state of Maryland collected these data on the Maryland side of the park in 2005. The project will enable Assateague Island National Seashore to manage and protect all of its estuarine waters holistically, across state lines, by providing the missing information on the National Seashore's estuarine resources in Virginia. The information will be integrated into ongoing research efforts to address several specific management concerns. Already, the park is receiving a steady stream of requests for these data from various government agencies and academic institutions who want to incorporate the data into research on aquatic habitats, hydrodynamic circulation models, and water quality trends.



Various inventories are revealing important information at Sand Creek National Historic Site.

Alibates Flint Quarries National Monument, Bent's Old Fort National Historic Site, Capulin Volcano National Monument, Chickasaw National Recreation Area, Fort Larned National Historic Site, Fort Union National Monument, Lake Meredith National Recreation Area, Lyndon B. Johnson National Historical Park, Pecos National Historical Park, and Washita Battlefield National Historic Site.

Documenting Vegetation Communities across the Southern Great Plains: The Southern Plains Network has partnered with the U.S. Bureau of Reclamation, Colorado Natural Heritage Program, Natural Heritage New Mexico, Kansas Biological Survey, the Botanical Research Institute of Texas, and the Lady Bird Johnson Wildflower Center to create the first maps of the vegetation communities within network park boundaries. These "snapshots in time" provide a base-line inventory of the types and distribution of plant communities. This will enable scientists to determine how these areas change in future decades in response to climate change and management practices.

Hawaii Volcanoes National Park. *Kuhuku Plant Inventory:* This inventory identified vegetation communities and located rare, threatened and endangered plants, as well as disruptive alien weeds. Forty-one kilometers of transects and 177 vegetation plots were ground-surveyed; 6.5 hours of helicopter surveys were conducted. A total of 455 vascular plant species were encountered, of which 40 percent were native. Five endangered, 1 threatened, 1 candidate endangered, 7 species of concern, and 26 locally rare native species were found. Results from this study will enable managers to develop a framework for long-term management priorities and strategies in Kahuku which was added to Hawaii Volcanoes National Park in 2003.

Vital Signs Monitoring

Fiscal Year 2007 marks a significant milestone in that for the first time in the history of the National Park Service, all parks with significant natural resources now have in place the minimum staffing, funding, and data systems to routinely collect, manage, analyze and report long-term data for a modest set of

vital signs and to effectively deliver data and information on resource condition to park managers, planners, and other key audiences. The National Park Service received the final Natural Resource Challenge funding increase in FY 2007 to support the final two networks for vital signs monitoring. As of September 30, 2007, all 270 (100 percent) of natural resource parks have identified their vital signs, 197 (73 percent) have completed the design of their state-of-the-art monitoring plans and have implemented vital signs monitoring, and 157 (58 percent) have completed at least one year of field data collection and are able to estimate current condition for specific vital signs (see table below). Four networks are at least one year ahead of schedule in designing and implementing their long-term monitoring program. The Service's performance goals for vital signs monitoring have been met or exceeded every year.

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 elements and processes that are monitored 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 various ecological, biological, and physical processes that act on those resources. The broad-based, scientifically sound information obtained through natural resource monitoring will have multiple applications for management decision-making, research, education, and promoting public understanding of park resources.

The table below illustrates the annual accomplishments of the 32 I&M networks in completing the planning and design of their long-term monitoring programs and implementing operational monitoring of vital signs. Data and expertise provided by the I&M networks are a key source of data for park Natural Resource Condition Assessments, Resource Stewardship Strategies, and other park planning and management efforts.

Because of funding restrictions, only the highest priority vital signs, or those that are already funded by some other source, can be monitored initially. However, many parks have augmented Natural Resource Challenge funds with personnel and funding from other sources and have established partnerships with numerous agencies and universities to leverage funds, and 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, dis-

Annual Accomplishments of the 32 I&M Networks

Actual and Projected Accomplishments Vital Signs Monitoring and Resource Assessments		# Parks Completed by end of FY			# Parks Projected	
		2005	2006	2007	2008	2009
Planning and Design Phase	Identify and Synthesize Existing Information	251	270	270	270	270
	Prioritize and Select Vital Signs (Vital Signs identified)	222	250	270	270	270
	Monitoring Plan Completed, Peer-Reviewed, and Approved—Operational Monitoring Begins (Monitoring Implemented)	104	157	197	253	270
Monitoring & Assessments Implemented	"Current Condition" Values Available for Specific Vital Signs—Operational Monitoring Ongoing	10	104	157	197	253
	Park Natural Resource Condition Assessments Completed	0	0	0	16	22
	"Target Values" Identified and Compared to "Current Condition" for Specific Vital Signs as part of Resource Stewardship Strategy (RSS) Development	0	1 RSS	6 RSS	# RSS	# RSS

solved 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 in various categories with currently-available funding is

summarized below (this includes leveraging funding and staffing through partnerships in situations where the networks will routinely deliver data summaries for a particular vital sign to park managers and planners). The number of networks and parks for each vital sign category will change as each network completes the final design and testing of their sampling protocols and negotiate with partners on options for implementing the moni-

Vital Sign Category	Example Measures (varies by network)	# Networks (Parks)
Weather and Climate	Temperature, precipitation, wind speed, ice on/off	31 (258)
Water Chemistry	pH, temperature, dissolved oxygen, conductivity	32 (237)
Invasive/Exotic plants	Early detection, presence/absence, area	28 (226)
Land Cover and Use	Area in each land cover and use type; patch size & pattern	28 (226)
Surface Water Dynamics	Discharge/flow rates (cfs), gauge/stage height, lake elevation, spring/seep volume, sea level rise	28 (183)
Birds	Species composition, distribution, abundance	30 (182)
Ozone	Ozone concentration, damage to sensitive vegetation	20 (147)
Fire and Fuel Dynamics	Long-term trend of fire frequency, average fire size, average burn severity, total area affected by fire	19 (121)
Forest/Woodland Communities	Community diversity, coverage and abundance, condition & vigor classes, regeneration	18 (111)
Wet and Dry Deposition	Wet deposition chemistry, sulfur dioxide concentrations	19 (110)
Aquatic Macroinvertebrates	Species composition and abundance	17 (106)
Mammals	Species composition, distribution, abundance	22 (105)
Visibility & Particulate Matter	IMPROVE network; visibility and fine particles	20 (98)
T&E Species and Communities	Population estimates, distribution, sex & age ratios	18 (90)
Soil Function and Dynamics	Soil nutrients, cover and composition of biological soil crust communities, soil aggregate stability	14 (90)
Stream/River Channel Characteristics	Channel width, depth, and gradient, sinuosity, channel cross-section, pool frequency and depth, particle size	14 (90)
Vegetation Complexes	Plant community diversity, relative species / guild abundance, structure / age class, incidence of disease	13 (90)
Air Contaminants	Concentrations of SOCs, PCBs, DDT, Hg	15 (86)
Amphibians and Reptiles	Species distribution & abundance, population age/size structure, species diversity, percent area occupied	17 (76)
Groundwater Dynamics	Flow rate, depth to ground water, withdrawal rates, recharge rates, volume in aquifer	12 (76)
Nutrient Dynamics	Nitrate, ammonia, DON, nitrite, orthophosphate, total K	11 (72)
Fishes	Community composition, abundance, distribution, age classes, occupancy, invasive species	13 (63)
Insect Pests	Extent of insect related mortality, distribution and extent of standing dead/stressed/diseased trees, early detection	8 (53)
Riparian Communities	Species composition and percent cover, distribution and density of selected plants, canopy height,	9 (50)
Invasive/Exotic animals	Invasive species present, distribution, vegetation types invaded, early detection at invasion points	11 (49)
Wetland Communities	Species composition and percent cover, distribution and density of selected plants, canopy height, aerial extent	9 (41)
Microorganisms	Fecal coliform, E. coli, cyanobacteria	6 (31)
Grassland/Herb Communities	Composition, structure, abundance, changes in treeline	8 (33)
Soundscape	Types and time periods of natural and anthropogenic sound; percent-time-audible	6 (31)
Coastal/Oceanographic Features & Processes	Rate of shoreline change, sea surface elevations, area and degree of subsidence through relative elevation data	7 (30)

toring in as many sites as possible with the limited resources available.

The table below shows the number of I&M networks and parks that will monitor each vital sign category using existing funding (including partnerships with others where the networks will deliver data summaries to park managers and planners). Vital signs that will be monitored in fewer than 30 parks are not listed.

Profiled below are a few examples of highlights from park monitoring accomplishments during FY 2007 that show successes in better resource understanding, better resource management, or better protection of park resources. These examples provide a sample of some of the exciting successes that can be achieved through a program of consistent, continuous long term monitoring of the natural resources the National Park Service is entrusted to protect.

Integration of Science and Management

Integration of Science and Management Workshops and Publications: I&M Staff from the Intermountain Region sponsored two workshops focusing on the topic of “Integration of Science and Management” and the effective delivery of inventory and monitoring results to park managers, planners, interpreters, and the general public. Workshop results were summarized in a special issue of the publication series, the *George Wright Forum* (Volume 24, number 2) and are contributing to better resource communication tools and products throughout the National Park Service.

Integration of Natural Resource Data Systems: I&M staff at the Washington Office are designing and implementing an internet-based data portal to deliver inventory and monitoring information directly to park managers, planners, researchers, interpreters, and the general public. This portal will provide one-stop shopping for finding and downloading information needed to make sound decisions about park natural resources, and establishes an essential bridge between science and park management.

Blue Ridge Parkway. *Monitoring and Modeling Protect Exploited Species:* Poachers annually remove thousands of plants of multiple spe-

cies from Appalachian Highlands Network parks for domestic and Asian/European markets, both for medicinal and horticultural uses. Rangers for the Blue Ridge Parkway are using the evidence and coordinates provided from I&M Network monitoring plots to target areas for surveillance. As part of efforts to monitor population dynamics and poaching of exploited plants along the Blue Ridge Parkway, the I&M network has partnered with the USDA Forest Service and NatureServe to develop models for predicting locations where exploited plant species occur in relatively high abundance. The Rich Hardwood Coves ecological community type is associated with particular geologic strata and soil mineral content, as well as topographic position and landform.

Capitol Reef National Park. *Modeling and Adaptive Management of Endangered Cactus on the Colorado Plateau:* The Northern Colorado Plateau Network and resource staff from Capitol Reef developed a simulation model of the population dynamics of the endangered Wright’s fishhook cactus (*Sclerocactus wrightiae*). Results of this simulation can be used by park management to test or modify management practices of grazing allotments in the park. The potential for the demise of these endangered populations due to trampling and other factors led the park to explore the conditions under which populations survive and go extinct to aid in determining the potential fate of existing populations. The model can simulate the birth, death, and growth of individual plants using precipitation obtained from weather station records.

Cape Cod National Seashore. *Monitoring the Effectiveness of Salt Marsh Restoration:* Monitoring has documented that vegetation changes resulting from the reintroduction of seawater to a restored salt marsh over seven years have strong spatial gradients and are correlated with marsh surface elevation, distance from the point of seawater entry, and porewater salinity. Common reed (*Phragmites australis*) has substantially declined within the floodplain, allowing native salt marsh grasses to proliferate. Since 1999, incremental increases in flow through a tide-restricting dike have facilitated the rapid decline of salt-intolerant vegetation while encouraging the expansion of native salt marsh species.

Great Smoky Mountains National Park. *Effectiveness of Management Actions to Control Invasive Forest Pests:* The park is monitoring the forest health of eastern hemlocks and comparing the effectiveness of three management treatments using an adaptive management approach. Ninety-three monitoring plots were established in treated (three treatment methods: biological control, systemic insecticide [imidacloprid] and foliar insecticidal soap) and untreated areas. Monitoring results showed that hemlock woolly adelgid (HWA) numbers were significantly reduced in chemically-treated stands. Data from 2006 and 2007 are being analyzed but field observations of several year old imidacloprid treatments show excellent HWA control and re-growth of infested trees.

Monitoring of Raptor Productivity—Raptor monitoring in the San Francisco Bay Area Network showed declines in the number of nests found and in productivity. In this 21st year of monitoring, 9 prairie falcon nests were active this year, with 34 nestlings fledged. For the third year in a row, a peregrine falcon successfully nested produced fledglings within **Pinnacles National Monument**. Other nesting raptors observed this year included golden eagles, red-tailed and red-shouldered hawks, cooper's hawks, sharp-shinned hawks, great-horned owls, a long-eared owl, a white-tailed kite, and a turkey vulture.

Point Reyes National Seashore. *Elephant Seals at a Record High:* The population estimate of 2,285 elephant seals in 2007 marks an all-time high since their near extinction along the central coast during the mid 1970s.

Shenandoah National Park. *Gypsy Moth Defoliation:* Forest Monitoring revealed unusually high levels of defoliation in the spring of 2007 that triggered an assessment of the area along Skyline Drive. Aerial reconnaissance and mapping conducted by the Virginia Department of Forestry staff in July verified the ground survey results. In September, USDA Forest Service staff gathered Gypsy Moth egg mass count data in the area of highest defoliation along Skyline Drive and found gypsy moth egg mass densities around 2800 egg masses per acre. This high density of egg masses suggests that control measures be pursued to reduce gypsy moth numbers next year. Park staff are using monitoring results as a basis for submitting a USDA-FS/FPM funding proposal for gypsy moth treatments in 2008.

Great Smoky Mountains. *Effects of Deer Overbrowsing and Stilt Grass Invasion Documented by Monitoring:* An analysis was completed of vascular plant cover in long-term vegetation plots installed in the late 1970s in the Cades Cove area. Cades Cove represents an area with a concentrated white-tailed deer population, which was compared with similar plots from

Ranger Tim Francis and Appalachian Highlands Network Coordinator Robert Emmott examine sacks of Galax confiscated from poachers. Law Enforcement Rangers are using evidence and coordinates provided by the I&M monitoring plots to target areas for surveillance.



the same era located outside of the Cove in areas with fewer deer. The results indicate a significantly reduced number and diversity of herbaceous plant species over a 26 year period. Also in a portion of the Cades Cove vegetation study are deer exclusion plots. Reproduction of trees and success of seedlings were reduced compared to the exclusion areas. Another factor was the dominance of the aggressive Japanese stilt grass (*Microstegium vimineum*). This exclusion of tree seedlings occurred anywhere stilt grass dominated—whether deer were excluded or not. However, during drought years tree seedlings successfully competed with the grass inside the exclosures, but seedlings outside the exclosures were unable to take advantage of the reduced cover of stilt grass. After 10 years, no tree seedling had been able to attain and maintain a height of 20 cm in unfenced plots; whereas, tree seedlings within exclosures made dramatic increases following drought years.

Partnerships / Leveraging

Grand Teton and Yellowstone National Parks. *Interagency Whitebark Pine Monitoring:* After 4 years and more than 3,000 miles hiked in the mountainous regions of the Greater Yellowstone Area (GYA), field crews completed establishment of 177 transects for the Interagency Whitebark Pine Monitoring. The whitebark pine is a key indicator species in the Greater Yellowstone Area and monitoring has begun on blister rust infection and severity in 4,731 tagged whitebark pine. The sample represents a statistical distribution for the entire GYA, encompassing 14 million acres. This area includes six National Forests and Grand Teton and Yellowstone National Parks. This major accomplishment is made possible through a collaborative effort with partners from the USGS Interagency Grizzly Bear Study Team, Yellowstone and Grand Teton National Parks, the Greater Yellowstone Coordinators Committee (six Forests in three USDA Forest Service regions), the USDA FS Forest Health Protection and the Department of Mathematical Sciences at Montana State University. Staff with the Greater Yellowstone I&M Network completed the design of the interagency sampling protocol, which has now been peer reviewed and approved.

Appalachian National Scenic Trail. *Launch of the MEGA-Transect:* During November 2006,

the Northeast Temperate network funded and helped organize a workshop to explore the potential for using the Appalachian National Scenic Trail as an environmental monitoring mega-transect (the mega-transect idea has been popularized by National Geographic Explorer-in-Residence Michael Fay, who spoke at the workshop). The conference attracted more than 60 scientists, and resulted in the establishment of a new monitoring initiative, the A.T. MEGA-Transect. The A.T. MEGA-Transect seeks to attract a wide range of participants, including citizen scientists, students, academic researchers, and others who are interested in using the trail as a large scale environmental laboratory. Early examples of the kind of cooperation that will be possible include a water sampling initiative that relies on a program administered by the Water Environment Federation, and a mammal monitoring program developed by the Smithsonian Institution (<http://www.appalachiantrail.org/megatransect>).

Learning Center of the American Southwest Established: Four I&M networks in the southwest (Sonoran Desert, Southern Plains, Southern Colorado Plateau, and Chihuahuan Desert) representing 48 NPS park units joined together to establish the Learning Center of the American Southwest in an effort to improve the communication of important park resource and monitoring information to decision-makers, staff, and the public. The partnership among the four networks and with other NPS programs will enable managers and the public to get a more comprehensive assessment of resources and to enable a more efficient effort that will minimize duplication and take advantage of shared resources. A draft web site can be viewed at <http://www.desertplainslearning.org/>.

Olympic and Mount Rainier National Parks. *Collaborative Monitoring and Management of Fisheries Resources:* Staff with the North Coast and Cascades Network conducted snorkel surveys of ten rivers in Olympic and one in Mount Rainier during 2005 to 2007 to monitor populations of salmon and other fish species of high ecological importance. Preliminary results indicate: 1) mountain whitefish is the most abundant fish species; 2) adult summer steelhead were scarce in all the coastal rivers; 3) hatchery steelhead were more abun-



Snorkelers identify and count fish species in the Sol Duc River, Olympic National Park, as part of the North Coast and Cascades Network River Monitoring Program.

dant than wild steelhead in certain rivers; 4) and non-native fish species were observed in only one of the ten rivers. Results of the river monitoring are used by park managers to collaboratively manage fisheries resources with the State of Washington, local native tribes, and other stakeholders.

Early Detection of Invasive Plants Handbook Developed: The Klamath Network worked with many partners to cooperatively produce an *Early Detection of Invasive Plant Species Handbook*. The lead on the project was the USGS, with significant contributions by the Klamath Network staff, Pacific West Region I&M Coordinator, and university researchers. This valuable tool will present natural resource managers with a comprehensive, practical approach for detecting, prioritizing, and monitoring non-native plant species.

Credible Science

Cape Cod National Seashore. Wood Frog Population Expansion: Amphibian monitoring in 2007 found that the population of wood frogs

(*Rana sylvatica*) continues to increase and that the distribution of the species is expanding northward towards Wellfleet. The total number of egg masses found (260) far exceeds the previous maximum of 160 recorded in 2005 and trend analysis of data from 2002 through 2007 show a nearly significant, positive trend (slope=0.79, p=0.06).

Acadia National Park. Ecological Integrity of Northeastern Forests: The Northeast Temperate Network completed the first year of a four-year rotational monitoring design to report on the ecological integrity of forests at Acadia National Park. The percentage of 82 stands showing late-successional structure and the volume of coarse woody debris were both lower than expected (and may reflect Acadia's history of logging and fire), but standing dead tree (snag) density suggested good integrity. Likewise, soil chemistry showed mixed results. The C/N ratio, a measure of nitrogen saturation, was within the healthy range, but preliminary results indicate the Ca/Al ratio, a metric of acidic deposition impacts, may be below the range considered healthy for tree growth.

EXOTIC PLANT MANAGEMENT TEAMS

The Exotic Plant Management Teams (EPMT) are an integral part of the invasive species program for the National Park Service. They were established to provide a framework and a first response to exotic plant invasions in parks. The 16 teams are stationed across the country, each serving a biogeographically linked network of parks. While general direction and guidance is provided by the Invasive Species Branch of the Biological Resources Management Division, each team has a Steering Committee of representatives from the served parks. Team liaisons are generally supervised by the Committee or the regional EPMT Coordinator. Over the last 6 years they have treated more than 50,000 acres, worked in more than 200 parks and have treated more than 300 invasive plant species. In addition to project work, teams provide technical assistance to parks, regions, and the Inventory and Monitoring networks in invasive plant management. Following are some highlights:

- In FY 2007 the teams treated more than 14,700 acres.
- Although invasive plant control and treatment remain the primary focus of the teams, the teams also play an important role in all aspects of invasive plant management; including inventory, monitoring, prevention, education and outreach. On average teams spend between 5–20 percent of their time on inventories, 5–20 percent on monitoring, 5–15 percent on prevention and cooperative efforts, 60–85 percent on control and less than 10 percent on assisting with research.
- In the last 6 year, the teams have inventoried more than 1,200,000 acres and more than 220,000 acres in FY 2007.
- In FY 2007 additional funding became available to focus on invasive plant management in three geographic areas: the northern Great Plains, southern Florida and in the Rio Grande drainage. The Northern Great Plains EPMT used the additional funds to restore prairie sites in the badland country of North and South Dakota through controlling leafy spurge, Canada thistle, and other noxious weeds. In the Rio Grande the supplemental funds were used control invasive plants and restore native vegetation along river corridors for rare species like the willow flycatcher.
- Teams assist parks in strategic planning through gathering information and through direct involvement in vegetation managing plans. Currently the Northern Rockies team is leading an effort to complete invasive management plans for ten parks.
- **Whiskeytown National Recreation Area.** Early detection and rapid response is an ecological based technique for detecting and treating small infestations before they can proliferate. The California Team discovered and then treated a small infestation of diffuse knapweed (*Centaurea diffusa*), a highly invasive species and a plant of concern by the State of California. This species could have invaded hundreds of acres in the park if not detected and treated.
- **San Juan Island National Historical Park.** The North Cascades Team has been working with an area fire and vegetation ecologist to restore Garry oak habitat. The restoration prescription calls for controlling invasive plants in conjunction with restoring natural fire regimes to the ecosystem.
- **Colorado National Monument.** The Colorado Plateau Team completed removal of tamarisk at all known sites. The team will continue to monitor these sites and treat any new plants over the next few years.
- **Canaveral National Seashore.** The team completed the initial treatment of the Brazilian pepper tree on the Western Mainland Tract. This 4,000 acre tract, jointly managed by Canaveral National Seashore and the Merritt Island National Wildlife Refuge is habitat for the federally listed Florida Scrub jay. This species requires open pine flat woods. These flat woods were rapidly disappearing due to the encroachment of the invasive Brazilian pepper tree.
- **The Gulf Coast Team** assisted in the ongoing recovery efforts following hurricanes Katrina and Rita. Like many disturbances the hurricane provided pathways and habitat for the spread of invasive plants. The team continues to consult with parks and area groups on treatment within the hurricane zone.

Managing invasive species requires coordination across boundaries and jurisdictions. The EPMTs are leaders and active participants in local and regional cooperative efforts. Following are some examples of these cooperative efforts:



Student Conservation Association Volunteers controlling weeds at the Chesapeake and Ohio Canal National Historical Park. The National Capitol EPMT has worked to form cooperative weed management areas.

Researchers at with the Great Lakes-Northern Forest CESU are working to understand the genetics of the Pitcher Plant. More information about this project is found on page 50.
NPS Photo: Joy Marburger

The Alaska Team provides technical assistance and guidance to the region, working with interagency teams to coordinate management of invasive species across Alaska. The team is coordinating with regional and park staffs to create a regional management plan. The team has focused on prevention in Alaska parks which still have only limited populations of exotic and invasive plants.

The Great Lakes EPMT is a leader in the Midwest Natural Resources Group. The team was instrumental in the formation of the Northwoods Cooperative Weed Management Association.

The Pacific Island Team plays a pivotal role in the Maui Invasive Species Committee, leading a five year effort to control Miconia on the island. These efforts are now expanding to other species including highly aggressive pampas grass on Maui.

The National Capital Team has been instrumental in forming cooperative weed management areas in the Washington Metropolitan area. This is one of the first operational cooperative management areas in an urban environment.

The Southeast, Florida and California Teams are in leadership roles in regional and national Exotic Plant Pest Councils. These roles facilitate cooperation across ownerships, increase visibility for invasive species and assist in management of invasive species adjacent to public lands.

The Lake Mead Team continues to play a leadership role in regional efforts to control salt cedar. In concert with other federal, state and local agencies the team provides coordinated control efforts in the area. Using scientific principals to prioritize control, the team concentrates in areas that can be maintained tamarisk-free.

The North Cascades Team has been instrumental in the formation of Cooperative Weed Management areas around parks. Coordination with area tribal governments had lead to more effective coordinated treatment of growing populations of knotweed along local rivers.

COOPERATIVE ECOSYSTEM STUDIES UNIT NETWORK

In FY 2007, the National Park Service continued to support NPS participation in the Cooperative Ecosystem Studies Units (CESU) network. CESUs are multi-agency partnerships with the nation's universities and other institutions, organized around biogeographic areas. Seventeen individual CESUs are part of a national network competitively established with leadership from the National Park Service, USGS, and other federal agencies. 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 in an ecosystem context. A total of 227 universities and other partners (including 47 minority institutions) now participate in the CESU Network. These partners collaborate with the federal agencies to provide local expertise for key local needs and priorities. Host universities provide office space, administrative support, and access to university faculty, students, staff, and resources. Host universities may also offer adjunct faculty status to NPS coordinators. The National Park Service is one of 13 federal agencies in the CESU Network. Participation enables the National Park Service to partner with other federal agencies and universities to obtain high-quality science, usable knowledge for resource managers, responsive technical assistance, continuing education, and cost-effective research programs.

CESU funds from the Natural Resource Challenge provide salary and support for a coordinator at the host university in 12 of the 17 CESUs. NPS coordinators are "brokers," working with park managers to identify research, technical assistance, education needs, and to provide specialized expertise and assistance available from the universities and other federal agency partners in the CESU Network. Remaining available funds support research, technical assistance, and educational activities as well as operating expenses.

CESUs operate within all regions of the National Park System but Natural Resource Challenge funding to support NPS participation in 5 of the 17 CESUs is not currently available. Regional offices help support NPS participation in these five CESUs, through collateral duties, additional funding, or assigning addi-

tional responsibilities to existing coordinators. Information about Natural Resource Challenge funding for NPS positions is provided in the table below.

In FY 2007, a total of 848 NPS projects were administered through CESUs and supported by a diverse range of funding sources that totaled nearly \$43 million dollars. In FY 2007, nearly half of the CESUs reported an upward trend in total funds obligated to projects and several benefited from national initiatives. For example, the South Florida-Caribbean CESU, with a 66 percent increase in funds obligated, benefited from the Critical Ecosystems Studies Initiative, a research program of **Everglades National Park** with ties to the national effort to restore the Everglades. In addition, the Great Basin CESU reported a substantial amount of funds originated with the sale of public lands in Nevada under the Southern Nevada Public Lands Management Act. Of the CESUs reporting a decrease in funds obligated in FY 2007, most attributed the decrease to a shift from inventories to monitoring protocol development by the I&M Networks. Summary funding and project totals by NPS funding category for all 17 CESUs are provided in the *Total Funding and Number of NPS Projects Administered through CESUs in FY 2007* table.

Through the efforts of NPS coordinators duty-stationed at CESU host universities and

other staff with CESU responsibilities, NPS park and program managers across the system have become increasingly aware of the expertise and services available through this collaborative mechanism. NPS coordinators have been very effective in working with the universities and other partners to be responsive and efficient in meeting diverse National Park Service needs and priorities.

CESUs and NPS coordinators are providing key services to I&M Networks. For example, coordinators help locate expertise and facilitate projects to assist in conducting inventories, developing conceptual models, developing monitoring protocols, reviewing reports, and conducting peer reviews. Furthermore, most NPS research coordinators serve on the Board of Directors for one or more I&M Networks.

NPS coordinators continue to collaborate with each other to ensure that parks in their respective region get access to the best available expertise from across the entire CESU Network. Active NPS participation in the CESU Network is a key component of the Natural Resource Challenge. The *Total Funding and Number of NPS Projects Administered through CESUs in FY 2001–2007* table shows trends in CESU activity since FY 2001.

Status of Funding for NPS CESU Positions

CESU	NPS Position in 2007 (Y/N)	FY 2001 or 2003 \$
Californian	N	
Chesapeake Watershed	Y	\$155,000
Colorado Plateau	Y	\$155,000
Desert Southwest	Y	\$155,000
Great Basin	Y	\$155,000
Great Lakes-Northern Forest	Y	\$153,000
Great Plains	Y	\$155,000
Gulf Coast	Y	\$153,000
Hawaii-Pacific Islands	N	
North & West Alaska	N	
North Atlantic Coast	Y	\$155,000
Pacific Northwest	Y	\$155,000
Piedmont-South Atlantic Coast	N	
Rocky Mountains	Y	\$155,000
South Florida-Caribbean	Y	\$155,000
Southern Appalachian Mountains	Y	\$155,000
Upper & Middle Mississippi Valley	N	

Yosemite National Park. Californian CESU. *Sierra Nevada Forest Restoration Targets and Quantification of Forest Change Since 1911 Based on Direct Re-measurement:* Historical references are increasingly important in understanding how forests have changed as a result of forest management and impacts by wildfires and wildfire suppression activities. Researchers from the University of California, Berkley developed this project to assess demographic changes and spatial patterns in mixed conifer and ponderosa pine forests within Yosemite National Park based on the re-measurement and analysis of a historic 1911 timber inventory data to provide empirically defensible restoration targets that can be used by park resource professionals in the management of the park. The impacts of land management activities on Yosemite National Park include fire suppression, harvesting, and grazing from adjacent landscapes. The 1911 transects were relocated and all plots georeferenced. Plots were then re-measured to compare changes in forest structure, stand dynamics, and fire histories during the nearly 100 year intervening period since the original measurements were obtained. The last portion of this project connects long-period fire history to within park vegetation samples. Connecting centuries of fire history data through the acquisition of fire scar blocks to the

vegetation reference plots provides the park with invaluable insights into fire regimes that have contributed to the present forest conditions displayed in the park. This project also contributes to park management in assessing future scenarios that could be expected to occur with certain changes in fire frequency and climate change models. The data obtained through this project will have direct benefits in how park management would alter under such environmental change.

Zion National Park. Colorado Plateau CESU. *Linking Cougar Decline, Trophic Cascade, and Catastrophic Regime Shift in Zion National Park:* The strength of top-down forces in food webs is highly debated starting with the publications of Aldo Leopold in the 1940s on the irruption of deer populations on the North Kaibab Plateau after eradication of large mammalian carnivores. There are few good examples illustrating the role of large mammalian predators in structuring abiotic and biotic systems. Based upon the results of this study, researchers from Oregon State University hypothesize that an increase in human use in Zion Canyon in Zion National Park has resulted in a catastrophic regime shift through pathways involving trophic cascades and abiotic environmental changes. Increase in visitation to Zion Canyon apparently re-

Total Funding and Number of NPS Projects Administered through CESUs in FY 2007.

Funding Source	Total No. of Projects ¹	Total Funding
CESU Natural Resource Challenge	61	597,674
Park/Region	319	11,257,284
I&M	177	8,966,670
NRPP	63	2,364,538
Other Servicewide Funding	259	18,382,881
SUBTOTAL	879	41,569,047
+ regional funding of CESU personnel/operations		1,112,899
TOTAL	879	42,681,946

¹ Total number of projects by funding source in each category; actual total is 848.

Total Funding and Number of NPS Projects Administered Through CESUs in FY 2001–2007

Fiscal Year	Total Projects Initiated	Total \$	# of 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

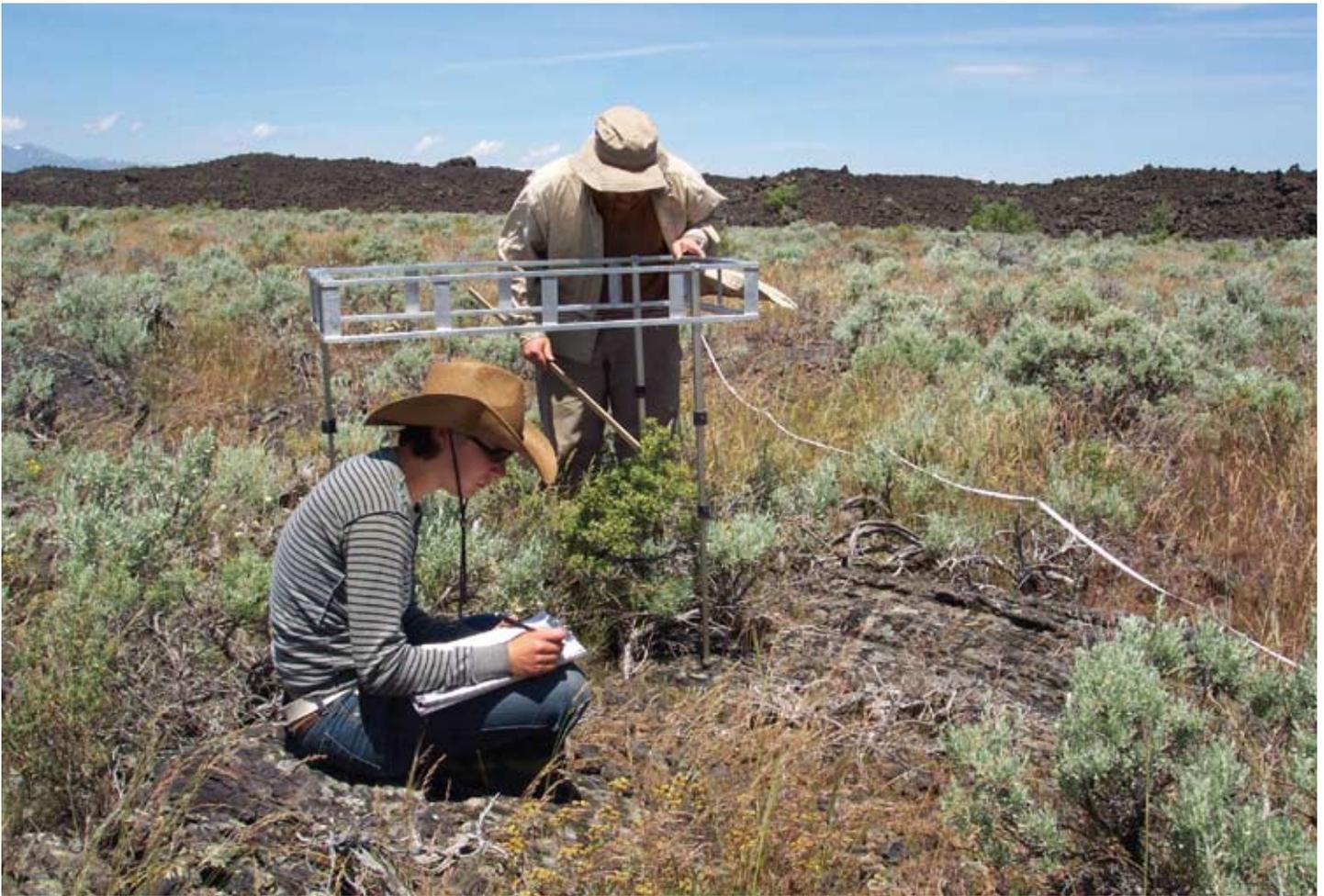
sulted in reduced cougar densities which led to higher mule deer numbers, higher browsing intensities resulted in reduced cottonwood tree recruitment, increased bank erosion, and reduction in both terrestrial and aquatic species abundance. These results can have broad implications to ecosystems managed by parks where large predators have been extirpated.

Chiricahua National Monument and Fort Bowie National Historic Site. Desert Southwest CESU. *Bat Species Richness and Abundance at the Chiricahua National Monument and Fort Bowie National Historic Site (year 8 of a 10 year project)*: This project is a unique long-term project that is quantifying bat species richness and abundance at two NPS units in southeastern Arizona. Arizona has one of the richest bat faunas in the United States, but species ranges are only generally or broadly known across the desert southwest. Twenty-three of the 44 bats species that occur in the United States have been documented in the Chiricahua Mountains. At Chiricahua National Monument and Fort Bowie National Historic Site the National Park Service partnered with a nationally recognized bat researcher from the Arizona-Sonora Desert Museum to document long-term use and trends of bats species in the Chiricahua Mountains, specifically in the two park units. Biologists from the University of Arizona and Bat Conservation International have also participated in this collaborative project. Documentation of bat species in these park units (time of year, important habitats, roost sites, presence of rare species, etc.) will provide park managers useful information to help inform management decisions on a host of park policies and actions from prescribed fire planning to visitor use activities. Also, these historic data will become more valuable for predictive modeling as resources in the park units change due to global climate change.

Craters of the Moon National Monument and Preserve. Great Basin CESU. *Survey Plant Communities of Kipukas within Craters of the Moon National Monument and Preserve*: Craters of the Moon was established to protect a variety of volcanic features and landscapes in the Great Rift Volcanic Rift System of Idaho. In 2000, the monument was expanded to include the source area for the lava flows. With this expansion, an estimated 570 kipukas were

added to the previous 14 that were known within the original monument boundary. Kipukas are isolated islands of soil and vegetation formed when they were surrounded by lava flows. Given their isolation and remoteness from anthropogenic influences some of these islands represent virtually pristine habitat and have been designated as ecological benchmarks. Although research has been conducted at a few sites, very little is known about vegetation, soils and disturbance for most kipuka locations in the monument. In 2004, the National Park Service partnered with Idaho State University to conduct a two-year study to survey and describe vegetation and associated ecological attributes in 106 randomly selected kipukas at Craters of the Moon. Special emphasis was placed on documenting occurrence of non-native plant species in each kipuka. Data from this study suggest that kipukas of Craters of the Moon support a rich and highly variable flora. Statistical analysis also showed that kipukas nearer other kipukas had higher plant diversity, which supports the interpretation that the main source of species diversity on kipukas now may be other kipukas and their remnant sagebrush flora. More than 174 plant species were documented during the study, including 17 non-native species. Cheatgrass (*Bromus tectorum*), the most abundant and widespread of the non-natives, was present at 73 kipukas (78 percent of the sampled sites) and was often one of the most abundant species. Results from this study confirm the need for a more extensive inventory to ascertain the resource values and management needs contained within these unique islands. Information provided by this project will be used to: 1) guide inventory and monitoring efforts as part of the Natural Resource Challenge; 2) assist park staff with current management decisions with regard to fire management and noxious weed control; and 3) support interagency management plans designed to protect the natural values of the area's unique island ecosystems and increasingly rare native plant communities.

Apostle Islands National Lakeshore, Indiana Dunes National Lakeshore, Isle Royale National Park, and Pictured Rocks National Lakeshore. Great Lakes-Northern Forest CESU. *Determination of Genetic Diversity and Restoration Potential of the Pitcher Plant (*Sarracenia purpurea*) in the Lake Superior Watershed*: The



Idaho State University Graduate Student Cameron Pederson and field assistant conducting point-frame vegetation sampling in a kipuka at Craters of the Moon National Monument and Preserve.

objective of the project was to study current genetic diversity of the unique wetland species, the pitcher plant (*Sarracenia purpurea*), to understand the best practices for conservation and restoration of the species. The project examined the genetic and morphological diversity of the pitcher plant within the wetland habitats of western Lake Superior and southern Lake Michigan. As our landscape becomes increasingly fragmented, so do the remaining wetlands become increasingly isolated ecosystems, creating unique challenges for restoration and causing plant populations to become isolated. Maintaining genetic diversity of the species is an important conservation goal. Genetic diversity provides the necessary foundation for plant species, such as the pitcher plant, to respond to environmental pressures. Application of sound, science-based management can help reduce the loss of plant diversity where species have been extirpated due to anthropogenic impacts.

Big Thicket National Preserve. Gulf Coast CESU. *All Taxa Biodiversity Inventory (ATBI) at Big Thicket National Preserve:* The All Taxa

Biodiversity Inventory (ATBI) is a project that involves citizen scientists and taxonomists in the exploration of the biodiversity of the park. ATBIs promote civic engagement with parks and their resources and they also promote scientific understanding of biodiversity in the general public. Bioblitzes are the starting form where the public can participate in a marathon session to identify species, but the ATBI goes a step further combining scientific expertise and a solid data engine that allows park managers to use the new knowledge gained from the ATBI for resource protection. Several universities, nonprofit partners and community organizations worked together to develop the Thicket of Diversity under the umbrella of the Big Thicket Association. The Thicket of Diversity has since raised funds from several foundations matching the initial start from the NPS funding and has generated scientific proposals in the form of Taxonomic Working Groups. Eastfield College (a community college in Dallas) was another partner and through a National Science Foundation Grant, they brought 20 students and volunteers to work with the Big Thicket and also brought high tech equip-

ment including two new portable scanning electron microscopes. On the first day of the ATBI effort, one bird feather revealed three species of feather mites that were sent out to experts who currently think there may be a new species discovered. The fungal team discovered two new state records and potentially one undescribed species.

Kaloko-Honokohau National Historical Park. Hawaii-Pacific Islands CESU. *Baseline Assessment of the Coral Reef Habitat Adjacent to the Shores of Kohanaiki Development in Kaloko-Honokohau National Historical Park:* This project was designed to establish a statistically valid baseline for future monitoring of the status and health of coral reef habitat in Kaloko-Honokohau National Historical Park. Changes to underwater habitats may occur from land-based pollutants entering marine waters. Park waters are downslope from several large-scale existing and planned urban developments, including industrial parks, a golf course, housing developments, wastewater treatment disposal, and resort and marina development. The objectives of the study were to: 1) initiate a sampling design to enable identification of changes in total percent coral cover, algal cover, and coral health/survival change over time at two zones within Kohanaiki Reef, 2) identify differences in total percent coral cover, algal cover, and coral health/survival over time

at Kohanaiki Reef versus reference (“control”) sites, and 3) identify changes over time in sea urchin (multiple species) and Crown of Thorns starfish (*Acanthaster planci*) populations at Kohanaiki Reef and reference sites. Baseline data on benthic habitat cover and sea urchins and starfish were collected in Spring 2006, Fall 2006, and Spring 2007 via underwater photographic surveys on 63 randomly selected, permanently-installed transects. Analysis of data is complete, and the baseline has been established in six reef habitat areas of the Park. Follow-up long-term monitoring of the benthic habitat in Kaloko-Honokohau will be funded by park base funds. Cooperators: University of Hawaii at Hilo Principle Investigator James Beets and benthic habitat specialist Lisa Merrack. Park agreement technical representative is Sallie Beavers.

Sitka National Historical Park and Glacier Bay National Park. North and West Alaska CESU. *Eelgrass Habitat and Associated Fauna, including the Grass Shrimp Hippolyte clarkia, in Sitka National Historic Park, Sitka, Alaska:* The eelgrass study is a cooperative effort among University of Alaska, Harte Research Institute, Texas A&M University-Corpus Christi, and Sitka National Historical Park and Glacier Bay National Park, Alaska. A survey to create a species list of macroinvertebrates within the Sitka National Historical Park was

A diver photographs coral cover along a transect in Kaloko-Honokohau National Historical Park.



completed on July 14, 2006, on a -2.0 ft. low tide. The results of this survey increased the total number of documented marine macroinvertebrates to 254 species in 9 phyla. Notable finds during the invertebrate surveys included several species which had not been recorded previously in Alaska. These include an amphipod (*Thorlaksonius truncatus*), a hermit crab (*Orthopagurus minimus*), and a chiton (*Dendrochiton semiliratus*). One find of particular concern were several shells (carried by hermit crabs) of the snail *Batillaria attramentaria*. This snail, originally from Asia, has established itself along the west coast of North America but has not previously been recorded in Alaska. This eelgrass sampling project allowed for many outreach opportunities. The Southeast Alaska Math & Science camp in particular involved Native Alaskan high school students interested in post-secondary education in the biological sciences. The students (while participating in project related activities) learned about tidal zonation, invertebrate and fish taxonomy, animal physiology, sampling procedures, field work methods, use of GPS (global positioning systems), and reporting study data.

Cape Cod National Seashore, Fire Island National Seashore, and Gateway National Recreation Area. North Atlantic CESU. *Using Stable Isotopes to Assess and Monitor Anthropogenic Nutrient Inputs to Estuaries:* Many estuaries are increasingly subject to high inputs of nitrogen from septic systems and wastewater treatment facilities. The use of stable nitrogen isotope ratios is one method that has been proposed to indicate anthropogenic nutrient enrichment in estuarine systems; however, the role of stable isotopes as a tool in long-term ecosystem assessment and monitoring has not been fully developed. Resident producer and consumer species were collected from *Spartina alterniflora* dominated marshes at Cape Cod National Seashore (MA), Fire Island National Seashore (NY) and Gateway National Recreation Area (NY). These marsh-estuarine systems represented a range of anthropogenic impact, with Hatches Harbor (Cape Cod) representing a relatively pristine system and Jamaica Bay (Gateway) within a highly urban landscape. Tissue isotope ratios of cordgrass (*Spartina alterniflora*), sea lettuce algae (*Ulva lactuca*), common mummichog (*Fundulus heteroclitus*), and ribbed mussel (*Geukensia demissa*) were analyzed. Power analysis was

used to examine sample sizes necessary to detect change in nutrient source using the species sampled. Consumer species demonstrated lower within-site variability than producer species and would therefore require smaller sample sizes to detect changes in nitrogen source and loading.

The data collected in this study demonstrate that stable nitrogen isotopes in resident estuarine organisms represents a useful tool for assessing nitrogen loading threats to estuarine systems from human sources and for long-term monitoring of system condition. It is expected that coastal parks in the Northeast, perhaps through the Network Monitoring Program or the Cape Cod prototype monitoring program, will periodically monitor stable N isotope values in estuarine organisms to determine if the influence of human-derived nitrogen in the system is increasing (due to development activities adjacent to the park) or decreasing (due to implementation of correction management strategies).

Pacific Northwest CESU. *High Resolution Climate Maps for Pacific Islands, 1971–2000:* Climate data, including maps of precipitation and temperature, are one of the 12 core inventory types of the Inventory & Monitoring program. At a national level, the National Park Service used the National Oceanic and Atmospheric Administration (NOAA) climate atlas to meet this inventory need. When the Pacific Island Network began conducting inventories, NPS staff quickly realized this resource was limited to contiguous North America, leaving the Pacific Island parks without a comparable product (a partial product was available). The Network subsequently partnered with the PRISM Group at Oregon State University who had prepared the original NOAA climate atlas products. The goal was to produce up-to-date, high resolution, digital maps for 1971–2000 mean monthly and annual: minimum and maximum temperature, mean dew point, and total precipitation; encompassing the Hawaiian Islands, Guam, Northern Mariana Islands (Saipan, Tinian, and Rota), Palau, American Samoa, and Federated States of Micronesia (Kosrae and Pohnpei).

For the first time, detailed and comprehensive climate maps, using consistent methods, are available for the State of Hawaii and the U.S.

affiliated Pacific Islands. The free, publicly available products are being used for conservation purposes within the Pacific Island Network and by other DOI agencies such as the U.S. Fish & Wildlife Service, as well as in other contexts. The U.S. Geological Survey uses these maps for calculating hydrologic inputs and preparing water supply estimates. The maps also facilitate Office of Insular Affairs coordination responsibilities when providing U.S. federal assistance in the Pacific Islands. With the rising profile of climate change and sea levels, this baseline inventory serves as a key link when assessing and interpreting the status and trends of some of our nations more remote natural resources.

Congaree National Park. Piedmont-South Atlantic Coast CESU. *Determine the Long-term Effects of Wind Disturbance on the Old-growth Forests and Lianas of the Congaree National Park:* Congaree National Park encompasses the largest tract of old-growth bottomland hardwood forest in the southeastern U.S. Seasonal hurricanes and windstorms impact the forest. The shrub layer of the forest often shows the most dramatic response after a damaging windstorm. An interesting relationship between lianas (woody vine plants which climb up a tree) and tree composition has been observed but not investigated. In this project, the park collaborated with the Savannah River Ecology Lab (of the University of Georgia) and the School of Natural Resources at Ohio State University. The researchers set up a series of sample sites across disturbance and tree size class gradients. Using lianas as an indicator species of forest community structure and development, the researchers were able to show at what point along a natural successional trajectory certain old-growth characteristics are attained. The park is able to use the visible abundance of lianas as a simple indicator of the stage of forest community development.

Everglades National Park. South Florida-Caribbean CESU. *Movements and Habitat Use of Burmese Pythons in the Southern Everglades:* The recent colonization of Everglades National Park and adjacent areas by Burmese Pythons (*Python molurus bivittatus*) has created significant new challenges for restoration of this world-renowned ecosystem. The purpose of this project is to provide science support to

evaluate the impacts of pythons on native biological diversity and development of control measures for Burmese pythons. Strategic field studies of python life history are underway to: 1) determine habitat use and movements of pythons; 2) synthesize results on natural history of pythons in an adaptive framework to evaluate relationships between ecosystem restoration and habitat modification on control of pythons; 3) provide a preliminary assessment of the impacts of pythons on native species; and 4) develop spatially explicit habitat suitability model to evaluate Everglades restoration alternatives on the spread and establishment of pythons. This information is critical for restoration of Everglades' pre-python conditions. If successful, this activity will benefit not only Everglades National Park, but also vulnerable conservation areas throughout southern Florida (Big Cypress National Preserve, water conservation areas), the remainder of the peninsula, and coastal southeastern U.S.

RESEARCH LEARNING CENTERS

Seventeen Research Learning Centers (RLCs) were created beginning in FY 2001 to foster new and cutting edge knowledge about park resources through research, education, and public engagement. Nearly 1000 research projects investigating park biology, physical sciences, social sciences, and other disciplines are facilitated through the RLCs each year, providing critical information quickly to park management. Twelve RLCs have been funded through the Natural Resource Challenge (NRC) and five through a combination of existing park base and partner support. The two newest RLCs, Crater Lake Science and Learning Center and Greater Yellowstone Science Learning Center, were established in FY 2006. The mission of the RLCs is to increase the effectiveness and communication of research and science results in the national parks by:

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

RLC staffs generally include research and education coordinators and, in some cases, other technical and administrative support personnel. While staffs are located at a host park, most RLCs serve multiple park units; more than 100 of the existing 390 National Park System (NPS) units are served in some fashion by RLCs. Basic facilities for research and education vary widely from one RLC to the next, but nearly all provide services to researchers including housing, office and meeting space, internet access, and a range of products and services that communicate science and research results to internal (NPS) and external audiences. In addition, some RLCs provide project funding and grant writing assistance as well as the logistical support in the form of wet and dry analytical labs (e.g. refractometers, microscopes, sieves, sample bottles, etc); field equipment; access to libraries, park data, and archives; transportation (including use of boats and research vessels for aquatic and marine research); and field assistants (student interns and citizen science volunteers).

Through the efforts of RLCs, the Park Service is effectively meeting managers' needs for quality scientific information. In FY 2007, RLC research coordinators helped to establish and implement more than 930 research projects, many of which were critical to park management decisions. RLC housing accommodated more than 21,000 people-nights, saving researchers more than \$1.2 million in lodging expenses. RLC staffs involved more than 450 university students in park research. About one-half to one-third of the RLCs now offer internship and fellowship programs, generally in collaboration with other NRC programs such as Cooperative Ecosystems Studies Units (CESUs) or nonprofit park partners. Seed money from these programs helps promote park research while providing modest stipends for future scientists. RLC efforts helped produce more than 70 peer-reviewed research papers in FY 2007. Such articles and ancillary products (e.g., presentations to staff, research briefs) are critical for park management to make the best possible science-informed management decisions.

Science communication and educational activities are integrated into many research projects to promote science literacy, science-informed decision making, and resource stew-

ardship. RLC education coordinators created dozens of science communication products used by teachers, students, park staff, and the general public. These include on-line multimedia approaches such as digital video, audio recordings, and electronic field trips along with more traditional products such as project summaries, newsletters, brochures, resource and site bulletins, wayside and visitor center exhibits, and nature trail guides. Dozens of public workshops and seminars were held on specific topics, such as invasive species and wildlife conservation, as well as synthetic conferences highlighting a range of park research projects. Through RLCs, hundreds of teachers and thousands of students were engaged in hands-on science activities in and about parks. Internally, RLC staffs provided hundreds of hours of training for park resource managers, interpreters, and concessionaires. Because science communication is an important component to all Natural Resource Challenge programs, RLCs are currently involved in efforts to collaborate with other programs, such as the Inventory and Monitoring programs (I&M) and CESUs, to identify products that can be jointly produced to consistently convey high quality resource information to managers and the public.

Partnerships are the key to RLC success. In FY 2007, RLCs engaged hundreds of park partners including universities, schools, nonprofit organizations, community groups, federal, state, and tribal agencies, and a range of NPS programs. By involving partners in park research, scholarship, and educational activities, RLCs logged more than 20,000 volunteer hours and leveraged nearly \$1 million in direct match and in-kind support. Additionally, millions more in research was supported solely by outside funding agencies in projects facilitated by the RLCs. Among the most successful volunteer efforts were citizen science programs. Some of these were "bioblitzes" (one or two day events to inventory one taxa or habitat such as aquatic invertebrates, moths, or beetles) while others represent longer-term programs to monitor the health of a species, such as the Common Loon, or a group of species such as butterflies.

RLCs are quickly realizing their potential as integral and essential components for using

science to aid park management. Highlights of RLC supported activities for FY 2007 include:

The North Coast and Cascades Research Learning Network worked with partners to develop a residential science program for 5th graders from counties surrounding the park. The curriculum materials are rich in hands-on science lessons and activities that introduce students to park research. Interpreters teach in conjunction with North Cascades Institute staff, graduate students, and seasonal educators. Students learn about the formation, movement, and study of glaciers within the parks; participate in an activity that demonstrates the need for mammal diversity through which they learn about the park's forest carnivore study; and use observation skills to become familiar with international migratory song birds and the park's song bird monitoring program. Math and science hands-on activities are woven through this curriculum-based program.

The Old-Growth Bottomland Forest Research and Education Center supported several research projects in 2007 targeting hydrology, geology, geomorphology, and vegetative community dynamics related to periodic flooding from the Congaree River. Detailed ecological information is currently needed by park management to actively participate in the relicensing process of the Saluda Hydroelectric Dam, located approximately 30 miles upstream of **Congaree National Park**. The Center continues to be actively engaged in a science-based, stakeholder-inclusive, collaborative process to determine an appropriate, adaptive, and sustainable flow regime for improving and restoring the ecological integrity of the floodplain ecosystem protected by the park. Changes in the hydrology of the Congaree River and the associated flooding patterns within the park have occurred since the Saluda Dam became operational in 1930. The Saluda Dam has affected the timing, frequency, magnitude, and duration of flooding events within the park, with unknown effects to the unique floodplain forests the park is mandated to protect. As a privately-owned hydropower facility, the Saluda Dam is regulated by the Federal Energy Regulatory Commission (FERC). In accordance with the Federal Power Act, FERC issues 30–50 year licenses for the operation of all non-federal dams that must balance social

and environmental concerns with the need for hydropower generation. These data sets are critical in developing recommendations for dam operations that will mitigate impacts to downstream ecosystem function, aquatic and riparian communities.

Ocean Alaska Science Learning Center: Collaborative efforts focused on studying harbor seal populations from **Glacier Bay National Park and Preserve** to Kodiak Island. In 2007 a Steller's Eider chick was hatched in captivity at the Alaska SeaLife Center. This achievement was made possible through Ocean Alaska collaborative efforts to maintain the only captive breeding colony of Steller's Eiders in North America.

Appalachian Highlands Science Learning Center: The center assisted a team of researchers studying beetles, or Coleoptera, in writing a successful grant to the National Science Foundation. The multi-year grant blends documenting beetle diversity in **Great Smoky Mountains National Park** with educational efforts. The highlights included a week-long "beetle blitz" including 30 scientists, a family day at the Sugarlands Visitor Center that attracted hundreds of people, and a three-day intensive workshop for teachers titled "Beetlemania." Via a grant from the Burroughs Wellcome Fund the Center provided 11 high school interns to assist researchers with collecting data in the field or lab, averaging 175 hours each worked during the summer; 8 of these worked as assistants directly under 4 researchers and the other 3 worked under NPS supervision collecting data requested by researchers. Seventeen permitted researchers utilized the interns for their work.

California Mediterranean Research Learning Center: At **Cabrillo National Monument** in San Diego the Center installed two sets of cameras that show the highly valued rocky intertidal areas managed by the National Park Service. The cameras are deployed on two solar stations designed by partners. Views from the live webcams are available on the California Mediterranean Research Learning Center web site www.researchlearningcenter.org and at the High Performance Wireless Research and Education Network (HPWREN) web site <http://hpwren.ucsd.edu/cameras/>.

Continental Divide Research Learning Center: The Rock Mountain Front Range is one of the loci of chronic wasting disease for the country. Chronic wasting disease is an illness similar to mad-cow and Creutzfeldt-Jakob (nvCJD) diseases. The Continental Divide Research Learning Center support of chronic wasting disease projects has contributed to the development of new testing methods; an understanding of the movement of the disease within the region; and the long-term knowledge of the relationship of genetics to the prevalence of this class of disease.

The **Atlantic Research Center** facilitated several studies that provided data for park managers to make informed decisions, leading to improved resource and visitor protection. At **Cape Cod National Seashore** park managers used results of ongoing research into spadefoot toad distribution and movements to reduce road mortality, and to select the best design for rehabilitation of a bike path through spadefoot habitat. The resulting bike path will result in increased recreation and access for visitors while protecting resources. The results of a study on the effects of hunting on cottontail rabbit populations at Cape Cod National Seashore and a related survey for New England cottontails on the outer Cape were used in a Final Environmental Impact Statement and Record of Decision for the hunting program at the seashore. Preliminary results from a study of macroalgae abundance, species composition, and growth rates in the tide-restoring East Harbor were used to address local resident and Town of Truro concerns regarding odor-producing algal blooms. Elevated levels of mercury in kettle pond fish tissues at Cape Cod led to issuance of a consumption warning. The sampling was conducted as part of a collaborative study of mercury deposition facilitated by the Center.

Crown of the Continent Research Learning Center: Climate change is increasingly gaining visibility as one of the most significant threats facing national parks and the Research Learning Center has made communicating the impacts of change one of its highest priorities. In 2007, three wayside exhibits were installed and a site bulletin made available for park visitors. Seasonal interpretive training and resources were provided for the third consecutive year. Staff also supported several regional and na-

tional efforts to communicate climate change impacts by 1) spearheading development of “talking points” for ten different bioregions throughout the U.S.; 2) organizing speakers and discussants for a series of concurrent sessions at the biannual George Wright Society forum; 3) writing articles for NPS Sustainability News and Ranger Magazine; 4) coordinating a scenario planning workshop for Pacific West and Alaska Region managers; and 5) presenting overviews to a variety of audiences including the Natural Resource Advisory Group and the National Leadership Council.

The **Great Lakes Research and Education Center** worked with the Nature Conservancy for a second year on rearing of the Karner Blue Butterfly, a federally endangered species found in **Indiana Dunes National Lakeshore**. Brood-chamber rearing is part of a re-introduction program coordinated by The Nature Conservancy in state and federal lands in the Midwest. The Research and Education Center also supported a program connecting underserved high school students with Great Lakes research leveraging \$59,000 of non-NPS funding.

Mammoth Cave International Center for Science and Learning continues to assist in the re-lighting of Mammoth Cave. The Center is assisting in choosing light types and placements to enhance the visitor experience while protecting the cave from impacts caused by lighting systems (exotic plant growth, modification of behavior of cave adapted invertebrates, and cave environmental change). This assistance includes both providing general direction and participating in on-the-ground lighting development. To support this lighting work, the Center is a lead on a cooperative project with **Mammoth Cave, Carlsbad Caverns, Wind Cave, Sequoia and Kings Canyon, and Great Basin National Parks** to study how the growth of exotic plants can be controlled in lighted caves through optimizing types and levels of lights. This project was funded through the Natural Research Preservation Program for FY 2008.

Murie Science and Learning Center (MSLC): Teaming with the University of Alaska Fairbanks and the Denali Education Center, park education staff worked with the Alaska Natural History Institutes to offer two

Alaska Summer Research Academy (ASRA) modules in the park. The modules last two weeks and are designed to give high school students from around the state an opportunity to learn professional skills. Additionally, in the Alaska Scientists of the Future program, nine high school students from three Alaskan school districts studied climate change indicators at **Denali National Park and Preserve**. Based at the MSLC Field Camp, several professional instructors added technology expertise to the existing high quality teaching staff. Students used the MSLC classroom as a base for downloading probe, photo and video data onto individual laptops. Students collaboratively produced a final video sample summarizing their findings.

The **Pacific Coast Science and Learning Center** is providing critical information for NPS engagement in California's Marine Protected Area designations. The Center facilitated mapping more than 8,000 acres of NPS seafloor habitat. Working with partners, the Center is funding and designing Marine Protected Area monitoring programs. The Center also participated in the California Marine Protected Area stakeholder group to develop scientifically and economically viable Marine Protected Areas in or adjacent to NPS managed waters.

Urban Ecology Research Learning Alliance: In the fall of 2006, researchers from the University of Maryland Center for Environmental Science-Appalachian Lab, a partner in the Chesapeake Watershed CESU, pulled a federally endangered Indiana bat from a mist net in a tunnel along the **Chesapeake and Ohio Canal National Historical Park**. This was the first sighting in the park of this endangered bat in 27 years. This exciting discovery presented the park with a big challenge because this is a stretch of the park being considered for part of the "Rail to Trail" Maryland State project. Facilitated by Urban Ecology Research Learning Alliance and the Chesapeake Watershed CESU, new bat monitoring started at the park, giving park managers valuable information to help them determine how to best protect park resources and provide recreational opportunities for visitors.

In Frozen Niagara Cave at Mammoth Cave National Park Dr. Kurt Helf monitors roosting cave crickets by measuring their distance from a permanent landmark.





Chapter IV: Natural Resource Preservation Program (NRPP)

When Congress created the National Park Service in 1916, it tasked the Service with preserving the parks unimpaired for future generations. Parks strive to fulfill this mandate in a dynamic world where parks face unpredictable challenges such as hurricanes, floods, and other man-made and natural disasters. Established in 1981, the Natural Resource 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 park-level activities in a diversity of areas such as wildlife, fisheries, and vegetation management; specialized inventories; planning; mitigation actions; and restoration activities.

Through the Natural Resource Challenge, funding for NRPP projects increased from \$5,432,000 in FY 2000 to \$12,789,000 in FY 2003. However, since FY 2005 NRPP funding has been reduced by \$4,066,000. These reductions translate into 20 or 25 fewer on-the-ground projects in parks per year and reduced performance outcomes. Funding for FY 2007 remained at \$8,229,000, the same level as FY 2006. In addition to the above reductions, regions were allowed to assess NRPP projects up to 1 percent of their budget in order to provide funding for contingency uses.

The NRPP continues to serve as a comprehensive, accountable funding source for resource management projects. Pre-panel technical reviews, professional cost estimates, and new Servicewide Comprehensive Call guidance increase the accountability and efficiency of this funding source. More than half of NRPP funds are available for general natural

resource management projects. The balance of the funds strategically target specific needs for small parks, disturbed lands restoration, threatened and endangered species, and funds that are distributed to the regions for natural resource projects in parks (see table below).

NATURAL RESOURCE MANAGEMENT PROJECTS

Natural Resource Management Projects make up the largest segment of the Natural Resource Preservation Program. 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 which are then reviewed and ranked by a panel of subject-matter experts. The panel provides project funding recommendations to the 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. Projects must cost at least \$50,000 but no more than \$900,000 and be completed 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 of an annual accomplishment report. Highlights from FY 2007 NRPP-Natural Resource Management projects are:

NRPP Funding Categories

Type of project	Number of Projects	Actual Allocation (\$)
Natural Resource Management	31	3,190,000
Threatened and Endangered Species	12	474,000
Disturbed Lands Restoration	12	803,000
Small Park	60	948,000
Regional Block Allocation	72	1,324,000
Alaska Projects	8	474,000
USGS/BRD Technical Assistance	Not Reported	240,000
Servicewide Projects	26	776,000
Total		\$ 8,229,000

A researcher from North Dakota State University collects a benthic invertebrate sample using an Ekman Grab Sampler at Sand Point Lake in Voyageurs National Park. This is one component of an effort to monitor key indicators of the ecological effects of lake levels affected by regulatory dams on Rainy Lake and the Namakan Reservoir which are border waters of the United States and Canada.

Canyonlands National Park, Natural Bridges National Monument, and Hovenweep National Monument. *Acoustic Monitoring of Natural Soundscape:* This project collected the acoustic data necessary to describe natural ambient sound levels in the primary vegetation types in the three parks, and to determine the primary sources of both natural and non-natural sounds. NPS Management Policies state that the natural ambient sound level is the baseline condition, and the standard against which current conditions in a soundscape will be measured and evaluated. Data collection and equipment specifications followed guidelines provided by the NPS Natural Sounds Program. More than 14,000 hours of acoustic data were collected at 13 locations representing the primary land cover types in the three units. This information will help park managers to make informed decisions related to the impact of noise on park resources.

Biscayne National Park. *Assess the Conservation of Genetic Diversity of the Critically Endangered Sargent's cherry palm:* This one-year project assessed the conservation of genetic diversity of the endangered Sargent's cherry palm (*Pseudophoenix sargentii*). The recovery goal is to preserve the species in its habitat, with genetically diverse and viable populations that can respond to natural habitat dynamics. Past joint conservation efforts (an ex situ conservation collection, propagation protocols, reintroduction, and monitoring) were used in measuring recovery success.

Voyageurs National Park. *Assess the Impacts of International Lake Level Management by using an Interdisciplinary Approach:* The purpose of the project is to determine the effects of new rules governing lake level management on the ecosystem of the large lakes of Voyageurs with objectives of measuring the responses of five carefully chosen ecological indicators (common loons, fish, wetland vegetation, benthic invertebrates, and fur bearers). These indicators were identified as the most likely portions of the aquatic ecosystem to be affected by fluctuation and timing of artificially-managed lake levels.

Olympic, Mount Rainier, and North Cascades National Parks. *Atmospheric Pollutant Loading Linkages to Trans-Pacific Air Mass:* Recent studies indicate that air pollutants originating in Europe and Asia remain airborne for thousands of miles and deposit in snow at rela-

tively high elevations in North America. These contaminants may accumulate in annual snowpack. Many of these pollutants, particularly persistent organic pollutants, accumulate and concentrate in food webs, threatening the viability of aquatic and terrestrial ecosystems. Atmospheric scientists describe the U.S./Canada border as the latitude most likely to receive these trans-Pacific air masses, suggesting that Olympic, North Cascades, and Mount Rainier National Parks are among the areas at greatest risk in the western U.S. The objectives of this study are to determine the seasonal flux, and spatial and interannual variability of semi-volatile organic compounds in snow deposition. The study is led by the U.S. Geological Survey Water Resources of Colorado and is coordinated with the Western Areas Contaminants Assessment Project. Probable sources of these pollutants will be linked with back-trajectory modeling and direct sampling of trans-Pacific air masses. At the conclusion of these studies, recommendations for long-term monitoring of contaminants in North Coast and Cascades Network parks will be made.

Acadia National Park. *Characterize Rocky Intertidal Shorelines at Newly Acquired Navy Base Lands:* The purpose of this work is to evaluate the Schoodic Education and Research Center (SERC) shoreline in Acadia National Park to provide a marine community baseline and to provide management recommendations based upon diversity and abundance indices, an experimental trampling study, and characterization of visitor use of the SERC shore. The community structure and visitor use of four similar shores in Acadia are being evaluated for comparison with the SERC shore. Marine community surveys were completed, as were video transects running across the intertidal zone.

Yellowstone National Park. *Conservation of the Declining Yellowstone Pronghorn Population:* This three year project established a monitoring program of abundance and key vital rates for pronghorn. Researchers studied the ecological interactions among wolves, coyotes, and pronghorn to determine if there is differential recruitment among pronghorn fawning areas in relation to wolf and coyote densities and use areas. Migration patterns and summer use areas of pronghorn were

determined to ensure they are not adversely affected by future infrastructure projects. Researchers mapped habitat characteristics among fawning areas and migration routes of pronghorn. Information from the study is contributing to production of an electronic field trip focused on the conservation of Yellowstone pronghorn. The study is a collaborative effort among Yellowstone National Park, Yellowstone Ecological Research Center, University of Idaho, Bernice Barbour Foundation, and Yellowstone Park Foundation.

Great Sand Dunes National Park And Preserve. *Determine Grazing Ecology And Management Of Elk And Bison:* In 2000 the U.S. Congress authorized the expansion of the former Great Sand Dunes National Monument by establishing a new Great Sand Dunes National Park and Preserve in its place, and establishing the Baca National Wildlife Refuge. A new ungulate management plan to address the challenges brought about by the new land designations has not yet been developed. The new land areas have different management requirements, and the situation is predicted to result in elk seeking out the park and other protected areas as refugia. Elk are currently far in excess of agency goals and heavily impact fragile dune grasslands and sensitive riparian habitats within the national park, refuge, The Nature Conservancy lands, and private lands. Elk and bison both graze the Great Sand Dunes habitat, so the entire protected land complex needs to be managed as one ecosystem. This study will guide managers to a new grazing management plan for both elk and bison.

Saint Croix National Scenic Riverway. *Document Habitat Requirements of the Winged Mapleleaf Mussel: Potential Habitat Degradation and Decline:* The purpose of this study is to gather information on the habitat requirements of the federally endangered winged mapleleaf mussel. This information is needed in order to protect the existing population and establish new populations. The objectives are to describe the status of winged mapleleaf populations at three locations in the St. Croix National Scenic Riverway; describe winged mapleleaf microhabitat requirements; and monitor mussel community and habitat dynamics at several Riverway locations to assess habitat degradation. Thus far, study results

show that mussel density, species richness, and sediment size are significantly greater at locations with the federally endangered species.

Gateway National Recreation Area. *Efficient Surveillance, Targeted Management, Natural Transmission Dynamics of West Nile Virus:* This project used field data on species composition and abundance and West Nile Virus infection levels in mosquitoes and birds through time at Gateway National Recreation Area in a first attempt to describe West Nile Virus transmission dynamics. The results will be used to (1) develop efficient surveillance programs that can be used in national parks to monitor mosquitoes and West Nile Virus to determine the level of risk to humans and wildlife, and (2) make reliable decisions about mosquito and West Nile Virus management. The final product will be a surveillance and management protocol, adjustable to local environmental conditions at different parks, that can be used as a guideline for surveillance and management of mosquitoes and West Nile Virus.

Channel Islands National Park. *Establish Baseline Ecological Conditions of Newly Established Marine Reserves:* This project will expand the park's existing kelp forest monitoring program through establishment of 16 new fixed sites to ensure adequate inside/outside reserve baseline data to properly evaluate the effectiveness of the new marine reserves. This project collected 3 years of baseline data for 70 taxa or categories of algae, fish, and invertebrates from 24 fixed sites in and adjacent to 4 of the newly established Marine Protected Areas in Channel Islands National Park. This baseline data is currently being analyzed and will be used to evaluate the effectiveness of the Marine Protected Areas.

Cape Hatteras National Seashore, Cape Lookout National Seashore, Moores Creek National Battlefield, Congaree National Park, Charles Pinckney National Historic Site, Fort Sumter National Monument, Kennesaw Mountain National Battlefield Park, Chattahoochee River National Recreation Area, Horseshoe Bend National Military Park, Ocmulgee National Monument, Fort Pulaski National Monument, Fort Frederica National Monument, and Cumberland Island National Seashore. *Establish Exotic Plant Management Program for Southeast Coast Network Parks:*

Over a three year period this project will establish a module to develop and implement a systematic exotic plant management program at 13 units within the Southeast Coast Network. The parks protect significant resources which are being threatened with habitat loss, displacement of native species, alteration of ecological processes, landscape degradation, and damage to historic structures. The parks currently do not have the capability to effectively confront the exotic species invasion. While the ultimate objective is to eradicate populations of exotic plants, the broader objective is to establish an effective program that each park can maintain after project completion. Components of the developed plans will include inventories, supporting databases, prioritization, treatment prescriptions, and monitoring protocols. The module's full success will be achieved through treatment of each park's most severe threat.

Glacier National Park. *Evaluating the Prey Base for Lynx: Snowshoe Hare Abundance, Habitat Use, and Population Dynamics:* A December 2002 court ruling mandated that critical habitat be designated for Canada lynx (*Lynx canadensis*), which were listed as threatened in the contiguous U.S. in 2000. Because lynx are critically dependent on snowshoe hares as prey, designation of critical habitat is likely to require assessment of snowshoe hare populations. Because lynx occur in the park, it is crucial for effective park management to understand the dynamics of their principal prey. Currently, nothing is known about snowshoe hares in Glacier, thus making it difficult to assess which habitats in the park are suitable for lynx. The results from this project will be valuable for Section 7 consultation with U.S. Fish and Wildlife Service, management decisions, and protection of lynx under the Endangered Species Act.

Petrified Forest National Park. *Excavation of Threatened Fossil Bone-bed:* The purpose of the project was to conduct excavations of a fossil bone-bed with objectives of protecting scientifically relevant specimens being destroyed by erosion. Other components of this project include preparation and curation of fossils collected from the site as well as the publication and presentation of results. Initial and ongoing findings include salvage and recovery of several scientifically important spec-

imens including partial skeletons of Triassic Period reptiles. The fundamental project goals of salvaging and stabilizing threatened fossils have been successfully completed.

Padre Island National Seashore. *Protecting Endangered Kemp's Ridley Sea Turtle Nests from Vehicular Traffic:* The purpose of this project is to gather information vital to the development of management strategies for the Kemp's Ridley sea turtle at Padre Island National Seashore. From April 1 to July 14, 2007, NPS staff and 105 volunteers conducted nesting patrols on North Padre Island each day, for a total patrol effort of 121,492 kilometers and 8,895 hours. A record number of 128 Kemp's Ridley nests were found during FY 2007. Kemp's Ridley tissue samples were collected from adult nesting sea turtles, hatchlings and embryos found dead in the nest, and dead stranded turtles for genetic analyses. Data were collected on nest size, depth, sand compaction, and temperature. Study sites were set up around each natural nest after the eggs were removed and sites were monitored for disturbance by vehicles, pedestrians, and animals. Sand ruts caused by vehicle traffic were measured at sites where turtles were documented to have crossed them. Corrals were built at two locations in the park and sand temperatures monitored at these sites. Efforts to increase public awareness included 13 public hatchling releases where more than 2,200 people attended as well as 40 media interviews.

Great Smoky Mountains National Park. *Support for Predator Beetle Facility Needed to Control Exotic Hemlock Woolly Adelgids:* This project focuses on biocontrol for backcountry Hemlock Woolly Adelgids management. Currently *P. tsugae* is the biocontrol agent that is most available. University of Tennessee Beneficial Insects Lab produced nearly 200,000 predator insects for control of non-native hemlock woolly adelgid in Great Smoky Mountains and other cooperators, 150,000 of which were released in the park. This number exceeded expectations. Follow-up monitoring protocols have been developed and have already been initiated for the nine *P. tsugae* releases that occurred in the park in 2002.

Buck Island Reef National Monument. *Track Recovery of Overfished Ecosystem:* This project



A record number of Kemp's Ridley nests were found at Padre Island National Seashore during FY 2007.

Sasajiscymnus tsugae beetles feed on hemlock woolly adelgids in Great Smoky Mountains National Park.

will provide sound scientific documentation of imperiled habitats and depleted species in the recently expanded Monument and no-take reserve, and establish a long-term basis for evaluating their possible recovery. By leveraging more than \$325,000 from National Oceanic and Atmospheric Administration (NOAA) National Centers for Coastal Ocean Science Biogeography Program in partnership with Buck Island Reef, this project will:

- 1) provide missing information on benthic marine habitats and their use by vertebrate and invertebrate species,
 - 2) yield chemical and oceanographic data to begin assessing marine water quality, and
 - 3) provide information on previously harvested species of fish and marine invertebrates to document their condition and recovery.
- Transferable information could be applied to **Dry Tortugas National Park** and the **Virgin Islands Coral Reef National Monument**.

THREATENED AND ENDANGERED SPECIES PROJECTS

A portion of the NRPP funding is allocated for projects focusing on threatened and endangered (T&E) species to assist in implementing the Natural Resource Challenge and in meeting related strategic plan performance management goals. The long-term goal of the T&E program is to increase the number of populations of listed species that are making progress toward recovery, and to restore these species where they have been extirpated from parks. The program funds on-the-ground T&E conservation efforts. In FY 2007, \$474,000 was allocated specifically for these projects. Highlights of 2007 NRPP T&E projects:

Padre Island National Seashore. *Determining Seasonal Movements, Habitat Use, and Abundance of Piping Plovers:* The threatened Atlantic Piping Plover (*Charadrius melodus*) is a winter and stopover resident at Padre Island National Seashore. The objectives of this project were to determine seasonal movements, examine habitat use, and evaluate abundance in four sections of Padre Island's Gulf of Mexico. Eight surveys found 824 piping plover in late FY 2005, 78 surveys found 3,477 piping plover in FY 2006, and 68 surveys found 2,578 piping plover in FY 2007. The population fluctuated due to tidal variations, sampling frequency, man-made disturbances (including increased oil and gas activity), variations in

migration patterns, and storm events. Piping plover density is the highest within the northern 10 miles of the park with the highest numbers distributed over a 4.5 mile coastal strip that is closed to vehicular traffic. Radio transmitters and bands were attached to two piping plovers. Both birds were located 45 times within 51 attempts during 2.5 months of study. Both birds had extreme site fidelity within a 45 by 95 meter area. Despite many efforts, no successful captures have occurred since 2006. Additional analysis is currently underway to: 1) determine areas that consistently support the highest number of piping plover, 2) graphically demonstrate the distribution, 3) determine trends in habitat use, behavior, and distribution, 4) determine piping plover associations with other shorebirds, 5) determine the origin of banded birds and their distribution, and 6) analyze piping plover occurrence and distribution relative to weather.

Wind Cave National Park. *Reintroduction of Black-Footed Ferrets:* The three objectives of this project were to facilitate the establishment of a self-sustaining population of the federally endangered black-footed ferret (*Mustela nigripes*), test the viability of a reintroduction site with less than 5,000 acres of prairie dogs (Wind Cave National Park maintains two 3,000 acres sites of prairie dogs), and to provide surplus wild-born kits to other sites. On July 4th, 2007, seven ferrets were released back into the park after a 30 year absence. An additional 42 ferrets were released in 2007 bringing the total up to 49 for the year. Sixteen of the 49 ferrets released were captive bred ferrets that came from the National Black-footed Ferret Conservation Center in northern Colorado. The other 33 were wild born ferrets that came from the Conata Basin, 60 miles east of the park on the USDA Forest Service's National Grasslands in western South Dakota. This was the first year of a three to five year reintroduction effort with the U.S. Fish and Wildlife Service.

Point Reyes National Seashore. *Threatened Western Snowy Plover Recovery:* Since 1996, the National Park Service and Point Reyes Bird Observatory Conservation Science have collaborated in a project to study, monitor, and protect the federally threatened western snowy plover (*Charadrius alexandrinus*) within Point Reyes National Seashore. The

main objective is to implement the U.S. Fish and Wildlife Service's draft Snowy Plover Recovery Plan and to restore 64 breeding pairs within Point Reyes. In 2007, the program increased chick hatching rates, nesting success, and chick fledging rates, as compared to 2006. In FY 2007, a total of 28 nests were found on Point Reyes beaches (22 were fenced to protect them from predators, dogs, and recreational disturbance), the breeding plover population was estimated at 30 to 32 pairs, 83 eggs were laid (up from 69 in 2006), 64 chicks were hatched (up from 51 in 2006), and 24 chicks survived to fledge (the highest number since 1999). A volunteer education program educates visitors about the plover life cycle, ways to reduce human impacts, awareness for the plover recovery program, compliance with area closures, and coastal restoration efforts. About 2,500 weekend and holiday visitor contacts were made by park employees and docents. Breeding plovers used newly restored coastal dune habitat, foretelling future larger program successes. Between 2001 and 2005, 50 acres of non-native plants have been removed from important plover habitat, thus increasing fledgling success. For the first time since 1972, plovers nest in restored dune areas once dominated by the non-native European beachgrass. The restored site allows plovers to see approaching predators and provides protection and native food sources. Male plovers have moved chicks to the restored area from as far as 1.5 miles away.

DISTURBED LANDS RESTORATION PROJECTS

In FY 2000 a portion of NRPP funds was established for projects related to disturbed land restoration. Disturbed lands are those park lands where the natural conditions and processes have been degraded, damaged, or destroyed by developments (e.g., facilities, roads, mines, dams) and/or by agricultural practices (e.g., cropping, grazing, timber harvest). Restoration is the process of assisting the recovery of disturbed areas through direct manipulation of degraded ecosystem components. Regions submit proposals for park projects, which a panel of subject matter experts review and recommend for funding based on project quality, resource threats, and other factors. Projects must cost at least \$10,000 but not more than \$250,000, and may last up to 3 years. Parks receive their project funding an-

nually. Some project highlights from FY 2007 are:

Great Basin National Park. *Reclamation of the Lincoln Cirque Mining Exploration Area:* Disturbance associated with the Lincoln Cirque mining exploration area was affecting the hydrologic function of the north and middle forks of the North Fork of the Big Wash watershed. The Big Wash watershed was selected as a reintroduction site for the Bonneville cutthroat trout (*Onocorhynchus clarki utah*). The National Park Service entered into a conservation agreement with the U.S. Fish and Wildlife Service in January 2001 to prevent listing of Bonneville cutthroat trout as a threatened species. Therefore, correcting impacts to the aquatic ecosystems from this mining exploration site and restoring watershed health were a high priority in assisting with the Bonneville cutthroat trout recovery efforts. Watershed conditions outside of the mining impacts are essentially pristine. The area is an important bighorn sheep lambing area and suitable for wilderness designation. The Lincoln Cirque exploration area consisted of 31.5 acres with associated mine-related features, including 10 exploration trenches, 12 waste rock piles, and more than 1.7 miles of roads. The project included re-grading the main access road to preexisting natural drainage patterns and constructing an environmentally compatible hiking trail in the former road prism. All side roads, landings, trenches, and pits were re-graded and/or de-compacted. Erosion control matting was used where needed and native seed used throughout the site. Hand crews then placed native mulch, large rocks, and down woody debris on the sites to assist with natural re-vegetation by creating microenvironments to intercept rainfall and wind-blown seeds, and to increase seed germination.

Indiana Dunes National Lakeshore. *Complete Restoration of 500 Acres of Wetland at Derby Ditch-Great Marsh:* The Great Marsh is an inter-dunal peat base wetland in a dune-beach complex less than one-mile from Lake Michigan. The wetland sits between two large dune systems. The southern perimeter is delineated by the Calumet Dunes, which are approximately 10,000 years old and the northern perimeter by the Tolleston Dunes, which are only 3,000 years old. There is historical evidence that the Great Marsh once extended from

Gary, Indiana, east nearly to Michigan City, a distance of 20 miles. Industrial development eliminated the western half of the Great Marsh, and today the Great Marsh is only ten miles long and a half-mile wide. The goal of this project was to return the Great Marsh-Derby Ditch to a condition reflective of ecosystem processes and plant community types found in the pre-industrial period of southern Lake Michigan. This specific project builds upon work to restore the hydrology of Derby Ditch-Great Marsh, which was initiated in 1998 in cooperation with the Indiana Department of Environmental Management and further funding from the U.S. Fish and Wildlife Service-North American Waterfowl Conservation Association, which enabled filling numerous portions of the ditch to reestablish native hydrological patterns. In FY 2007, the third and final year of funding, the following tasks were accomplished. Herbicide was applied to 5 invasive species covering approximately 220 acres representing an estimated 17 infested acres. The woody canopy was reduced on approximately 1-acre and 31,250 plant plugs representing 34-species were installed. Approximately 12 pounds of seed representing 17 species were collected. Oversight was provided for off-site wetland mitigation in which fill from 1.4 acres of abandon home-sites was removed and native seed and plants installed, 6 groups of volunteers, representing 68 volunteers, installed 1,550 plants and removed garlic mustard and cattail seedlings.

Glen Canyon National Recreation Area.

Restoration of Springs on Navajo Point: The enabling legislation for Glen Canyon National Recreation Area authorizes grazing by domestic livestock. Portions of Glen Canyon have been grazed since the late 1800s. In some areas overgrazing has occurred, resulting in soil erosion, changes in vegetation, increases in exotic plants, and losses of wildlife species. Some of the most severe examples of overgrazing are associated with high elevation springs. The Navajo Point springs occur at elevations of about 7,300 feet where groundwater emerges from shallow swales and intermittent stream channels at points of contact with underlying sandstone bedrock. This project sought to restore Cottonwood, East End, and French's Springs in the Navajo Point area. NPS staff identified six objectives: eliminate feral animals from allotments; prepare plant species

lists for restoration purposes; collect baseline data on sites prior to restoration; collect native plant materials and propagate for restoration; contract for physical rehabilitation and planting; and monitor progress of project in terms of water discharge, sediments, and vegetation and wildlife recovery for two years. In FY 2007 funding for this project enabled the physical rehabilitation, planting of native species, and monitoring of recovery. Physical restoration included installation of small check dams using natural on-site materials composed of fallen logs, boulders and rock to reduce soil erosion and runoff, and to dissipate flood energy. In some areas, staff used burlap and other biodegradable material to stabilize dams and other check points. Planting live willow stakes (*Salix lutea*) and dogwood (*Cornus sericea*) followed the physical stabilization at two of the springs where vegetation had been eliminated.

Golden Gate National Recreation Area. *Complete Restoration of Salmonid Habitat at Banducci:* This project implemented the second phase of a two-part project to restore natural processes and stream channel habitat for federally listed Coho salmon and steelhead trout in Redwood Creek where it flows through the Banducci site. The Banducci site is a 28-acre former flower farm where agricultural operations impaired natural processes along 3,800 feet of the creek. Redwood Creek will be returned to natural processes that include floodplain overflow, expanded riparian habitat, increased channel complexity, reduced incision, and increased sinuosity; all of which enhance habitat for Coho salmon and steelhead trout. The creek supports the United States' southern-most genetically viable population of Coho salmon (*Oncorhynchus kisutch*) as well as a population of steelhead trout (*O. mykiss*), both federally listed threatened species in the North Central California Coast Evolutionarily Significant Unit. Project goals were reached by excavating about 2,000 cubic yards to create 0.6 acres of new terraced floodplain along 550 linear feet of incised channel. Six engineered log jams were also installed to induce a natural meander in a channelized reach with very little habitat complexity.

Sleeping Bear Dunes National Lakeshore.

Platte River/Waterwheel Site Restoration: The Platte River flows through Sleeping Bear

Dunes National Lakeshore at a very low gradient, in a uniform sandy dune/beach substrate as it moves toward Lake Michigan. The Waterwheel Site is an approximately 300 foot long reach of the Platte River located immediately downstream of Platte Lake and upstream of Loon Lake and Lake Michigan. Park managers identified the Waterwheel Site for restoration because of the significant man-made impacts, visitor safety concerns, and high probability of success. Prior to restoration the right bank of the channel consisted of a concrete wall and the left bank had a wood retaining wall. Both artificial walls had fill material placed behind them. Both retaining walls had once served former canoe liveries; but were failing, causing unsafe conditions and degradation of the river habitat. The artificial channel walls encroached into the natural channel of the river, increasing flow depth and velocity, and preventing the channel from developing a natural stable cross-section form with natural vegetation. In addition to the wood retaining wall, the left bank also contained a 110 foot long, 30 foot tall, and ¼ inch thick steel sheet pile wall. The steel sheet was installed in the early 1990s to prevent hydrocarbons from entering the Platte River through groundwater migration during the clean-up of contamination caused by nearby underground fuel storage tanks. The steel sheet was covered with six-inch diameter cobbles. The steel sheet and cobbles were no longer needed and prevented the restoration of natural stable channel banks and vegetation. Park staff developed specifications to revegetate the site with the appropriate number and type of plant species. No erosion control measures were anticipated for the reconstructed channel banks, because the channel bank slope, the depth of flow, the shear stress and the flow velocity would be extremely low along the reconstructed channel banks. Park staff installed siltation control. The sheet pile

and cobbles were removed from the left bank. The left and right banks were cleared and grubbed. Staff excavated and disposed of the left and right bank encroachments. The concrete wall was demolished and disposed of. Park staff seeded the area with native species.

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. The funds are allocated according to the natural resource management workload of these parks.

In FY 2007, 60 projects in at least 57 parks were funded. In total, \$948,000 was allocated in FY 2007 to the regions for these projects. A complete list of the projects is included in Appendix B.

Mount Rushmore National Memorial. *Control Exotic Flora:* This project is part of ongoing annual efforts to eradicate exotic flora within the memorial. Seasonal staff worked in conjunction with the Northern Great Plains Exotic Plant Management Team. With the team, they utilized GPS, chemically sprayed, and manually removed exotic plants from the park. Approximately 60 acres were treated either chemically or manually to reduce exotic plants within park boundary. Continuous efforts need to take place to completely eradicate exotic plants from Mount Rushmore.

Saugus Iron Works National Historic Site. *Control Invasive Phragmites australis for Saugus River Restoration:* The purpose of this

NRPP—Small Park Projects			
Region	Funding (\$)	Number of parks	Number of projects
Alaska	19,000	2	2
Intermountain	246,000	14	14
Midwest	173,000	13	13
National Capital	19,000	2	2
Northeast	118,000	8	8
Pacific West	164,000	7	8
Southeast	209,000	11	13
Total	\$948,000	57	60



Anchialine pools are rare ecosystems. Protection of anchialine pool resources is a priority for Kaloko-Honokohau National Historical Park.

NPS Photo: Jessica Schwartz

project was to complete phase one of control of the invasive non-native common reed in three acres of floodplain wetland along the Saugus River in Saugus Iron Works National Historic Site. The objective was to manually cut the standing *Phragmites* and establish conditions that would allow access through the site by the Northeast Region Exotic Plant Management Team for phase two herbicide treatment. Phases one and two were accomplished in the summer of 2007. Phase three of control will occur as part of the project “Restore Saugus River Turning Basin and Dock” in 2008–2010.

Kaloko-Honokohau National Historical Park.

Developing an Anchialine Pool Catalogue, Spatial and Temporal Database, and Collating “Lost” Pool Data: Anchialine pools are rare, unique ecosystems of brackish water that are tidally influenced but have no direct connection to the ocean. The pools are hydrologically connected to the groundwater and provide habitat for endemic, rare and candidate endangered species. Throughout Hawaii, and particularly Hawaii Island, anchialine pools

are threatened by development, aquifer withdrawals, groundwater pollution, and exotic species. Protection of anchialine pool resources is a priority for Kaloko-Honokohau National Historical Park, which contains approximately 10 percent of the state’s pools. The purpose of this project is to improve the efficacy of anchialine pool management and research by individually identifying, mapping, and recording basic biological and physical data on each pool. These data are being collected at each tidal state and are entered into a comprehensive geo-spatial database that also incorporates water quality and biological inventory data from previous and ongoing studies. Researchers glean previous studies for data and cross-reference them into the database to enable comparison of the results of research on specific pools over time.

Congaree National Park. *Identify Genetic Differences within the Rare Carolina Bogmint Populations:* Researchers observed differences between two known populations of Carolina bogmint (*Macbridea caroliniana*), a globally imperiled plant species. This project col-

lected both genetic and habitat parameters to complement the existing baseline information pertaining to the spatial distribution and pollination of Carolina bogmint. Researchers collected leaves from 200 stems in the muck swamp east of Cedar Creek as well as 50 stems from the muck swamp west of Dry Branch. These samples will facilitate genetic work. Researchers prepared the field samples by fixing leaf tissue in extraction buffers, collecting proteins on paper wicks, preserving/storing wicks onto micro test plates for gel electrophoresis, and transferring specimens to the University of Georgia for analysis. The data analysis phase of the project will continue in FY 2008 in order to meet the study objectives.

Arkansas Post National Memorial. *Inventory, Mapping and Control of Exotic Plants:* This project aimed to identify, record, and control exotic plant populations at both the memorial and Osotouy units. The first step in this process was to conduct a thorough survey of both the terrestrial and aquatic plant communities of both units, which encompass 758 acres. Location, area, cover density, and phonology were recorded. Researchers used this information to populate an exotic plant database and create maps. Once exotic taxa and associated attributes were identified and mapped, then staff could complete treatment prioritization of the various exotic plant populations. NPS staff considered the potential to alter resources, the potential for spread, and the feasibility of control when deciding where and how to control exotic plants. This project produced GIS data that resource managers will use to guide exotic plant control, reduction of invasive plants on the natural landscape, and reduced resource competition for native species. Eight gross-acres of parkland impacted by invasive plants were surveyed and treated. Youth Conservation Corps and NPS staff cut down and treated exotic trees and shrubs, including trifoliate orange (*Poncirus trifoliata*), Chinese and European privet (*Ligustrum sinense* and *Ligustrum vulgare*), and Japanese honeysuckle (*Lonicera japonica*). The invasive plants removed constituted 4.5 acres of the 8 acres targeted for treatment. Mapping of the treated area was also completed.

Vicksburg National Military Park. *Perform a Mussel Survey:* The park contains upwards of 7.5 miles of streambed habitat that may be

utilized by listed or non-listed mussel species. This project will allow for an intensive and comprehensive survey targeting mussel species that will provide park managers with definitive data regarding the presence or absence of mussel populations within the park. This information will then be available to park staff when making future management decisions that may affect streambed habitat. One issue that has the potential to adversely affect Vicksburg National Military Park streambed habitat is whether or not, and to what extent, the park proceeds with battlefield restoration. Restoring the battlefield more closely to its wartime appearance necessitates removing an undetermined quantity of forest cover. As forest cover directly influences stream ecology, knowing whether or not a stream contains T&E species (such as mussels) is imperative prior to restoration activities being undertaken. Researchers have begun preliminary work on the park's mussel survey, and will continue the study through the fall 2007.

Timpanogos Cave National Monument. *Restoring the Natural Cave Soundscape:* There are 35 timers located throughout the cave system. Each timer produces a distinct ticking noise. This ticking noise can be heard throughout the cave system, impacting both the natural soundscape and the visitor experience. This project will restore the natural soundscape of the cave which is vital to the functioning of the park. It may also provide indicators of the health of the cave ecosystem and will increase understanding of the impact of human noise on quiet places. Tour operations close for the winter season. This closure allowed the park to begin the on-site work. Two lighting control boxes were removed from the cave system to use as references for the new lighting control system. A contract was awarded for the design and components of 35 new lighting control timers. A second contract was awarded for the installation of the new timing control boxes once they are completed. The installation of the new timing control boxes is expected to be completed in early May 2008 after the winter snow melts and the caves are safely accessible.

Pipestone National Monument. *Tallgrass Prairie Restoration/Exotic Weed Control:* This project sought to restore 1 acre of agricultural field to native prairie and contain or eliminate 1.7 acres of nonnative plant species throughout

the monument. In 1997, the monument identified 80 acres of targeted disturbed lands. The monument has restored 1 acre of this land every year since. Restoration activities include prescribed fires, seed collecting, spreading native seed, and exotic weed control. Eleven of the 90 non-native species are highly invasive, capable of causing adverse impacts, and require annual treatment to protect the existing tallgrass prairie plant communities. In 2007 staff seeded 15.3 acres of recently acquired abandoned agricultural field with seed previously collected from the monument's native prairie. Monument staff also treated 131 acres of exotic species during the field season and collected 50 pounds of seed for future restoration projects.

REGIONAL BLOCK ALLOCATION PROJECTS

NRPP funding is available to all NPS regions for park projects as a part of regional natural resource programs. Qualified projects are those that improve natural resource knowledge and condition, including projects such as specialized inventories (those currently outside the scope of the Servicewide I&M Program's 12 databases) and mitigation actions (i.e., fossil inventories and invasive plant or invasive animal control). NRPP Regional Program Block Allocation funds are used for a wide variety of projects. For example, the Pacific West Region has funded several projects that are multi-park projects; meaning the same project is conducted in several parks in that region. In the Midwest Region the projects fall under several broad topical categories: Resource Inventories and Biological Surveys; Ecology and Species Management; Species Monitoring and Control; Impacts to Resources; and Ecosystem Restoration.

In FY 2007, a total of \$1,324,000 was allocated to 72 projects in 50 parks. A complete list of these projects is included in Appendix B. Some 2007 highlights are:

Ozark National Scenic Riverways. *Assess Spring Input and Water Quality:* This project gives the park its first substantial park wide inventory of freshwater spring resources. The park contains more than 420 documented springs, one of the highest in the National Park System. Due to the large number of springs, the project accomplished approximately 7/8 of the inventory, with the uppermost portion of the Current River still to be surveyed. The accomplishments to date include individual site data assessing both hydrologic and cultural characteristics, GPS points, an ArcGIS layer with quality-checked attribute information, an assessment of spring distribution by geologic bedrock, photo documentation for each spring, and a characterization of previously unknown distribution of spring fauna within these hundreds of spring sites. This information will allow park managers to make better informed decisions about park springs.

Effigy Mounds National Monument. *Control and Survey New Garlic Mustard Populations:* This project allowed for a complete follow-up of previously treated garlic mustard infestations on the North Unit, South Unit and the Heritage Addition of the monument. Staff employed a backpack torch to incinerate the seed bearing plants and first growth of garlic mustard. This application was conducted in areas that have had substantial investments of time and effort with spraying, hand pulling by volunteers, prescribed fire and backpack burning earlier in the season. Due to the timing of the funding authorization the garlic mustard was

NRPP—Regional Block Allocation Projects			
Region	Funding (\$)	Number of parks	Number of projects
Alaska	190,000	2	10
Intermountain	189,000	10	9
Midwest	189,000	9	10
National Capital	189,000	7	16
Northeast	189,000	5	10
Pacific West	189,000	8	8
Southeast	189,000	9	9
Total	\$1,324,000	50	72

already into seed when the project started. This limited the treatment process to that of using a backpack burner to incinerate the seed heads and first year plants. This application of fire allowed for a control effectiveness to approach nearly 100 percent in the prevention of seed release. Due to the ability of each plant to produce hundreds of seeds, this level of treatment is necessary to control populations by drawing down the seed bank. This project also utilized Youth Conservation Corps personnel for hand removal of garlic mustard where there was no danger of seed dispersal.

George Washington Memorial Parkway. *Create Digital Atlas of Breeding Wood Warblers at Turkey Run and Great Falls Parks:* Researchers conducted a survey of breeding wood warbler species during the 2006 and 2007 breeding seasons at these two units. Bird diversity and abundance was estimated using point-count survey methods, standard breeding-bird atlas techniques, and nest finding. The survey will be used to generate a digital breeding bird atlas for natural resource managers. Warblers are of specific ecological interest because they are sensitive to both natural and human-induced environmental shifts, especially habitat fragmentation.

Whiskeytown National Recreation Area. *Determine the Hydrologic, Geochemical, and Historical Factors that Influence *Puccinellia howellii*:* The objective of this project was to develop a restoration, monitoring, and management plan for Howell's alkali grass (*Puccinellia howellii*) and the salt springs that support the only known occurrence of this narrowly endemic grass. During FY 2007, hydrologic, chemical, botanical, and edaphic field data were collected and provided critical information on the complex requirements for *P. howellii* success. Additionally, 350 *P. howellii* seedlings were planted in areas that spanned the environmental gradients present on the site. Survival and seed production of the plantings were tracked for over a year. Extensive topographic survey data were collected and are being used to create detailed plans for removing unnatural features and to restore natural water flow patterns and soil processes. This information is being used as the basis for a restoration plan, which will outline the steps necessary to re-establish the natural hydrologic, geochemical and edaphic properties to support *P. howellii*.

iii. The restoration plan will provide: 1) the degree and extent to which *P. howellii* habitat has been impacted; 2) guidelines on how the habitat would best be restored; and, 3) a strategy for monitoring the success of restoration efforts. Implementation of the restoration will be conducted with NPS partners, which include the California Department of Transportation, California Department of Fish and Game, and USFWS.

Manassas National Battlefield Park. *Habitat Preferences of Birds Wintering in Restored Grasslands of the Mid-Atlantic Region:* Populations of many grassland bird species are in decline. Conservation activities at Manassas and other national parks have included grassland restoration to increase the quality of park habitat for wildlife. This study gathered information about habitat requirements of birds wintering in grasslands in order to aid in the development of management plans that will benefit these activities in national parks. The goal of the work completed thus far was to determine the influence of grass vegetation structure and hedgerows/tree lines on habitat use by birds, since these can be manipulated by land managers to improve habitat. Song sparrows (*Melospiza melodia*) and savannah sparrows (*Passerculus sandwichiensis*) were the focal species of the study. Savannah sparrows preferred shorter grasses and tended to stay away from edge, while song sparrows preferred taller vegetation near edges. However, both species utilize areas with more dense vegetation, possibly because it provides escape cover within the field. Based on this information, birds would benefit from a variety of grass heights and density within fields, as well as retention of some vegetated edges to provide cover. Future work will focus on determining how much land area is needed to provide adequate winter habitat, what foods are important to these species, and whether they return in successive years. Data gathered from this work will provide comprehensive recommendations for natural resources managers that will enhance the quality of parks for wildlife conservation. Improved habitat will also enhance wildlife viewing opportunities for visitors.

Santa Monica Mountains National Recreation Area. *Implementation of a Three-Phase Containment, Eradication and Restoration Program*



A sound monitoring station at Denali National Park's Kahiltna Pass, 10,500 feet above sea level.

Resource managers completed field data collection for all parks within the Alaska Region containing active Off-Highway Vehicle (OHV) trails adjacent to, or within park boundaries.

for *Harding Grass*: The purpose of this project was to eradicate *Harding Grass* (*Phalaris aquatica*) infestations on NPS lands within the Santa Monica Mountains National Recreation Area. Ninety-eight infestations of *Harding Grass* over 33.5 acres were treated. Cover was reduced from 50–90 percent to 5–20 percent. Eradication goals defined in the implementation plan were met; however, third year plans to begin native plantings were delayed due to extreme drought. Implementation of these plantings will begin in FY 2008, rainfall permitting.

Canaveral National Seashore. *Measure Sea Turtle Nest Predator Distribution and Abundance*: This study assessed the effects of natural and anthropogenic environmental variation on raccoon (*Procyon lotor*) activity, ghost crab (*Ocypode quadrata*) density, and the subsequent effects on loggerhead turtle (*Caretta caretta*) egg predation. During the 2007 summer, researchers monitored 96 randomly located transects. Transects were sampled in sets of 24 on two-consecutive nights biweekly, from mid-March through October. On each sampling event, transect length was measured, and all mammal tracks were identified to species, counted and measured. Nest fates (predation, inundation, hatching success) have been monitored in 136 loggerhead nests. In fall/winter 2007 researchers will use multiple regression models to assess the effects of environmental variables (turtle nesting activity, GIS habitat coverage, recreational activity, etc.) on raccoon activity. Subsequently, the effects of raccoon activity on ghost crab density and marine turtle egg predation by both predators will be monitored. These analyses will allow researchers to identify factors affecting the likelihood of predation, assess the efficacy of current management, and make suggestions to improve the efficiency of future management.

Shenandoah National Park. *Remove Non-native Plants From A Globally Rare Community—Monitor Rare And Non-native Species Extent*: This project aimed to protect the integrity of a rare wetland plant community from invasive plants. The project goals were to document the extent of invasive plants, to document the extent and status of rare plants, and to remove invasive plants. In FY 2007, student volunteers and NPS staff

spent 700 hours hand-pulling invasive species. All stems of Japanese stilt grass (*Microstegium vimineum*), Garlic mustard (*Alliaria petiolata*), and Oriental lady's thumb (*Polygonum caespitosum*) were hand-pulled from a 1.62 hectare area. To maximize effectiveness, pulling continued to focus on the two most pristine areas of the wetland. The invasive plant treatment area was located within and surrounding two quarter hectare areas that support numerous rare plant populations.

ALASKA SPECIAL PROJECTS

This funding category was established in FY 2003 to enable the National Park Service to undertake projects to better protect and manage Alaska's National Park Service units, which are managed under the Alaska National Interest Lands Conservation Act and other Alaska-specific requirements. Selection criteria for projects supported through this source included appropriations language, proposal reviewers' recommendations, park, and regional priorities. In 2007, projects included mapping of off-highway vehicle routes, testing of landscape-scale acoustic profiling, and acquisition of high resolution satellite imagery for base cartography. Other projects supported through the Alaska Special Projects included baseline genetic research on salmon and brown bear populations and evaluation of international efforts to preserve the declining Chisana caribou herd.

Denali National Park and Preserve. *Stratified Random Sampling for Baseline Soundscape Conditions in Large Alaskan Parks*: The purpose of the project is to develop the methods and sampling protocols for effectively building a baseline soundscape inventory. The objectives identified for the 2007 fiscal year were to collect and analyze acoustical data at eight sites throughout the summer visitor season, and compile a representative sound profile for each site. An acoustical database was developed, allowing for effective implementation of the Backcountry Management Plan. A protocol for monitoring sound in large Alaskan parks is under development. The analyzed acoustical data is being used by park planners as an indicator of the frequency and intensity of man-made noise intrusions on the parks' natural sounds. Other possible uses include biological habitat assessment and species identification.

Wrangell-St. Elias National Park and Preserve: *Nesting and foraging ecology of Kittlitz's murrelets in Icy Bay:* Despite the relatively pristine environment of Icy Bay, the local population of Kittlitz's murrelets (*Brachyramphus brevirostris*) has declined by 53 percent (18 percent per year) since 2002. To better understand and manage Kittlitz's murrelets, the park hired three seasonal technicians to assist with a study in Icy Bay from May–August 2007. Researchers captured and attached radio-transmitters to 37 Kittlitz's murrelets from 15–22 May. During the breeding season staff located 30 birds. Investigators recorded standard morphological measurements to compare with other populations and banded all birds with a USFWS band on the right leg. They also photographed the dorsal and ventral portion of each murrelet. Blood samples were submitted for sex identification and hormone analyses to determine number of fecund females in the population. The primary goal of this effort was to determine the efficacy of a modified mark-recapture study intended to provide information on local and over-winter survival in future years.

Alaska Parks. *Mapping and Scientific Management of Off-Highway Vehicle Trails in Alaska—Implementing Backcountry Management Plans:* Resource managers completed field data collection for all parks within the Alaska Region containing active Off-Highway Vehicle (OHV) trails adjacent to, or within park boundaries. Summer 2007 field data collection of trail centerlines and condition assessments were conducted for: **Klondike Gold Rush, Katmai, Gates of the Arctic, Wrangell-St. Elias, and Denali.** Final data sets (map products, tables and trail condition classifications) were produced for OHV trails inventoried during the summer 2006 field season. This included: **Lake Clark, Aniakchak, Gates of the Arctic, Cape Krusenstern, Wrangell-St. Elias, and Yukon-Charley.** State of the Trail Assessment was modified to adapt Trail Management Objectives from the USDA Forest Service TRACS methodology. Refinements to Evaluation of Management Options were also made with the development of standardized trail project reports that provide design, construction, and cost data for sustainable trail projects conducted in cooperation with the NPS-Alaska Region Rivers, Trails, and Conservation Assistance Program. Previous completed data sets

for **Denali, Glacier Bay, and Wrangell-St. Elias** were used extensively by regional and park staff to respond to OHV related NEPA actions in those parks.

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. Information on the project topics and status reports are found in Appendix E.

SERVICEWIDE PROJECTS

In addition to parks, there are often project needs outside specific Servicewide programs that require funding unavailable from other sources. These special needs are often interdisciplinary, and may include activities with professional organizations, certain publications, or work on Servicewide databases. Specific project needs that cannot be accommodated operationally are identified for funding by NRPP, fee monies, or other sources. A significant amount of the funding and projects provide assistance to parks, either through special topic workshops on issues affecting parks, or the development and support of tools to assist parks. Projects related to airborne contaminants, geo-hazards, emergency response, and ocean stewardship are examples of projects funded in FY 2007. For a complete list of funded projects see Appendix B.



Chapter V: Servicewide Natural Resource Programs

Essential to the success of the Natural Resource Challenge and management of the National Park System were the development and strengthening of Servicewide resource focused programs. These Servicewide programs are a repository of wide-ranging expertise that provides invaluable assistance to parks in the areas of policy and legal advice, technical assistance, plan and proposal development, and education/outreach. The Natural Resource Challenge focused on strengthening four basic program areas: Air Quality, Biological Resource Management, Water Resources, and Geological Resources. In addition to these core programs, the Environmental Quality and Natural Sounds Programs also provide expertise and direct assistance to requesting parks. This chapter summarizes some of the results of effective partnerships between parks and these programs to improve natural resource protection through all aspects of discovery, learning, understanding, sharing, resource protection and restoration, and evaluation.

AIR QUALITY PROGRAM

The National Park Service Air Quality Program is responsible for preserving, protecting, and enhancing air quality and air quality-related values (i.e., resources that are affected by air pollution, including, visibility, soils, aquatic systems, and vegetation) in the National Park System in accordance with the NPS Organic Act and the Clean Air Act. Air quality protection relies on acquiring information about air quality and Air Quality Related Values (AQRVs) in parks. To learn about the health of park air resources, the Park Service conducts air quality monitoring at numerous park units and supplements this in-park data with representative data from other nearby monitors. Data relevant to resources sensitive to air pollution are also collected at various parks. Data analysis provides understanding of the causes and effects of pollution on park resources, while also identifying sources of pollution that are likely contributing to pollution in parks. Trend tracking is used to measure and evaluate performance, identify problem areas, and allocate staff and fiscal resources.

Because the Park Service is not an air regulatory agency, information sharing and collaborative activities are used to promote development of plans, regulations, and permitting decisions that help improve air quality in parks. Information gathered from air quality monitoring and data analysis is shared with park managers, researchers, the public, and regulatory agencies. After more than 20 years of monitoring in numerous parks and through advancements in science, understanding, and collaborative relationships; in 2007 the Air Quality Program was able to produce its first “scorecard” characterizing air quality conditions and trends in 140 parks.

In 2002, the Natural Resource Challenge supplemented funding for the Air Quality Program and subsidized additional monitoring, including an assessment of airborne toxic contaminants in parks. Funds were also made available to augment professional expertise within the Program and at strategic locations to better serve specific local and regional resource management needs. As a result, there is an enhanced ability for the National Park Service to engage in external arenas where decisions regarding pollution control programs are being made. The quality and accessibility of air quality data, along with the improved ability to engage in collaborative activities with regulatory agencies and stakeholders have facilitated the achievement of NPS air quality goals.

Learning and Understanding

Air Quality Monitoring and Data Analysis: The National Park Service operates a network of ambient air quality monitoring sites in units across the system. Under the Gaseous Pollutant Monitoring Program the Park Service currently measures ozone, carbon monoxide, sulfur dioxide, nitrogen oxides, and particulate matter. As part of the Clean Air Status and Trends Network the Service monitors ozone and dry deposition. The Park Service tracks wet deposition as part of the National Atmospheric Deposition Program/National Trends Network. Via the Mercury Deposition Network the Service measures mercury in parks. The Park Service monitors visibility and

Providing parks like Yellowstone National Park with detailed digital soil maps is one of the many services of the Geological Resources Program.

particulate matter as part of the Interagency Monitoring of Protected Visual Environments (IMPROVE).

Air quality monitoring provides data crucial to effective air quality protection and management. As a result of monitoring located in park units and numerous other parks with monitors nearby, the Park Service reports on air quality conditions in 141 parks. 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 EPA, 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, to employ less expensive monitoring equipment in some areas (e.g., portable ozone samplers), and to solicit funding support from state and local agencies.

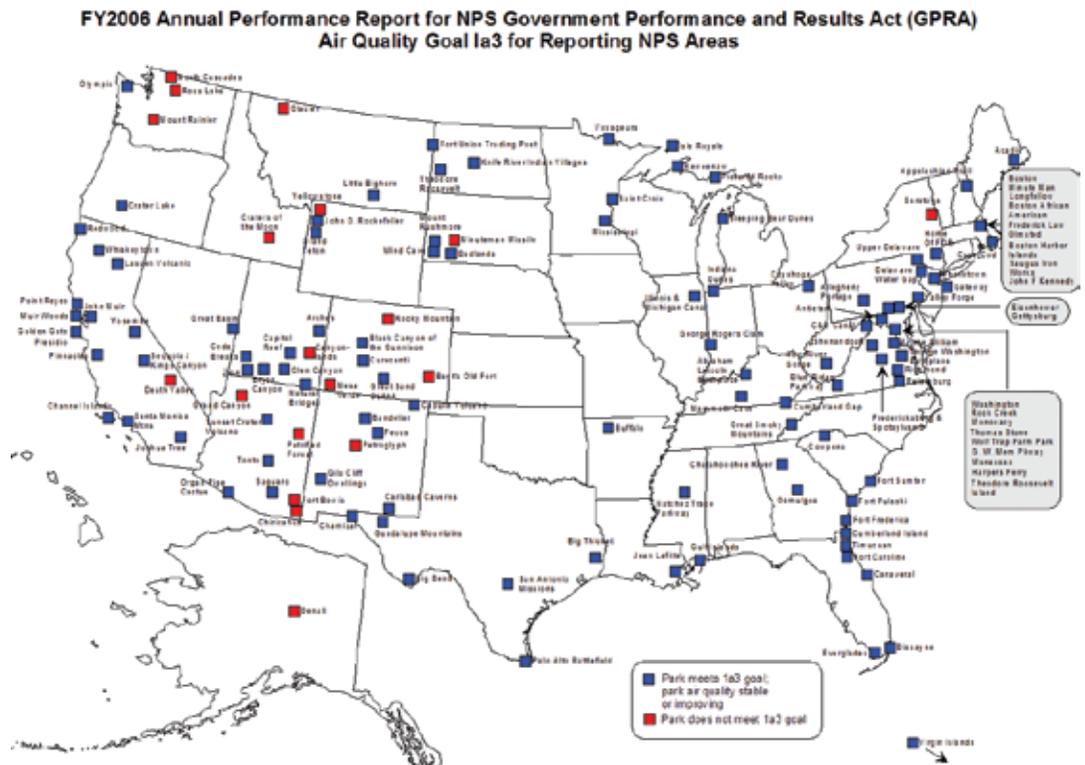
Through analysis of these and other monitoring data, the Program provides air quality assessments for most park units with significant natural resources. The Inventory and Monitoring networks are planning for long-term natural resource monitoring of vital signs, that is, indicators of ecosystem health. Many of the networks have identified air quality as a “vital

sign” and are relying on this Program for guidance and support for air quality monitoring. Special monitoring and data analysis themes include:

Yellowstone National Park. Several years ago, winter snowmobile traffic was found to be producing carbon monoxide concentrations that were approaching the National Ambient Air Quality Standard at the West Entrance. The Program provided on-going air pollution monitoring at several locations and assisted in measuring the in-use emission levels of snowmobiles and snowcoaches. These data were used in models to test various scenarios for the Winter Use Plan and as part of the park’s adaptive management plan feedback. The Program provided air quality and vehicle emissions information, reviewed and advised on the modeling plans, advised the park on possible snowcoach Best Available Technology (BAT) emission controls, attended public stakeholders meeting on the Winter Use Plan Environmental Impact Statement, and provided information on air quality at a public meeting in Cody, Wyoming.

Night Sky Monitoring Program: One of the key tasks of the Night Sky Program is to inventory night sky quality in parks. In FY 2007, inventories were completed in 3 more parks and initiated in 13 more parks bringing

A map of air quality monitoring stations in national parks.



the total completed to 30 with 24 in progress. Additionally, night sky data collection methods were peer reviewed and published. Other important tasks have been to retrofit lighting in parks, advise parks on new facility lighting, and compile a knowledge base of night sky friendly lighting standards. Partnership with the International Dark-sky Association (IDA) has resulted in the creation of a Dark Sky Park certification program. **Natural Bridges National Monument** was named the first IDA Dark Sky Park, and several other parks are currently pursuing this status.

Rocky Mountain National Park. RoMANS (Rocky Mountain Atmospheric Nitrogen and Sulfur Study): The park is experiencing a number of harmful effects due to atmospheric nitrogen and sulfur compounds. These effects include visibility degradation, changes in ecosystem function and surface water chemistry from atmospheric deposition, and human health concerns due to elevated ozone concentrations. The nitrogen compounds include both oxidized nitrogen (compounds derived from nitrogen oxide emissions) and reduced nitrogen (compounds derived from ammonia emissions). The effects of organic nitrogen compounds are not known at this time. The objectives of this study are to further our understanding of what will be needed in the longer term to address effects at the park and to reduce uncertainties for future planning efforts.

Ecological Effects Projects: The ecological effects program had two primary areas of focus in FY 2007: ecosystems indicators and thresholds. Natural resources vary in their response to air pollutants. The amount of pollution that causes a specific response to a resource is called the pollutant threshold, or critical load. The National Park Service is working cooperatively with university and federal scientists in **Rocky Mountain, Glacier, Grand Teton, Sequoia, Yosemite, and Great Smoky Mountains National Parks** to determine pollutant thresholds for resources considered very sensitive to air pollutants, including high elevation lakes and forests, and alpine plant communities. Information from these efforts will enable the Service to establish park management goals, to report and communicate more effectively on resource trends and condition, and to ultimately help protect sen-

sitive resources in parks.

The Air Quality Program continued to support ongoing and new projects to assess air pollution impacts on park ecosystems in FY 2007. Accomplishments to date for these projects are:

Big Bend National Park. *Impacts of Atmospheric Nitrogen and Climate Change on Desert Ecosystems:* Completed in FY 2007, this project sought to understand: 1) the impacts of nitrogen deposition on microbial and soil nitrogen dynamics and plant productivity within the arid grasslands and high elevation oak-pine forests, and 2) the impacts of changes in precipitation timing and amounts on plant growth, soil nutrient, and microbial dynamics in the arid grassland. Findings indicate that increased moisture and nitrogen input to the mid-elevation Sotol Grasslands will likely shift the systems to a fungal dominated one. Increase in fungal activity may lead to increased litter decomposition and increased fungal activity may result in an accelerated decline in soil organic matter with increased precipitation, with greater biodiversity implications.

Abraham Lincoln Birthplace National Historic Site, Big South Fork National River and Recreation Area, Cumberland Gap National Historical Park, and Mammoth Cave National Park. *Assessing the Impact of Mercury Bioaccumulation in Cumberland Piedmont Park Units:* The purpose of this project is to examine the fate and transport of mercury in four parks with karst ecosystems. In FY 2007, monitoring locations were identified for collecting bat hair, insects, water, and sediment for mercury analyses. At Cumberland Gap National Historical Park and Mammoth Cave National Park, bat hair collection was initiated and project technicians received training in collecting insect specimens for the project. This project is being conducted in collaboration with Western Kentucky University.

Great Smoky Mountains National Park. *Determine the Impacts of Aluminum Toxicity and Calcium Loss on Threatened High-Elevation Spruce-Fir Forests:* The purpose of this project is to determine how soil aluminum toxicity, calcium availability, and nitrogen saturation vary with modeled deposition, topography, and edaphic (soil) characteristics and how

these factors influence the distribution of plant species in high elevation spruce-fir forests. This project is being conducted in collaboration with Michigan Technological University.

Grand Teton National Park. *Assess the effects of nitrogen deposition on alpine vegetation:* The objective of this project is to assess the impact of atmospheric nitrogen deposition on the structure and function of alpine ecosystems in Grand Teton National Park through the use of field measurements, experimental manipulation of nitrogen loadings in alpine sites with contrasting (wet/dry) edaphic (i.e., soil) conditions, and assumed nitrogen input regimes. Data were collected across alpine sites on nitrogen deposition loading, plant composition, and plant and soil nitrogen status. Early findings indicate a response in soil microbial activity due to small differences in nitrogen deposition, potentially representing early indicators of ecosystem change under increasing nitrogen deposition. This project is conducted in conjunction with Utah State University.

Joshua Tree National Park. *Critical Levels of Nitrogen for Growth, Litter Persistence, and Germination of Invasive and Native Plants:* The objectives of this research are to determine the impacts of nitrogen deposition on native plant species, and to what extent the response of invasive species to nitrogen is

promoting vegetation type conversion. Two greenhouse experiments studied the impacts of nitrogen on plant growth, enabling the determination of a critical load value of soil nitrogen on plant growth. A litter decomposition study was also initiated to determine the longevity of potentially flammable exotic grass litter. This project is conducted by researchers at the University of California at Riverside.

Rocky Mountain and Glacier National Parks. *Evaluation of Long-Term Species Changes and Response to Nitrogen Fertilization in Alpine Plant Communities:* This research performed on-site experiments to establish critical nitrogen loads for alpine vegetation response (changes in species abundance and diversity) as well as soil chemical responses (inorganic nitrogen, cation species and total charge, and soil pH). In addition the research will provide a list of indicator plant species for terrestrial vegetation responses to nitrogen deposition within plant communities. This project is being conducted by researchers at the University of Colorado at Boulder.

Sequoia and Kings Canyon National Parks. *Development of Critical Loads for Atmospheric Nitrogen Deposition to High Elevation Lakes in the Sierra Nevada:* This project seeks to establish critical loads for nitrogen deposition in the high Sierra Nevada, using reconstructions of past lake chemistry based on diatoms pre-

Researchers at Rocky Mountain National Park are studying the effects of nitrogen on alpine vegetation.



served in lake sediments. Using a sediment-corer, 42 lakes were sampled. Additionally, chemical analyses of water samples and diatom enumerations of sediment cores were initiated. This project is a collaboration between the University of California at Riverside and Santa Barbara, and Yosemite National Park.

Assessment of Toxic Airborne Contaminants in Parks: In 2007, results began to emerge from a six-year assessment of airborne contaminants in western parks. Snow, water, sediment, vegetation, and fish samples were collected from eight primary parks in the West and Alaska. Of the 100 contaminants (e.g., pesticides, fertilizers, flame retardants, mercury) investigated, 70 were found in detectable amounts and a few were present in sufficient quantities to raise concerns for wildlife and humans. Many of the contaminants of concern have been banned in the United States for the past 20-plus years, with the highest concentrations in parks that were near areas where the chemicals were produced or used. The study also confirmed the influence of international transport.

Information Sharing

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. **Glacier National Park** received technical and funding assistance with wayside exhibits highlighting the effects of climate change in the park. Assistance was also provided with an air quality educational traveling exhibit at **Great Smoky Mountains National Park**. The exhibit will provide information to the public about air quality concerns at the park and what the people can do to conserve energy. An informational sheet describing the air quality monitoring program at **Petrified Forest National Park** was also produced. Air quality-related interpretive projects and activities help to promote public understanding of highly complex issues facing parks.

To help disseminate air quality information to the public, 16 digital cameras (“web cameras”) operate in 15 park areas. These cameras often show the visible effects of air pollution. Because these cameras are typically located near

air quality monitoring sites, the camera web pages 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 web sites had more than 100 million visits in FY 2007.

Ozone air quality forecasting is supported through current data web pages, submission of data hourly to the EPA AirNow air quality web site (<http://www.airnow.gov/index.cfm>) where it is used on pollution maps and as presentation of current conditions. The Program also participates in evaluating the NOAA ozone forecast model that is provided on the AirNow web site. Air quality forecasts and hourly monitoring data are used by several parks (e.g., **Acadia, Great Smoky Mountains, Mammoth Cave, Rocky Mountain, Sequoia and Kings Canyon National Parks**) to provide public warnings of unhealthy air quality conditions for ozone and sulfur dioxide. Parks issue advisories when air pollution has the potential to reach unhealthy levels to alert park visitors and employees of potentially unhealthy conditions.

Information about air quality in parks is also shared with the scientific community. Eleven papers were published in professional, peer-reviewed publications. Staff experts made more than 30 presentations at professional conferences, including organizing and chairing numerous sessions.

There was significant media coverage of the Night Sky Program. Key articles in *High Country News*, *USA Today*, and the *New Yorker* profiled the Night Sky Program. In parallel, public interest in park stargazing programs was very high, especially at parks like **Carlsbad Caverns, Grand Canyon, Great Basin, Death Valley, and Bryce Canyon National Parks**. The Night Sky Program assisted Bryce Canyon National Park in organizing an Astronomy Festival. The Festival drew nearly 6,000 visitors. The Night Sky Program also provided stargazing training programs for interpreters from 11 parks and loaned telescopes to **Great Basin and Mesa Verde National Parks** to jump start their stargazing recreation programs.

Air Resource Restoration and Protection

Armed with information acquired through

monitoring, data analysis, and research conducted since the Program was established in 1978, the National Park Service collaborates with state regulatory agencies, tribal governing bodies, the EPA, and various stakeholders to help develop strategies and plans that are needed to preserve and protect air quality in parks. The Prevention of Significant Deterioration program established by the Clean Air Act gives federal land managers and park superintendents an affirmative responsibility to protect air quality related values, including visibility, of Class I areas. The Clean Air Act defines Class I areas as national parks over 6,000 acres, national wilderness areas and national memorial parks over 5,000 acres, and international parks. The Park Service manages 49 Class I areas. The Clean Air Act also establishes a national goal of restoring natural visibility to Class I areas.

In many cases, regulatory agencies are required to consult with the Park Service when they make decisions that might affect pollution levels in parks. To carry out our stewardship responsibilities, the Service also engages in various policy making arenas and stakeholder forums to enhance our ability to protect park resources from the adverse effects of air pollution. Continued participation in several collaborative efforts include:

Improving Visibility in National Parks:

Since the 1980s, the Air Quality Program has had a leadership role in monitoring visibility, documenting various degrees of existing visibility impairment in Class I areas, assessing the causes and effects of visibility impairment, and alerting EPA and states to the need for installing pollution controls on specific older facilities that contribute to visibility impairment in parks. In 1999, bolstered by the wealth of data available regarding visibility impairment in national parks and wilderness areas, EPA expanded the visibility protection regulations and required all states to develop plans by 2007 (and subsequently in 10-year increments) to reduce regional haze, consistent with the Clean Air Act's goal of restoring natural visibility in Class I areas. The Program assisted EPA in developing technical guidance for states regarding key aspects of the regulations—in particular, the requirement that certain major stationary sources install the Best Available Retrofit Technology. The Na-

tional Park Service has been actively involved in regional planning efforts and has begun initial regulatory review of State Implementation Plans for regional haze. Although state plans have not yet been finalized, it is reasonable to anticipate fairly significant emission reductions will occur over the next decade to improve visibility in national parks.

Prevention of Significant Deterioration of Air Quality in Parks: Whenever a major new or expanding source of pollution wishes to locate near a Class I area, the Clean Air Act requires the National Park Service to assess whether its emissions would cause or contribute to an adverse impact on Air Quality Related Values (AQRV). Permit review activities involve an engineering analysis of proposed control technology to minimize emissions, review of the air quality impact analysis to determine whether air quality impacts will be within federal air quality standards and limits, and an AQRV analysis to assess potential impacts on sensitive park resources.

In FY 2007, staff reviewed 33 new source permit applications for projects proposing to locate near NPS-managed areas. A frequent recommendation included equipping new sources with better pollution control technology to minimize emissions, thereby reducing impacts on National Park System areas. Independent air quality impact assessments were conducted to help make informed decisions as to whether or not proposed new sources would adversely impact visibility and other air quality related values at NPS units.

The Park Service also reviews and provides comments on Environmental Impact Statements issued by other federal agencies for federal actions that may impact air quality resources in NPS units. Continuing interest in domestic energy development posed workload challenges. Extensive collaboration is needed with the responsible agencies and other affected jurisdictions (states and other federal agencies) to ensure air quality analyses are adequate to estimate potential impacts and mitigation measures are considered.

Rocky Mountain National Park. *New Approach Developed for Restoring Ecosystem Health:* Twenty years of monitoring and research at Rocky Mountain National Park have

documented adverse effects on the ecosystem from deposition of nitrogen. In collaboration with the Colorado Air Pollution Control Division and EPA, a Nitrogen Deposition Reduction Plan was developed that charts a course for reducing nitrogen deposition to the “critical load” established by the park. The Plan, which is the first of its kind in the country, was publicly supported by all the affected stakeholders including key sources of nitrogen emissions. It represents an important first step toward the implementation of voluntary and, if necessary, regulatory measures to control emissions of nitrogen in its various forms to reduce deposition harmful to park resources. The Plan is likely to serve as a template for addressing ecosystem impacts from deposition in other natural areas.

Regulatory Review: During FY 2007, Air Quality Program (through the NPS Director) provided comments on the EPA’s proposed changes to the National Ambient Air Quality Standards (NAAQS) for ozone. The proposed NAAQS will result in decreases in ozone levels compared with the current ozone NAAQS.

Restoration of Dark Night Skies: The National Park Service is a leader in night sky conservation and innovative approaches to lighting efficiency. Examples of assistance to parks regarding night sky values include: the development of Turtle Friendly Lighting Guidelines for **Cape Hatteras National Seashore** and working with National Park Foundation and Musco Lighting to develop new lighting technologies at **Zion National Park**.

WATER RESOURCES PROGRAM

The NPS Water Resources Program provides Servicewide leadership to preserve, protect and manage NPS water and aquatic resources. The Program works with parks, regions, and staff to continue the implementation of the water resources components of the Natural Resource Challenge. The diversity of the 391 NPS units means that parks face a wide range of issues. Modern park managers address complex challenges such as water quality; water rights; floodplain management; ground water analysis; watershed management and wetlands protection; water resources management planning; fisheries management; ocean and coastal resources protection; policy, legislative, and regulatory analysis; informa-

tion management; and training. The Water Resources Program provides a model for cost effective, centralized support for parks that do not have the range of technical expertise they need.

In FY 2007, the Program continued to deliver the highest level of support possible to parks in addressing a wide variety of water and aquatic resources-related issues. The Program provides services directly to parks through a broad range of programs such as Water Resource Projects (Water Resource Protection, Competitive Projects, and Other), Water Quality Monitoring, Aquatic Resource Professionals, Technical Assistance, and Watershed Condition Assessments.

Water Resource Projects are divided into three categories: Water Resource Protection Projects, Competitive Projects, and Other Projects which are non-competitive. Water Resource Protection Projects are targeted toward development of scientific information that will contribute to decisions that protect or restore surface or ground water systems. The majority of FY 2007 project funds were used to support ongoing studies designed to characterize surface or ground water flow systems. These tools are needed by decision makers to understand the potential for impacts to park water resources in the future from a number of existing water development proposals. Competitive Projects support many park-based activities, including the design of information management systems, regulatory assessments, riparian/stream and watershed restoration and protection projects with water quality goals, or other water quality improvement projects. Competitive Project funding for FY 2007 totaled \$507,800. The Program’s base funding is no longer adequate to sustain the competitive project program; therefore, it will become inactive after FY 2007. Over the past ten years, in order to meet increased salary costs per FTE (Full-time Employee) and budget rescissions, the Water Resources Program has reduced funding to its project programs by \$1.4 million. This has resulted in an inability to support the Competitive Project program and reduced capability for Water Resource Protection projects.

The Water Resources Program also provided funds totaling \$287,600 to support projects

that addressed emerging, high-priority, park watershed condition issues that, because of the applicable time frames, could not be appropriately directed through the competitive project funding program. Examples of FY 2007 projects include assessing the condition of the Pecos River riparian corridor prior to implementing a public fishing program at **Pecos National Historical Park**; support for an All Risk Incident Team to prepare a quagga mussel detection, prevention, and response planning guide for the Pacific West and Intermountain Regions; expanding an ongoing groundwater quantity investigation at **Kaloko-Honokohau National Historical Park** to include monitoring of water quality parameters; and, bottom sediment and water quality baseline for assessing removal of Cornell Dam on the **Niobrara National Scenic River**. Partnering with other federal agencies, state agencies, and/or local watershed groups in carrying out these projects was emphasized. Projects include a supporting study for a wetland improvement project at **Minute Man National Historical Park**, evaluation of the influence of riparian vegetation on channel bank stability at **Canyon de Chelly National Monument**, and an assessment of historic and functional conditions to support lake restoration at **Ebey's Landing National Historical Reserve**. The National Park Service partners with other federal agencies and non-government organizations to manage NPS-owned water diversions in **Grand Teton National Park** to enhance stream flow in the Gros Ventre River.

The Water Quality Monitoring program 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 state and national water quality standards. Presently, about 120 park 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. Since water quality is a key vital sign in determining overall ecosystem health, the Water Quality Monitoring program is fully integrated with the Vital Signs Monitoring Program. The integration of these two programs has realized considerable cost efficiencies in staffing, planning and design,

administration, implementation, data management, and reporting.

The Water Resources Program additionally assists parks through the Aquatic Resource Professionals and Technical Assistance programs. In FY 2005 the National Park Service received \$1,205,000 to support aquatic resources specialists in parks with significant need. In FY 2007, 15 positions were funded with 12 positions duty-stationed in parks. The Water Resources Program also provides Technical Assistance to parks using a combination of its own staff and expertise acquired through partnerships. The Program assisted 160 parks with aquatic resource issues in FY 2007.

Since water quality is directly tied to the condition and health of its watershed, the Water Resources Program initiated the Watershed Condition Assessment Program as part of the Natural Resource Challenge. Parks receiving watershed assessments will be in an improved position to define natural resource conservation indicators and targets via park planning and report to "overall resource condition" performance accountability measures. As of FY 2007, the program initiated assessments in 38 inland and 47 coastal 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. Comprehensive assessments are achieved through academic partnerships in the Cooperative Ecosystem Studies Unit (CESU) networks and collaborations with other federal agencies.

These Water Resources Program programs support the natural resource management cycle of discovery, learning, understanding, sharing, and resource protection.

Discovery

In FY 2007 several important discoveries were made as a result of Water Resources Program supported projects. Some significant findings were:

Blue Ridge Parkway. Aquatic Inventory: Appalachian Highland Network staff, in conjunction with the Southern Appalachian Man and the Biosphere Foundation, sampled 50 sites on the Blue Ridge Parkway. Sites were chosen by overlaying prior records of rare taxa, plant



Amphibian monitoring at Horseshoe Bend National Military Park has revealed the presence of Chytrid fungus in southern two-lined salamanders.

Understanding the impact of water diversions on potential habitat for cutthroat trout in the Gros Ventre River system is crucial for the conservation of the population.

community data, aquatic resource maps, and lithologic models at high elevations, where acid deposition is likely to be a factor affecting water quality. Several additional significant discoveries were made during limited aquatic macroinvertebrate sampling, including two genera and five species new to science. Combined with previous years' results, the project has now yielded a total of 3 genera and roughly 20 species new to science.

Horseshoe Bend National Military Park.

Amphibian Inventory: The Southeast Coast Network detected Chytrid fungus in Southern Two-lined Salamanders at Horseshoe Bend National Military Park. This is the first time that the pathogen has been found in this species which is common to rocky streams. As monitoring continues, the known presence of this pathogen may aid understanding of amphibian population fluctuations.

Little River Canyon National Preserve. *Development of Geo-Referenced Database to Identify and Inventory Wetlands:*

The purpose of the project is to complete the inventory and mapping of the wetlands at Little River Canyon. The Tennessee Technological University is conducting field research for this project. Researchers submitted an interim report detailing findings at the close of the 2007 field season. Sixty-eight individual wetlands were identified and mapped in accordance to project protocols. Significant discoveries include: 9 wetlands contained rare plants, 4 contained exotic plants, and 13 were above average size. Approximately 50 percent of the park acreage has been inventoried and the project is ongoing in FY 2008.

Learning, and Understanding

Many Water Resources Program projects seek to provide science-based information to park management to enable them to make informed stewardship decisions. Some highlights from FY 2007 include:

Grand Teton National Park. *Assessment of Cutthroat Trout Survival and Growth in Irrigation Ditches off the Gros Ventre River and Population Connections to the Snake River:*

Water diversions can influence the quantity and quality of habitat available to fish within a river system, and often may be a source of mortality. Adult trout habitat in the lower

Gros Ventre River is limited by the effects of at least 13 irrigation diversions. Such a large proportion of the river flow is diverted that fish habitat (and flow) is often completely eliminated near the Highway 191 bridge. This may reduce the quantity and quality of trout habitat in the Gros Ventre River and serve as a barrier to fish movement between the Gros Ventre and the Snake River systems. A previous study examining water diversions in the Gros Ventre River found mountain whitefish (*Prosopium williamsoni*), cutthroat trout (*Oncorhynchus clarki*), speckled dace (*Rhinichthys osculus*), and longnose dace (*Rhinichthys cataractae*) in several of the diversion ditches. Understanding the role of these diversions on the potential habitat availability, mortality, and movement of cutthroat trout in the Gros Ventre River system is crucial for the conservation of this population. Initiated in FY 2007, this project is examining the growth and survival of fish entrained within the irrigation ditches and if cutthroat trout are moving between the Gros Ventre and Snake River systems.

Kaloko-Honokohau National Historical Park.

Determining Subterranean Groundwater Nutrient Input to Coastal Ocean Ecosystem: The purpose of this investigation was to help characterize the importance of submarine groundwater discharge to coastal habitats with the objectives of quantifying the flux of groundwater and associated nutrient into the nearshore of Kaloko-Honokohau National Historical Park and determining the transport and fate of these materials through the park's coastal waters. These objectives were accomplished through chemical analyses (organic, inorganic and radiochemical) of nearshore and groundwater samples collected over six seasonal surveys and time-series measurements of hydrodynamic (tides, waves, currents, winds) and physical water property (temperature, salinity, turbidity) data by a team of USGS, Stanford University and NPS scientists. The results show that groundwater enters the Kaloko-Honokohau coastal ocean at high rates (several million gallons per day) and contains significantly higher concentration of nutrients than the surrounding ocean water. Nearshore circulation moves this nutrient-rich water generally northward at relatively slow rates, leaving the coastal food web and endemic Hawaiian habitats vulnerable to adverse

impact by excess nutrients. While some coral reef taxa (*octocorals*) flourish in areas of high submarine groundwater discharge, future increases in submarine groundwater discharge and/or land-derived nutrient concentrations could promote more favorable conditions for green and brown algae which have led to coral reef decline elsewhere, most notably Kaneohe Bay, Oahu, and Discovery Bay, Jamaica, in the 1970s.

Big Hole National Battlefield, Devils Postpile National Monument, Hagerman Fossil Beds National Monument, John Day Fossil Beds National Monument, Kaloko-Honokohau National Historical Park, Lewis and Clark National Historical Park, Oregon Caves National Monument, Pinnacles National Monument, Pu'uhonua o Honaunau National Historical Park, and Pu'ukohola Heiau National Historic Site. *Map Wetlands in Small Pacific West Region Parks:* This project created wetland inventories and condition assessments for ten small parks in the Pacific West Region. During FY2006 and FY2007 the project biologist traveled to each of these parks, conducted interviews with managers to assess wetland information needs, conducted wetland mapping fieldwork, evaluated the condition of the wetlands according to a standard protocol, and completed draft reports. The resulting maps and condition evaluations will help park managers with protecting wetland resources and reporting on resource condition goals.

Yellowstone National Park. *Norris Geyser Basin Health and Safety: Effects of Shallow Ground-water System on Dynamic Ground Heating, Eruptive Behavior of Thermal Features and Threats to Visitor Safety:* Changes in the geothermal system at the Norris Geyser Basin during the summer of 2003 led to closure of approximately half the developed trails (5,800 feet) in the geyser basin because of visitor safety concerns. Little is known about what causes these changes and whether the relocation of boardwalks and trails will be a long-term solution to visitor safety issues, but changes in hydraulic head in the shallow cold ground-water system may affect geothermal features and thereby the safety of the public. Forty samples were collected in 2007 and analyzed for major ion chemistry, selected trace elements, dissolved gases, CFCs, tritium, and oxygen isotopes. Major ion and trace element

samples were analyzed by the USGS National Research Program Laboratory in Boulder Colorado. Continuous temperature monitoring has also continued in the Norris Geyser Basin on thermal features that exhibit changes in temperature and eruptive behavior with the analysis of these records conducted by Yellowstone staff to delineate the occurrence of thermal disturbances in the Norris area.

Sharing

The National Park Service works with partners to engage all Americans in caring for their national parks. Through interpretation and outreach the Water Resources Program seeks to share information with peers and the public. Through partnering with CESUs, state, and local governments the Program leverages its water resource funds. Examples from FY 2007 include:

Great Basin National Park, Lake Mead National Recreation Area, and Death Valley National Park. Hydrologic data collected by NPS studies for these parks are shared with the Nevada State Engineer, southern Nevada water purveyors, and private developers, thereby contributing to the larger-scale knowledge of regional aquifers and ground water availability in southern Nevada. The Park Service also presented expert interpretation of the data to the State of Nevada at hearings and other meetings to inform the Nevada State Engineer about the water right and public interest needs of park units.

Servicewide Water Resources Data and Information Management: The Water Resources Program supports network water quality monitoring programs by providing national program administration and reporting, establishing baseline inventories and analyses of available water quality data, supporting digitization of legacy data from analog reports and other archival materials, maintaining a Servicewide water quality database in the EPA-STORET national water quality database, and enhancing the means to flow data from the Networks into STORET. The database facilitates the sharing of information with park managers, researchers, and other federal and state agencies.

Glen Canyon National Recreation Area. *Emergency Measures to Prevent the Introduction of*

Quagga and Zebra Mussels: To prevent the spread of Quagga Mussels to Lake Powell, the park is reaching out and engaging visitors in stewardship. The park constructed “Mussel Free” self-certification stations for boats at each of six developed launch ramps. Signs were installed at six entrances and launch ramps to inform boaters of the self-certification system. Boaters who undergo the certification process receive dashboard certificates. Other outreach materials such as self-certification packets, *Zap the Zebra* brochures, and educational materials were distributed to approximately 100,000 boaters on Lake Powell in 2007. In addition to outreach activities, plans were created to respond to potential detection of larval zebra mussels in Lake Powell. Dive teams surveyed marina areas for adult mussels. A remotely operated submarine was used for depths more than 130 feet. The park acquired three plankton nets specifically designed for larval mussel sampling and purchased a cross-polarizing compound microscope with image analysis capability for veliger analysis in the Glen Canyon NRA Wahweap Laboratory.

Resource Protection and Restoration

In cases where credible science has shown resource impacts, the National Park Service seeks to protect and restore park resources.

Grand Teton National Park. Assisted the Environmental Quality Program on a damage assessment case involving the introduction of non-native plant species at the Snake River Gravel Pit reclamation site.

Isle Royale National Park and Mammoth Cave National Park completed *Water Resources Management Plans*. These plans will assist the parks in assessing current resource condition, discuss external influences impacting park water resources, and identify needs to fill critical data gaps.

Haleakala National Park. Provided overall coordination on a project to install an automated hydrologic monitoring system for natural resource management and visitor safety purposes.

Chickasaw National Recreation Area. Assisted with continuing a federal-state partnership to study the aquifer characteristics of the

Arbuckle-Simpson aquifer which feeds spring flow at the park.

Zion National Park. Provided a professional hydrologist for the Intermountain Region Burned Area Emergency Restoration (BAER) Team for the Dakota Hills Complex. In addition to detailed watershed modeling and documentation, recommendations for BAER water source restoration treatments and human safety from flash floods were provided in the BAER Report.

Pacific West and Intermountain Regions. *All Risk Incident Team to Prepare a Quagga Mussel Detection, Prevention, and Response Planning Guide:* The purpose of this project was to develop a guide that would assist NPS managers in assessing the risk of quagga mussel introduction, developing and implementing early detection and prevention programs, and responding appropriately in the event an introduction occurs. The project was undertaken in response to the detection of quagga mussels (*Dreissena rostriformis bugensis*) in **Lake Mead National Recreation Area** in January 2007. In April 2007, Water Resources Program funded an All-Risk Incident Command System Team that was charged by the Director with developing a plan to assist NPS units in responding to the threat of quagga and zebra mussel introductions. The team was supported by subject matter experts from the National Park Service, other federal and state agencies, and the private sector. In one week, the team produced the *Quagga/ Zebra Mussel Infestation Prevention and Response Planning Guide*. The guide has been distributed to regional offices and at-risk NPS units and is available for download from NPS intranet and internet sites with a link on “Inside NPS.” Biological Resource Management Program and Water Resources Program staffs will work with other NPS staff and partners to update the guide as new information becomes available.

Niobrara National Scenic River. *Bottom sediment and water quality baseline for assessing removal of Cornell Dam:* The Niobrara National Scenic River is a riparian corridor of exceptionally high biological diversity and a popular destination for canoeing, fishing, and other recreational activities. Cornell Dam is located on this segment of the river near Valentine, Nebraska, within the Fort Niobrara

Wildlife Refuge and just upstream from one of the most visible and heavily-used recreational reaches. In 1986, the Nebraska Public Power District quitclaimed land to the United States that included the Cornell Dam and Power House. With the impoundment now largely filled by sediment, the U.S. Fish and Wildlife Service is considering decommissioning Cornell Dam. Currently, the quantity and quality of the sediment in storage behind the dam is largely unknown, as are the effects a release of this sediment would have on the river ecosystem upstream and downstream of the site. The U.S. Geological Survey is conducting a study to assess the physical and ecological effects of removing Cornell Dam. The transport of sediment through the system will be simulated based on measured data, and historical ecological data will be compiled to determine the potential for ecosystem alteration caused by a new streamflow and sediment regime. Accomplishments include surveying the channel geometry, hydraulic properties, and bed-sediment characteristics of the reach downstream from the dam.

Sleeping Bear Dunes National Lakeshore. *Determine Factors Contributing to Recent Large-Scale Outbreaks of Type E Botulism:* In 2006 and 2007, die-offs of native fish, fish-eating birds, and shorebirds have occurred in near-shore Lake Michigan waters, including those of Sleeping Bear Dunes National Lakeshore. Necropsy results from fish and birds continue to indicate type E botulism poisoning. During the summer and fall of 2007, researchers explored a potential pathway for botulism transfer to fish and fish-eating birds. Investigators deployed continuous water quality monitoring devices on the lake bottom and recorded temperature, pH, conductivity, and dissolved oxygen. They collected monthly samples of food web components suspected in botulism transfer (i.e., sediments, dreissenid mussels, benthic algae, and round gobies) and sent them to U.S. Navy collaborators for type E botulism toxin analysis. To evaluate trophic connections, on one sampling date researchers collected samples (i.e., phytoplankton, benthic algae, dreissenids, and round gobies) for analysis of carbon and nitrogen stable isotopes (with collaborators from the Great Lakes WATER Institute), and on several dates collected samples of live round gobies and dead birds for gut content analysis.

BIOLOGICAL RESOURCE MANAGEMENT PROGRAM

The NPS Organic Act of 1916 directs the National Park Service 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” (emphasis added). In 2000 the National Park Service established the Biological Resource Management Program to provide a systematic and nationwide response to the increasingly complex task of managing biological resources on parklands. The Program provides professional, science-based support for vegetation mapping, invasive species management, terrestrial ecosystem restoration, threatened and endangered species protection, integrated pest management, and wildlife management. Beyond professional expertise, the program provides competitive funds to facilitate biological resource projects that address issues facing various park units and benefit multiple partners. These projects address a myriad of resource management needs for aquatic or terrestrial plants and animals throughout the National Park Service. This improved professional and financial capacity was the result of the Natural Resource Challenge.

Vegetation Mapping: As part of the Inventory and Monitoring Program, the Vegetation Mapping Program develops vegetation map inventories for the 270 National Parks in the program. Central to the Vegetation Mapping Program is adherence to established inventory mapping standards making the inventory products nationally consistent, appropriately detailed in scale and resolution, and quantitatively assessed for mapping accuracy. The Vegetation Mapping Program provides leadership and technical expertise to parks, regions, and the Natural Resource Program Center in the areas of the National Vegetation Classification Standard and taxonomic classification; imagery to render vegetation inventory data collection and characterization; field sampling design and stratification; partnerships to facilitate vegetation inventory; accuracy assessments; and protocol developments in fire and fuels, sparse vegetation sampling, and small park mapping.

Invasive Species: The Biological Resource Management Program provides a wide range of innovative and science-based services and policy guidance to manage invasive animal and plant species on parklands. Services of this program include: policy relating to invasive animals and plants; as well as, technical assistance and training to parks on prevention, rapid response, and control of invasive animals and plants. The program provides guidance on managing the sources of new infestations, reducing the effects of existing infestations, and restoring native plant communities and ecosystem functions. To accomplish this task, the staff advises and assists parks, regions, and national leadership on management of invasive plants and animals and ecosystem restoration. Management of invasive species is a growing and expanding program within the National Park System. Virtually all park units have reported the presence of invasive species and most units are now actively working to manage these invasive species. The majority of Vital Signs networks have identified invasive species as a priority for monitoring.

Ecosystem Restoration: The Ecosystem Management and Restoration Program supports ecosystem approaches and consistency to policy and practices in parks. The Program continues to balance its role of national program management with direct support to park-specific needs. Staff provides support and technical expertise to parks, regions, and the Natural Resource Program Center in the areas of biostatistics, statistical modeling, data analyses, study design, species of management concern, risk assessments, and All Taxa Biodiversity Inventories. The Ecosystem Management and Restoration Program provides biostatistics support to parks and NPS programs through an agreement with the University of Wyoming.

Endangered Species Program: During the last ten years, the Endangered Species Program has made measurable progress in improving the condition of federally listed and candidate species in the National Park System. As of October 2007, there were 481 species with 1,179 populations listed under the Endangered Species Act (ESA) in 204 NPS units. Some vertebrate species, such as Chinook salmon, steelhead, and whooping cranes, are listed as distinct populations. The Endangered

Species program funds conservation needs for nine taxa groups: mammals, birds, reptiles, fish, plants, invertebrates, amphibians, insects, and arachnids. Plants include flowering plants, lichens, fern and fern allies, conifers, and cycads. Invertebrates include corals, crustaceans, clams, and snails. Mammals and birds represent 24 percent of the listed species in parks and drew 55 percent of the 2007 NRPP funding. In FY 2008, the number of populations making progress toward recovery will change. This is due to the change in status of bald eagle (130 populations), gray wolf (12 populations), and grizzly bear (3 populations) whose populations will change to delisted/monitored and will be reported to Congress under the Species of Management Concern goal. Some grizzly bear and gray wolf populations remain federally listed in parts of their range.

Integrated Pest Management (IPM): Federal law directs all federal agencies to implement research, demonstration, and education programs to support adoption of Integrated Pest Management and to use these management techniques in carrying out pest management activities through procurement and regulatory policies, and other activities. 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. IPM incorporates the concepts of adaptive management.

Wildlife Management: The Program addresses the complex tasks of wildlife management through three focal areas: Human-Dimensions of Biological Resource Management, Migratory Bird Program, and Wildlife Health.

Human dimensions research is the acquisition of information that explains human thought and action regarding wildlife, using the concepts and methods of social science. The biological dimensions of wildlife management have been a focus of inquiry for nearly

a century, and while it is acknowledged that more biological science knowledge is needed in many cases, the greatest need in some situations is for knowledge about the human dimensions of wildlife management. The field of human dimensions seeks to understand human traits and looks at ways to incorporate that understanding into wildlife management planning and actions. Specifically, human dimensions of wildlife management refers to understanding: how and why people value wildlife, what benefits people seek and derive from wildlife, and how people affect and are affected by wildlife management.

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

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. It provides Servicewide leadership in addressing highly pathogenic avian influenza (HPAI) in wildlife and chronic wasting disease (CWD) on NPS lands. The Program provided technical assistance, consultation, and training to enhance the ability of park staff to meet the increasing demands of wildlife health issues including field anesthesia, sample collection and diagnostics, disease management, animal welfare, and fertility control, partnering with numerous other programs within the National

Park Service, most notably the Office of Public Health and Risk Management Program.

Whether addressing flora or fauna, all of the Biological Resource Management Program areas seek to fulfill the mandate of the Organic Act. These stewardship activities follow the natural resource management cycle of discovery, learning, understanding, sharing, resource protection and restoration, and evaluation. Highlights from FY 2007 efforts are below.

Discovery

National parks are dynamic environments where discoveries are often waiting under rocks or leaves. Basic research, baseline inventories, or observation sometimes lead to exciting new information as in the example below.

Olympic National Park. *All Taxa Biodiversity Inventory:* A coordinated comprehensive All Taxa Biodiversity Inventory (ATBI) was conducted at Olympic National Park to serve as a western prototype analogous to the successful effort at **Great Smoky Mountains National Park** in the eastern United States. An ATBI is an effort to survey as much of the invertebrate and non-vascular plant biota of a park as possible in a relatively short time. A successful effort requires the participation of both professional and citizen scientists to conduct the surveys and interpret the findings so that they can be included in management decisions. The results include early detection of invasive plants and animals, and documenting the distribution and abundance of rare, threatened, and endangered species.

Learning and Understanding

In order to preserve parks for the enjoyment of current and future generations, the National Park Service seeks to make stewardship decisions based on scientifically sound information. Natural resource projects provide park managers the tools needed to make informed decisions.

Great Sand Dunes National Park and Preserve. *Bison Conservation:* One of the primary data gaps in understanding the genetic architecture across North American bison conservation herds involves the lack of detailed genetic information from populations like the Medano-Zapata Ranch in the San Luis Valley of south central Colorado. This valley

also harbors the Great Sand Dunes National Park and constitutes the most biologically significant landscape of its size in Colorado. As a first step in closing this data gap, researchers evaluated levels of domestic cattle mitochondrial and nuclear introgression in this herd as well as other U.S. and Canadian government conservation bison herds. This work has been partially supported through grants and funds administered through The Nature Conservancy. Archive DNA sources collected during this study will be extremely valuable in evaluating genetic diversity and relationships among different bison herds. Anticipated results will give managers of this bison herd baseline information for the establishment of successful long term management priorities and possibly provide guidance for increasing the size and geographic distribution of these animals outside their current boundaries.

Grand Canyon National Park. *Collecting DNA from Mountain Lions:* Gaining information through noninvasive techniques about wild animal populations has always been a logistical challenge, particularly with carnivores, which are generally secretive and costly to capture and study. DNA samples from field-collected hair, tissue, and feces yield insights and data about these elusive creatures. A five-year study of mountain lions within Grand Canyon National Park is proving that DNA sampling and analysis is an effective, low-cost method for detecting and identifying individual mountain lions, kinship, and population estimates. During the fifth year of this study, the mountain lion research team succeeded in humanely capturing and radio-collaring seven animals. Remote cameras photographed several others, including a female with three cubs. Because radio-collaring provides extensive information about mountain lion territories and predation sites, this data is particularly valuable and confirms how closely the movements of these animals intersect with humans in the park.

Greater Yellowstone National Park. *Risk Assessment Models for Aquatic Invasive Species:* Staff explored statistical risk assessment models that could efficiently and effectively evaluate the potential for establishment and spread of aquatic invasive species in national parks. The results provide information to park managers to assist in the allocation of limited

resources to combat known invasive species with the highest potential for invasion, spread and harm. Initial application of risk assessment is planned for the greater Yellowstone National Park area. There is potential for risk assessments to be applied efficiently and effectively at a national scale.

The Vegetation Mapping Program has ongoing projects in 172 national parks. Of those, 127 parks are GPR goal complete (i.e. completion of a draft map). The program has completed 30 national park mapping projects, currently discoverable and downloadable from a joint USGS-NPS Vegetation Mapping web site (<http://biology.usgs.gov/npsveg/>).

Jean Lafitte National Historical Park and Preserve. *Characterization of Changes Regarding the Inventory of Fish Populations at the Barataria Preserve:* The objectives of this study were to assess changes in the composition and distribution of fish communities in the Barataria Preserve. The project documented the presence of newly introduced rare, threatened, endangered or non-native fish species that may require special management action. Scientists sampled 7,142 fish representing 68 species. Habitat conditions within Lake Cataoutche have changed dramatically in the last few years. Freshwater entering the lake from the diversion has increased the amount of submerged aquatic vegetation which may have led to the increase in habitat for freshwater species. At the same time, there appears to be a greater diversity of euryhaline (able to adapt to a wide range of salinities) species than found in previous surveys. Despite this increase, there has been no change in salinity. Instead, the increase in diversity and abundance may be due to a broader base in the food chain from what appears to be greater primary productivity in the lake. An increase in nursery grounds has increased the number and diversity of species entering the lake and exploiting this food source. Park managers will use the scientific information on the changes in the fish fauna as a foundation for advising stakeholders of the Davis Pond Freshwater Diversion.

Zion National Park. *Fire Management Effects on Native Bee Diversity and Abundance in Relation to Rare Plant Conservation:* The objectives of this study were to inventory bee

species within the park, assess affects of recent fire projects upon bee abundance and diversity, and develop protocols for use in fire planning and monitoring effects on bees as a critical component of the pollinator fauna. Bees were collected from 12 paired plots (burned and unburned) in similar habitats and from random collection points. More than 9,000 bee specimens were collected in the 2007 field season and are currently being processed and identified at the USDA lab in Logan, Utah. Bees from the 2006 field season have been processed and 224 additional species were identified bringing Zion's total number of bee species to 328. Plot data was analyzed and differences in abundance were detected between burned and non-burned plots (more abundance and diversity in burned plots).

Glacier Bay National Park and Preserve. *Investigate Causal Factors of Harbor Seal Decline:* Harbor seals are an important apex predator and the most numerous marine mammal in Glacier Bay; however, harbor seals have declined by up to 75 percent in the park since 1992. This project examined several causative factors as part of a multi-agency collaborative study to address hypotheses related to harbor seal declines. Scientists collected data to assess the behavioral effects of vessel disturbance at harbor seal haul outs, identify foraging areas, habitat use, and movements of seals during the breeding and non breeding season, and assess contaminant loads and disease status in harbor seals. The park initiated CESU agreements with San Jose State University to assess the effects of vessel disturbance on harbor seals, and University of Alaska Fairbanks to assess disease status and contaminant load in harbor seals. Two harbor seal capture trips occurred (n = 49 seals captured), 59 days were spent quantifying vessel use and the behavioral response of seals to vessel disturbance, and satellite tags were deployed (n = 15) to assess overwinter movements. Collection of samples and processing began for a systematic evaluation of serum antibodies to specific disease agents, assessment of concentrations of non-essential elements, and contaminant loads (e.g., chlorinated pesticides, PCBs, brominated flame retardants) in harbor seals. Presentations highlighting research were developed and given to park Interpretive and Resource Management Programs.

Sharing

The National Park Service works with partners to engage all Americans in caring for their national parks. Information is shared with scientific peers and the public through interpretation and outreach. Funds are leveraged through partnering with CESUs, state, and local governments. Examples from FY 2007 include:

Biscayne National Park. *Conserving Threatened and Endangered Sea Turtles:* The objective of this two-year project were to increase nesting success of sea turtles by: (1) increasing the spatial coverage and frequency of monitoring efforts, and thus the number of nests protected from predators; (2) improving the quality of nesting habitat through beach cleanups; (3) to increase our knowledge of the number of sea turtles nesting annually in Biscayne; and (4) increase public awareness of sea turtle conservation issues through public outreach. During the summer nesting season, beaches were monitored and new nests were protected with wire screens to prevent predation by raccoons. Increased frequency of survey efforts allowed for early identification and protection of sea turtle nests. Beach clean-up events were critical in removing large amounts of debris from the beaches, so that beaches could be more easily accessed by nesting female turtles and traversed by newly emerged hatchlings. Summer interns were able to complete their duties across a large spatial area on a consistent basis and thus were better able to protect new nests while getting a more accurate estimate of the number of sea turtles nesting annually in the park. Biscayne staff recruited and trained summer interns in May so that they could more effectively monitor the beaches during June and July, when monitoring is most vital to nest success. In 2007, three Student Conservation Association (SCA) interns conducted daily surveys beginning in June, thus protecting five new nests from raccoons. The daily monitoring improved the ability to identify new nests and provide immediate protection from predation. By September, four of the five nests had hatched, and each was assessed for nest size, hatching success, and other nest variables. Objectives 1 and 3 were met by increasing beach monitoring efforts within Biscayne. Objectives 2 and 4 were met by the inclusion of the public, particularly volunteer organizations and individuals.

Yellowstone National Park. *Boater Education Program:* Staff assisted in obtaining a \$25,000 grant from the U.S. Fish and Wildlife Service



Harbor seal hauled out on glacial ice in Johns Hopkins Inlet, Glacier Bay National Park.
NPS Photo: Jamie N. Womble

for Yellowstone National Park to implement a boater education program at Yellowstone Lake. The goal of the education program was to prevent the introduction of invasive aquatic plants and animals into Yellowstone waters.

Resource Protection and Restoration

In cases where credible science has shown resource impacts, the National Park Service seeks to protect and restore park resources. Highlights of FY 2007 include:

Lake Mead National Recreation Area, Grand Canyon National Park and Glen Canyon National Recreation Area. *Zebra Mussel Prevention and Control:* Staff provided technical assistance to Lake Mead National Recreation Area, Grand Canyon National Park, and Glen Canyon National Recreation Area on zebra mussel prevention, control, and outreach. Staff facilitated access to international experts, chaired science committee for Lake Mead, and contributed to management discussion at respective workshops. Branch and Water Resources Program also participated in Lake Mead partnership monitoring and manage-

ment workshop to discuss current and ongoing efforts by all parties in the Lake Mead area with regard to quaggas.

Rocky Mountain National Park. *Integrated Pest Management Partnership with USDA Forest Service:* The native mountain pine beetle (*Dendroctonus ponderosae*) is a cyclic pest found in the park and other areas. This native insect attacks lodgepole pine, ponderosa pine, white-bark pine, limber pine, and western white pine on a cyclic basis. Recent infestations however, are more severe and may be linked to drought and possibly climate change. Egg laying on trees is synchronized to avoid temperatures lethal to the developing larvae. Climate change may alter the situation causing beetle activity to shift to higher elevations and have more generations/season. Damaged timber creates a great increase in available fuel loads and increases risk of fire near developed areas. Early detection and use of pheromone trap traps developed by the USDA Forest Service are being employed.

Evaluation

The need for credible data does not end with the restoration process. Once decisions have been made and actions taken, park managers need to know the impact of those actions. Long term monitoring and evaluation provide not only data on the success of past efforts, but also information to guide future stewardship.

Mount Rainier National Park. *Assess Status Of Native Bull Trout & Cutthroat Populations:*

The purpose of this project was to confirm native char and trout stock presence in Mount Rainier National Park and to determine the extent of hybridization in three watersheds in the park. The specific objectives of this project were to obtain a baseline genetic profile and species delineation; provide a comparison of genetics within and among basins; provide information essential to meet National Environmental Policy Act mandates for specific construction projects; and to incorporate knowledge gained in this study into the statewide and regional information base to facilitate better understanding of the status of these species including native char distribution and the range-wide distribution of Dolly Varden and bull trout in the state. During the first year of this project Mount Rainier National Park field crews surveyed 81 streams throughout the park. Eighty-nine fin clips were obtained from native char in 14 streams. Two-hundred-fifteen fin clips were obtained from trout in 42 streams. Fin clips were preserved labeled and logged and shipped to the U.S. Fish and Wildlife Abernathy Fish Lab and to the U.S. Geologic Survey, Western Fisheries Research Center for char and trout identification, respectively, using DNA analysis.

Integrated Pest Management. *Pesticide Use:* Pesticides and biological control agents are two higher risk tools in the IPM toolbox. Other IPM tools include mechanical, physical, cultural pest management strategies. National Park Service tracks use of these tools through the Pesticide Use Proposal System. More than 2,560 Pesticide Use Proposals (PUPs) were submitted in 2007. The Regional IPM Coordinators reviewed 2,360 PUPs and 202 PUPs required second level review from Washington Office IPM Staff. The second level of review is reserved and required for proposals that may affect threatened and endangered species, are restricted use pesticides, aerial application, ap-

plications to more than 400 contiguous acres, or that may affect aquatic systems.

Data on park-level populations of invasive animals are being collected as part of Service-wide GPRA accountability requirements. Information collected will assist in setting priorities and measure accomplishments on invasive animal management. This is a joint effort by the National Park Service and the Colorado Natural Heritage Program.

GEOLOGIC RESOURCES PROGRAM

Since the designation of the very first national park in 1872, geology has played an important role in the establishment and appreciation of national parks. In the years leading up to its creation, explorers' reports of Yellowstone's geysers and other geologic wonders captured the imaginations and hearts of the American people. Recognizing the scientific value and natural wonders of the area, in 1872 the 42nd U.S. Congress established Yellowstone National Park as the nation and world's first national park.

Today, 136 years since Yellowstone's designation and almost 100 years since the establishment of the National Park Service, geology continues to play an important role in the creation and management of parks. Of the 391 NPS units more than 160 parks contain significant geologic resources. Scientifically important fossil deposits are found in 150 parks; 81 parks contain 3,600 known caves; and another 40 parks have known karst systems. Ninety-seven parks protect 7,000 miles of shoreline, 52 parks contain geothermal systems, 38 parks have volcanoes as a major feature, and 37 have active glacial features. Park museum collections have more than 35,000 geological specimens and nearly 416,000 paleontological specimens. Equally important to preservation of parks are the active geologic processes that affect all park units. These processes could be as universal as weathering, erosion, and sedimentation, or may be as regional as major river systems, volcanism, glaciation, or earthquakes.

Despite the prevalence and significance of geologic features and processes to the National Park System; most parks, regions, and networks do not have specialized geologic expertise. In many instances, park managers must contend with geologic hazards and the

ongoing effects of human activities such as mining, energy, and urban development. Climate change and the increasing demand for oil, gas, and minerals confront park resource managers with a widening array of complex resource management issues.

In response to parks' need for geologic expertise, the National Park Service established the Geologic Resources Program. The Program, in partnership with parks, regions, networks, and others, works to preserve, protect, enhance, and understand geologic features and processes and integrate this knowledge into resource stewardship within the National Park System. Geoscience, engineering, environmental protection, and policy specialists provide leadership and guidance to parks throughout the National Park System to integrate geologic resource information into the decision-making process.

The Program is well positioned to effectively and efficiently provide technical, scientific, legal, and policy information for parks, regions, networks, and the Directorate. However, since its inception the program has had limited funding with base budget essentially limited to professional staff personnel costs. The Program accomplishes many of its projects by utilizing partnerships with geologic organizations and leveraging funds from other NPS sources, such as the Recreational Fee and Natural Resource Preservation Programs (NRPP). In 2000, the program received a Natural Resource Challenge increase of \$695,000 to add six geologic specialists. 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.

In FY 2007, the Program was actively involved in park management projects across the National Park System, ranging from coastal management and hurricane response to disturbed lands restoration, fossil resource protection, and the permitting of mineral operations. The Program has 24 permanent staff engaged in providing geoscience technical assistance and policy and regulatory support to park managers, as well as presenting NPS geologic education and outreach to the public. Through its professional staff and partnerships with the professional geoscience community, the pro-

gram guides NPS endeavors to address geologic processes and features in park resource management and operations. Geologic and soils mapping and associated resource evaluations provide parks with key information for resource management. Other program efforts help parks to restore lands and remediate resource damage caused by previous human activities, including abandoned mineral operations, and to avoid or mitigate potential adverse effects from mineral development in and around parks. The Program also leads NPS involvement in the establishment of the National Cave and Karst Research Institute. Eight partner employees as well as numerous student interns and volunteers work directly with the Program to augment staffing.

Though the Geologic Resources Program's activities span the natural resource management cycle of discovery, learning, understanding, sharing, resource protection and restoration, and evaluation; FY 2007 highlights focus primarily on learning and understanding, sharing, and resource protection and restoration.

Learning and Understanding

Coastal Geology. The Program's coastal geology staff provides technical support and programmatic guidance to the almost 100 NPS units with coastal and lakeshore geology concerns. Program staff also continued to coordinate the Servicewide "coastal team" to enhance communication and consistency across the Programs and improve assistance to parks, regions, and the NPS Directorate. Highlights include:

Coastal geology staff continued to provide support to parks recovering from the series of major storms in 2005, including Hurricane Katrina that made landfall on units of **Gulf Islands National Seashore and Jean Lafitte National Historical Park and Preserve**. Program staff coordinated with other agencies and university scientists to provide coastal process expertise to park managers, including serving as the NPS primary contact with the USGS on hurricane science, and providing baseline geologic information and remote sensing data to affected parks. Staff also provided extensive coastal geology and policy support to Gulf Islands and senior NPS management concerning alternatives for replacing hurricane-damaged roads in the park. This input helped

shape the ultimate decision to replace the damaged roads with low-cost designs compatible with natural barrier island processes, consistent with NPS policy.

Coastal geology staff coordinated a Storm Hazard Project funded by the Recreation Fee Program. The project included a Coastal Engineering Inventory and an assessment of cumulative impacts from coastal engineering structures in ocean and coastal parks. USGS conducted new Storm Vulnerability Assessments at **Cape Lookout, Cumberland Island and Fire Island National Seashores**.

Staff also provided extensive technical support to **Gulf Islands National Seashore** on environmental and policy implications pertaining to the development of a science-based barrier island restoration strategy for inclusion in the U.S. Army Corp of Engineers (USACE) proposed Mississippi Coastal Improvement Program Comprehensive Plan and Environmental Impact Statement which will be presented in a status report to Congress in December 2007. The recommended restoration strategy, developed in close coordination with coastal resource specialists representing USGS, USFWS, NOAA, EPA, and USACE, addresses immediate and long-term actions to mitigate substantial erosion and land loss on the barrier islands.

Staff provided technical guidance with new tidal inlet formation in **Cape Cod National Seashore** as a result of an extratropical storm. At a forum for discussing, "The state of the science for assessing and mapping coastal hazards" in July 2007, staff gave a presentation entitled "Storm Vulnerability Assessments and Management Implications in Ocean and Coastal National Parks."

Staff worked closely with Inventory and Monitoring Networks to define coastal resource monitoring plans and inventory needs. Collaboration with the USGS continues to yield new protocols for integrating coastal geologic maps of submerged marine resources with map coverage of adjacent lands at **Kaloko-Honokohau National Historical Park and Dry Tortugas National Park**.

Staff served as the NPS advisor on a "Coastal Elevations and Sea-level Rise" Climate Change

Science Program Federal Advisory committee. Assessments of vulnerability to sea-level rise were published for four parks as a result of the ongoing USGS-NPS "Vulnerability of Coastal Resources to Climate Change" project, undertaken with NRPP and Recreational Fee funds.

Geological Hazards. Staff provided technical expertise to seven parks concerning the assessment and evaluation of geologic hazards. Staff acquired scientific information about the nature of a park's geologic hazards and the degree of risk they represent, then incorporated that information into the planning process and other park management decisions so that exposure of people and facilities to hazards is minimized. Since the control of naturally occurring geologic processes are generally expensive, often futile, and typically have harmful impacts that can outweigh their benefits, recommendations were provided to assist park management in taking the appropriate actions. Examples of technical support for the year included the assessment of a rock fall above a popular hiking trail at **Devils Tower National Monument**, the evaluation of a large landslide at the Drewry's Bluff Unit of **Richmond National Battlefield Park**, appraisal of a rock fall that resulted in two fatalities at **Glen Canyon National Recreation Area**, and coordination with USDA-FS Geologists and Glaciologists on glacial outburst potential at **Klondike Gold Rush National Historical Park**.

Paleontology. Diverse fossil resources have been documented in 181 parks and include plants ranging from microscopic algae and pollen to leaves and petrified logs, and animals ranging from marine shells to dinosaurs and Ice Age mammals, as well as trace fossils such as vertebrate tracks, burrows, and coprolites. Many of these natural resources in parks are of international significance and critical to understanding the history of life on Earth. The Natural Resource Challenge provided funding to support a paleontologist to develop a Servicewide program to manage fossil resources in the National Park System, and to provide technical assistance to parks. In FY 2005, the incumbent vacated the position and it has remained unfilled due to funding constraints, resulting from increasing personnel costs and across-the-board budget reductions.

The Program received Inventory and Monitoring (I&M) Program funding in 2007 to review and compile research literature and data on paleontological resources into summary reports for all parks in select I&M networks. Over a three-year period, this project will produce comprehensive summary reports for 19 I&M networks, encompassing 168 parks, thereby completing such reports for all 32 networks. The preparation of these summary reports is an initial first step to proper management of fossils in parks.

Technical support was provided to six parks and one national natural landmark on paleontological resources management issues in FY 2007.

Geologic Resource Evaluation. The Geologic Resource Evaluation (GRE), funded by the Natural Resource Challenge through the Inventory and Monitoring Program, provides digital geologic maps and geology-related information to parks. The Program helps park managers integrate the use of geologic resource information in resource management decisions. The GRE provides parks with 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, along with investigating existing geologic research and paper maps; a comprehensive digital geologic map; and a comprehensive geologic report.

In 2007, scoping meetings to evaluate park geologic resources and issues had been held at 202 parks. In addition to staff and park resource managers, knowledgeable geologic experts from the USGS, state geologic surveys, and universities participate in these meetings and provide valuable insights and follow-up information and assistance. Six new geologic reports addressing park geologic resource management issues were distributed to their respective parks, networks, and regions in 2007. Of the 270 parks characterized as natural area parks by the Inventory and Monitoring Program, staff and partners have completed digital geologic maps for 115 parks, which are served on the NR-GIS DataStore.

In addition to providing **Yellowstone National Park** with a digital geologic map, the GRE

team also completed the geologically complex **Great Basin National Park**, the only geologic map available for that part of the country. The team provided **Mammoth Cave National Park** with digital geologic coverage of its entire biosphere reserve.

The team also completed maps for **Cape Hatteras** and **Padre Island National Seashores**, the first in a series of national seashore maps. Unlike traditional geologic maps, shoreline maps, particularly along barrier islands, require mapping methodologies incorporating landforms, vegetation, soil, and coastal processes. No consensus among mapping agencies exists yet on the standards these maps need to meet. The national seashore maps are unique in that they are produced using new protocols developed by the National Park Service in collaboration with the USGS, state surveys, and academic institutions. **Cape Lookout, Canaveral, and Assateague Island National Seashores** could follow in 2008.

The program has now produced digital geologic maps for most of the iconic geologic parks. **Denali, Mount Rainier, Glacier, Yosemite, Arches, Canyonlands, Grand Teton, Rocky Mountain, Carlsbad Caverns, Everglades, Badlands, Wind Cave, Black Canyon of the Gunnison, Great Sand Dunes and Great Smoky Mountains National Parks** are completed and available for park resource managers and the public to use and enjoy. **Death Valley, Grand Canyon, and Big Bend National Parks** have new mapping underway that is expected to be completed by the end of FY 2008. Additionally, national monuments with a strong paleontologic theme such as **Fossil Butte, Petrified Forest, and Hagerman Fossil Beds, Florissant Fossil Beds, and Agate Fossil Beds** have completed maps. Cave and karst national monuments are represented on the list of completed maps with **Jewel and Timpanogos Caves**. Other geologic themed national monuments, such as **Craters of the Moon, El Malpais, Scotts Bluff, and Devils Tower** are also complete.

Soil Resources Inventory and Management. The Soil Resources Inventory and Management (SRI) project, funded by the Natural Resource Challenge through the Inventory and Monitoring Program, provides digital soil maps and soil resource management information to parks. Soils information including the physical, chemical, and biological properties is essential for park resource management and

protection, as well as providing park managers with the ability to predict the behavior of a soil under alternative uses. The natural features and diverse plant and animal communities depend on maintaining soil functions that support plant growth and limit accelerated soil erosion.

The SRI operates extensively through a partnership with the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) and the National Cooperative Soil Survey to undertake soil surveys in parks. Through this partnership, the SRI helps parks secure the information needed to manage soil sustainability and to protect water quality, wetlands, vegetation communities, and wildlife habitats. The information also assists the control of exotic species and establishment of native communities, as well as management of potentially high-use or developed areas in the park (e.g., visitor centers, campgrounds, trails, access roads). The key SRI products are digital maps of the park soils; data about the physical, chemical, and biological properties of those soils; information on the use and management of these soils; metadata; and information products such as a soil survey manuscript, fact sheets, and image galleries. The information is in sufficient detail for application by park managers, planners, engineers, scientists, and researchers to specific areas of concern. As of the end of FY 2007, 141 NPS units have a completed soil resource inventories, with an additional 86 parks underway. In FY 2007, the SRI for **Joshua Tree National Park** was initiated. This project will contain soil interpretations that will provide ratings for Burrowing Habitat Suitability for Desert Tortoises, based upon identified soil physical properties. Biologists and other researchers can use these ratings as part of an overall ecological model to help determine critical habitat for these species.

The SRI is also working closely with the Appalachian Highlands Network, the Chihuahuan Desert Network, and the Northern and Southern Colorado Plateau Networks to develop strategies to complete the SRI to support their ongoing vital signs monitoring activities that have identified soils as an important vital sign. Other examples of the Program's soil resources management efforts in 2007 include:

Channel Islands National Park: Assisted the Water Resources Program in using information from the recently completed soil resources inventory to identify locations of hydric soils in a wetlands restoration project at Prisoner's Harbor.

Chaco Culture National Historical Park: Provided technical assistance regarding issues for locating suitable "on site" and "off site" soil material for a proposed protective campground berms that would not conflict with native soils in the area and not affect the user experience in the campground, while at the same time minimize the potential for establishment of invasive plant species.

Apostle Islands National Lakeshore and John Day Fossil Beds National Monument: Provided technical assistance to Denver Service Center staff regarding the development of applicable Soils sections for the General Management Plans.

Sharing

Given the limited internal NPS geoscience capacity, assistance from the broader geologic community is important to supporting park resource management. Fortunately, the professional geoscience community has been very responsive to park needs. Through the Geologic Resources Program, the National Park Service has been able to channel this external professional interest to yield positive results for parks. Partner organizations, such as the American Geological Institute, Geologic Society of America, U.S. Geological Survey, and State Geologic Agencies have facilitated geologic research, education, and interpretation efforts and leveraged NPS funds for resource management projects in parks. These partnerships have lead to improved park geoscience information and associated resource management actions and better geologic information sharing with the public. Many of these partnerships are essential to the progress in accomplishing geologic inventory efforts under both the Geologic Resource Evaluation and the Soil Resources Inventory. The latter activity relies heavily on its partnership with the Natural Resources Conservation Service in the U.S. Department of Agriculture.

Geologic Education and Outreach. Staff began education and outreach efforts in



Geoscientists-in-the-Parks (GIP) participants provide parks with technical expertise. GIP Kathryn Bernard collects a sample at Oregon Caves National Monument.

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 using parks for teaching geology. Staff activities are designed to enhance learning and nurture people's appreciation for significant geologic resources in parks, thereby helping preserve America's heritage. Outreach conveys the knowledge gained through research and resource management to decision makers and the public. Many of our National Parks have depended on the Program and its expertise for assistance in developing and maintaining high quality geologic education and outreach materials and in collaborating with the geoscience community to assist park resource management.

Geoscientists-in-the-Parks. Staff manages the Geoscientists-in-the-Parks (GIP) program, working with professional geologic organizations and the academic community to meet the large backlog of park geoscience needs. The GIP program accomplishment in FY

2007 included placing 26 geoscientist participants in 17 parks, receiving most assistance through volunteer experts and students and other support at greatly reduced cost. These partnerships realized more than a 4:1 direct and in-kind match to NPS funds, gaining more than \$378,000 worth of expertise with \$78,000 in direct NPS funding and in-kind contributions. Geoscientists-in-the-Parks park projects reached tens of thousands of park visitors with geologic outreach and education programs, and hundreds of thousands more benefited through web site visits. Participants in the GIP program helped parks meet critical needs in natural resource management, research, public safety, and both formal and informal education.

National Cave and Karst Research Institute.

The year 2007 was a transitional year in the development of the National Cave and Karst Research Institute (NCKRI). The legislation that directed the National Park Service to establish the Institute near Carlsbad, New Mexico, also included direction that the Service jointly administers NCKRI with another pri-

vate entity responsible for day-to-day administration. This management plan was brought to fruition in FY 2007 with the formal transfer of administrative responsibility to New Mexico Tech and the creation of a broad-based Board of Directors to guide the Institute. The NCKRI Executive Director position was transferred to New Mexico Tech, and their recruitment action resulted in the October 2006 selection the full time director.

During FY 2007, the Director undertook extensive outreach efforts to institutions, organizations and individuals to help foster awareness of the important mission of the institute and establish new partners. He has forged new working relationships with both national and international partners. He also has established a very effective working relation with the members of the Institute's Board of Directors. The board is made up of more than a dozen key members of the academic, federal, and professional cave and karst communities that function as a cohesive group focused on helping to advance the Institute.

Excellent progress has been made toward construction of a NCKRI building that will incorporate sustainability features for energy efficiency and green building materials. Construction will begin in early summer 2008.

Resource Protection and Restoration

Cave and Karst. The National Park Service manages more than 121 parks containing karst and cave features. In FY 2007, the Program's cave and karst program coordinator continued to support the efforts of cave conservation, management, protection, and science throughout the National Park System until his retirement in March. Technical support highlights for the year include:

Provided oversight to parks that received Fee Demo project money to survey and inventory caves. This included a last moment shuffle to assign project money to survey and inventory caves at **Kalaupapa National Historical Park** on the island of Molokai.

Assisted **El Malpais National Monument** with technical advice on their cave survey and inventory program including updated software and other data storage and use recommendations.

Provided technical advice to **Lava Beds National Monument** on their cave management program and on specific infrastructure and ice-monitoring problems.

Disturbed Land Restoration/Abandoned Mineral Lands Reclamation. The Natural Resource Challenge established the NRPP Disturbed Lands Restoration fund (\$850,000). The program annually allocates project funds to parks based on competitive proposals. Staff prepares the technical guidance, reviews park work plans for technical adequacy, and provides oversight on cost accounting and accomplishments reporting.

With the funding for Disturbed Lands in FY 2000, the Challenge also funded two new Geomorphologists positions. They provided three primary functions related to restoration and geomorphic issues: park project funding, technical assistance, and Servicewide coordination. Highlights include:

Disturbed land restoration program staff oversaw \$795,000 in NRPP restoration project funding for six park projects. These projects restored nearly 752 acres of severely disturbed land.

Restoration and reclamation specialists responded to more than 24 technical assistance requests involving disturbed lands, abandoned mine safety, and geomorphic issues. Staff provided key technical assistance to park restoration efforts through site assessments, safety hazards analysis and mitigation design, geomorphic analyses and landform restoration designs, materials/equipment cost estimates, and project oversight assistance. Examples of technical support to parks include: assessment and development of trail management techniques to reduce erosion at **Guadalupe Mountains National Park**, assessment of site location of a low water ford at **Jewel Cave National Monument**, assessment of road design standards for roads across the fore-dune at **Padre Island National Seashore**, and development of closing hazardous mines to improve employee and visitor safety and protect bat habitat at **Dinosaur National Monument**.

Minerals Management. Currently, 30 NPS units contain nearly 750 active private mineral exploration or development operations, most

of which involve the production of oil and gas. Private entities that hold property rights to oil and gas and other minerals located inside parks must obtain NPS approval of development plans and performance bonds before initiating mineral related activities. Staff assisted park managers by reviewing 11 new oil and gas proposals covering 59 operations in 5 parks. These reviews ensure that operations conform to NPS nonfederal oil and gas regulations, which require operators to use technologically feasible methods least damaging to park resources and to reclaim their sites after operations to prior conditions. Staff also help parks understand and apply the NPS permitting requirements pertinent to other types of nonfederal mineral operations in parks. An example occurred at **Death Valley National Park**, where the park responded to an inquiry from a mining company about reopening a mine on state school lands within the park.

Because mining claims located under the Mining Law of 1872 exist in 18 park units and near many other units, staff continued to be engaged in mining claim issues potentially affecting parks. Proposed legislative changes to the Mining Law prompted questions from the Department of the Interior legislative office about the numbers of and activities on mining claims in park units. Staff responded to these questions on behalf of the National Park Service.

On lands adjacent to parks, the National Park Service works with other federal, state, and local permitting agencies, along with project proponents, to have park protection measures incorporated in mineral leasing or other energy development decisions:

- The Bureau of Land Management (BLM) and USDA Forest Service Geothermal Leasing Programmatic Environmental Impact Statement;
- The Bureau of Land Management and Department of Energy's West-Wide Energy Corridor Environmental Impact Statement;
- British Columbia's proposed Lodgepole surface coal mine adjacent to **Glacier National Park**;
- Numerous BLM oil and gas leasing proposals adjacent to park units;
- Numerous state mineral leasing proposals adjacent to park units;

- Several proposed liquefied natural gas port proposals on the east and west coasts and the Gulf of Mexico; and,
- Assessments of mineral potential adjacent to NPS units in North and South Dakota.

Abandoned mining, and oil and gas exploration and production sites represent a substantial portion of the disturbed lands requiring restoration in parks. NPS lands currently contain an estimated 3,200 abandoned mineral development sites with more than 10,000 hazardous openings, at least 30 miles of streams with degraded water quality, and more than 33,000 acres of disturbed land. Staff continued to assist parks address this outstanding reclamation need and augmented its efforts through partnerships. For example, staff assisted the Alaska Regional Office with regulatory questions associated with the cleanup of the Nabesna Mine in **Wrangell-St. Elias National Park and Preserve**.

Other examples of the Program's minerals management efforts in 2007 include:

Big South Fork National River and Recreation Area. Program and park staff successfully secured funding to begin plugging abandoned wells and performing site reclamation. The history of oil and gas development at the park has left a legacy of dozens of orphaned oil and gas wells with no responsible party.

Big South Fork National River and Recreation Area and Obed Wild and Scenic River. Staff continued to play a pivotal role in the development of an Oil and Gas Management Plan for the two parks. Working with the park and the Environmental Quality Program, staff provided strategies to improve the efficiencies and effectiveness of the approach taken in the plan to assure it addresses the unique oil and gas management challenges facing these two parks.

Big Cypress National Preserve. Staff assisted in reinitiating their oil and gas management planning effort that was tabled in 2004 pending the possible acquisition of the nonfederal mineral rights in the park.

Cedar Creek and Belle Grove National Historical Park. Staff provided a regulatory and environmental analysis of proposed rezoning of

688 acres adjacent to the park for expansion of an existing limestone quarry. Due to NPS concerns of trans-boundary impacts and local community support of this important historical area, rezoning has been placed on hold and may not be approved. A final decision on rezoning is forthcoming.

Chaco Culture National Historical Park. Staff assisted the park in authoring a letter for the Superintendent's signature informing BLM of NPS concerns about several potential oil and gas lease parcels directly adjacent to the park. The letter asked BLM to withdraw the parcels from a pending lease sale citing Chaco's enabling legislation specifically addressing inter-agency coordination to protect park and area cultural and archeological resources. The final letter resulted in the parcels being withdrawn from consideration from leasing pending further environmental and cultural resource study.

Collaborating with other Servicewide offices and the NPS Utah State Coordinator, the Program prepared extensive comments on the Bureau of Land Management's Notice of Intent to prepare a Programmatic Environmental Impact Statement for Oil Shale and Tar Sands Leasing on Land Administered by the BLM in Utah, Colorado, and Wyoming. This new initiative under the Energy Policy Act of 2005 could potentially affect eight park units in three states.

Whiskeytown National Recreation Area. Program staff helped respond to a spill of several tons of drilled material from an upstream gold mine into park waterways. Staff worked with the park and representatives of BLM, USGS, and the California Regional Water Quality Control Board to ascertain the various types, levels, and receptors of contamination currently entering the park from this mine and other mining sites surrounding the park, and to identify and initiate the enforcement and regulatory actions that should be taken to reduce contamination of Whiskeytown Lake, an important recreational area within the park and a drinking water source for several municipalities.

Pictured Rocks National Lakeshore. Staff continues to work with the Superintendent and the Solicitor's Office who was analyzing

the implications of restrictive easement deed language for proposed extraction of sand and gravel within the park.

ENVIRONMENTAL QUALITY PROGRAM

The National Environmental Policy Act of 1969 (NEPA) is landmark environmental legislation. NEPA requires all federal agencies to prepare studies of the impacts of and alternatives to proposed federal actions; use the information contained in such studies in deciding whether to proceed with the actions; and diligently attempt to involve the interested and affected public before any decision affecting the environment is made. The 1916 National Park Service Organic Act directs the National Park Service 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."

Read together, the provisions of NEPA and the NPS Organic Act jointly commit the Service to make informed decisions that perpetuate the conservation and protection of park resources unimpaired for the benefit and enjoyment of future generations.

The Environmental Quality Program provides technical assistance, national policy development and direct project assistance to parks in the areas of impact analysis and conservation planning under the National Environmental Policy Act (NEPA) and related laws; implementation of the National Park System Resources Protection Act, and damage assessment and restoration activities under the Oil Pollution Act and CERCLA. The Program also provides training and guidance in environmental and conservation planning, impact assessment and analysis, economic valuation of park resources, recovery for and restoration of damaged resources.

Resource Damage Assessment and Restoration Program

Under the Park System Resource Protection Act (PSRPA) (16 USC 19jj), the Oil Pollution Act (OPA) of 1990, the Clean Water Act (CWA) as amended by OPA, and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the National Park Service takes emergency actions and spill

response activities to prevent or minimize destruction or the loss of or injury to park system resources. Following incidents, the National Park Service conducts assessments to determine damages to park resources and develops and implements restoration of the impacted resources. The Resource Damage Assessment and Restoration Program supports: 1) Policy development and guidance; 2) direct technical assistance to parks in taking emergency response actions and conducting damage assessments following incidents, and in planning and implementing restoration projects; 3) outreach and training on emergency response and damage assessment for NPS personnel; 4) Case Management, and 5) Cost Recovery actions, and Project Management for Restoration support. In 2007, \$504,512 in damages were collected and deposited into the DOI Restoration Fund for restoration of damaged park resources. On the restoration side, more than \$1,208,242 was withdrawn from the DOI fund to initiate restoration projects in more than 22 different park units. Major restoration projects were finally initiated in and around **San Juan National Historic Site** following a lengthy planning and public review process using funds collected for the Morris J. Berman oil spill in 1994 including a coastal promenade and interpretive exhibits around El Morro Castle. In the collaborative state/federal effort, other restoration projects to conduct beach and reef restoration will be carried out by NOAA and the Commonwealth of Puerto Rico.

NATURAL SOUNDS PROGRAM

Early park managers intuitively understood the importance of a robust acoustic environment; many of the earliest laws for wildlife protection were developed by birders, hunters, and those versed in the fundamentals of animal husbandry. As the Park Service has matured during the last century, so too has its understanding of the critical role of sound in conserving both wildlife and scenery. Many animals depend upon sound for locating food, avoiding predators, or mating. Humans also rely on natural sounds; the linkages between hearing the sounds of nature and overall emotional and mental well-being is well documented. It is not coincidence that so many of the relaxation and exercise compact disks on the market incorporate the sounds of nature. After all, it is difficult to appreciate the beauty

and reverie inspired by natural wonders such as Timpanogos Cave with the buzz of lighting systems overpowering the sounds of cave echoes or stalactites dripping.

The NPS Natural Sounds Program was established in 2000 to provide parks with assistance, guidance, and a Servicewide consistent approach to managing acoustic environments (or soundscapes) in a way that balances the myriad expectations of park visitors with the protection of park resources and values. The mission of the Natural Sounds Program is to protect, maintain, and restore soundscape resources and values by working in partnership with parks and others to increase scientific and public understanding of the value and character of park soundscapes. 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. While the Natural Sounds Program contributes to each element of the natural resource management cycle; FY 2007 highlights focus on learning, understanding, sharing, resource protection and restoration, and evaluation.

Learning and Understanding

Data were collected in ten park units (**Great Smoky Mountains National Park, Bryce Canyon National Park, Lake Mead National Recreation Area, Golden Gate National Recreation Area, Mount Rainier National Park, Muir Woods National Monument, North Cascades National Park, Haleakala National Park, Hawaii Volcanoes National Park, and Minute Man National Historical Park**); all of these are ATMP parks. The Program provided guidance for data collection in three additional park units (**Grand Canyon, Yosemite, and Yellowstone National Parks**); two of these are ATMP parks.

An integrated computer archive of acoustic monitoring data was established on a custom hardware platform. Data from 34 park units have been converted into standard file formats, totaling nearly 10,000 days of observations and more than 5 Megabyte data files. Data from an additional 6 park units (928 days) have been obtained from the Volpe

Transportation Center, but they have not been converted yet. This computer system has eight processor cores in addition to nearly ten Tera-byte of storage to enable comparative analyses of sound levels across park units.

Combined acoustic and social science studies were conducted at five park units (**Hawaii Volcanoes National Park, Haleakala National Park, Muir Woods National Monument, Yosemite National Park, and Great Smoky Mountains National Park**).

Draft acoustic monitoring reports have been completed for five park units and are being reviewed by the units (**Yosemite National Park, Sequoia and Kings Canyon National Parks, Devils Postpile National Monument, Muir Woods National Monument, and Great Basin National Park**).

Sounds Program engineers designed and built a custom electronic circuit board to simplify and improve the automatic data collection systems. The digital audio recording component of these systems was improved to reduce the power consumption of this component by 60 percent. Overall system energy consumption has been reduced from 14 watts to 2 watts. Data processing software was written to automatically generate scientific graphics that concisely summarize acoustic monitoring data.

The generic “compression” algorithm that enables adjustment of noise duration metrics to account for temporal overlap among noise sources (developed by the Natural Sounds Program) was used to develop an incremental planning tool for air tour management. In this framework, the Volpe Center’s INM 6.2 aircraft noise modeling program is used to predict the noise footprint from a single aircraft flying on each route, and an interactive spreadsheet tool is used to calculate the aggregate effects of multiple flights on these routes. In addition to fostering intuitive understanding in park management staff, this tool enables flexible exploration of a wide range of alternatives without incurring additional modeling costs.

Lake Mead National Recreation Area. A baseline ambient acoustic data collection report was completed. Development of the Air Tour Management Plan will continue when the Grand Canyon Air Tour Plan is complete.

Badlands National Park. A baseline ambient acoustic data collection report was completed and a working Draft Air Tour Management Plan /Environmental Assessment was completed. Tiger Team meetings were held from April to June 2007 to review Chapters 1 through 3 of the document.

Sound monitoring station at Hidden River, on the South side of the Alaska Range in Denali National Park and Preserve. Improvements to recording equipment resulted in 60 percent less power consumption.



Great Smoky Mountains and Acadia National Parks. Acoustic monitoring was completed at both parks and data analysis and noise modeling is ongoing. Air Tour Management Plan development is scheduled to begin in 2008.

Statue of Liberty and Governors Island National Monuments: Acoustic Monitoring was conducted at the monuments in preparation for Air Tour Management Plan development in 2009.

Sound Management Plans (SMPs): The Sounds Program assisted parks with soundscape management by developing indicators and standards against which impacts to the acoustic environment can be measured pursuant to park management objectives, and establishing baseline acoustic ambients to characterize the overall acoustic environment (**Minute Man National Historical Park, Zion National Park, Grand Canyon National Park, Hawaii parks, Mount Rushmore National Memorial, Muir Woods National Monument**, etc). Acoustic monitoring was conducted for the development of the Minute Man Soundscape Management Plan and preliminary analysis of the data is complete. Results of the soundscape analysis were shared with Minute Man park managers and the SMP is currently being developed. Acoustic data previously collected for **Zion National Park** was re-analyzed to support the development of the Zion SMP. The draft SMP including soundscape indicators and standards was developed. Review of the draft Zion SMP is ongoing.

Sharing

Given the increased understanding of the important role the acoustic environment plays in overall ecosystem health as well visitor enjoyment and wilderness management, the 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 2007, the Sounds Program was very successful in expanding productivity by leveraging its budget with various project partners including: acoustic monitoring for ATMPs with FAA and Volpe; park-based Social Science/Visitor Use research with various academic institutions and private sector partners, soundscape planning and workshops with various parks, model validation and improvement with the

Federal Interagency Committee on Aircraft Noise (FICAN), and cooperation with the Acoustical Society of America (ASA).

In carrying out data collection and analysis, the Sounds Program employs four research associates with Colorado State University, which has allowed the Sounds Program to attract highly qualified individuals while augmenting research and educational capacity. These research associates have given several presentations on their work at the university and at professional meetings.

Military: Natural Sounds Program staff regularly attends regional Airspace/Military coordination meetings in order to promote and foster productive working relations with the various branches of the U.S. military. In 2007, staff established Air Force contacts for dealing with overflight issues at **Kaloko-Honokohau National Historical Park, Yosemite National Park, and Chickasaw National Recreation Area**. Attendance at regional Airspace/Military coordination meetings will continue in 2008 as it facilitates continued cooperative relationships between parks and military airspace managers and allows issues to be dealt with in an efficient manner.

At the 2007 George Wright Society meeting (St. Paul, MN), Sounds Program hosted three concurrent sessions (acoustic monitoring technology, social science studies, soundscape planning). Sounds Program staff contributed six presentations and one poster.

Sounds Program staff participated in several professional meetings: Acoustical Society of America, Quiet Commotion conference, and the Vail Symposium. Sounds Program staff contributed three seminars and one guest lecture at Colorado State University.

The Sounds Program continued its successful jointly funded partnership (50/50) with Colorado State University employing a part time "Acoustic Fellow" graduate student in the field of acoustic ecology to assist primarily with social science research on the visitor values about the opportunity to hear the sounds of nature.

Sounds Program staff wrote a feature article and other submissions for a special sound-

scapes issue of *Legacy Magazine* published by the National Association for Interpretation, the *Adubon Magazine*, and *American Hiker*.

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

Resource Restoration and Protection

An important element of the Natural Sounds Program mission is working with the Federal Aviation Administration (FAA) to implement the National Parks Air Tour Management Act (NPATMA) which comprises approximately 65–75 percent of the Program budget and staff resources.

Mount Rushmore National Memorial. A working Draft ATMP/EA was completed in 2006. In 2007, the largest air tour operator informed FAA that he retired and is no longer conducting air tours over the park. In addition, the National Park Service determined that seven of the eight alternatives analyzed in the Environmental Assessment (EA) would result in “impairment” of natural resources. Consequently, alternatives for the Mount Rushmore ATMP are currently under revision. Upon internal review of the draft, several issues (e.g. speech interference analysis for rock climbers, national security/visitor safety analysis) were identified and various efforts including an elevation meeting with the FAA Assistant Administrator, Aviation Policy, Planning and Environment, and NPS Associate Director of Natural Resource Stewardship and Science were undertaken to identify acceptable methods for completing the analysis.

Hawaii Parks: A Notice of Intent to prepare an environmental impact statement for the air tour management plan for **Haleakala National Park** was issued in November 2006. Public and agency comments on the scoping document were received and numerous discussions and planning meetings took place regarding developing and refining alternatives. A Rapid Ethnographic Assessment was conducted as well as visitor surveys on soundscapes and air tours. The air tour management planning process for **Kalaupapa National Historical Park** was closed in January 2007 after all of the existing air tour operators withdrew their applications to conduct air tours over the park. The EIS alternatives development continued for **Hawaii Volcanoes National Park** using the

Integrated Noise Model sensitivity modeling information and interactive spreadsheet tool process mentioned above. A visitor experience survey on soundscapes and air tours was also conducted.

Expedited NEPA: The National Park Service is continuing to work with FAA and air tour stakeholders to develop several methods for streamlining and expediting the ATMP/NEPA process including a programmatic ATMP and the use of the Aviation Rulemaking Committee (ARC) process that would include FAA, National Park Service, environmental groups, the air tour operator, and possibly Native American Tribes. In cooperation with FAA, the Sounds Program identified several candidate parks for the expedited ARC process. However when the parks were contacted, it was determined that no air tours were occurring at the park or the operators agreed to fly outside the park and the half mile buffer thereby making the ATMP unnecessary.

Expedited Alternative Development process: FAA and the National Park Service continue to refine and improve an iterative process that is allowing for a much faster, less expensive, and responsive way of developing ATMP NEPA alternatives. The expedited Alternative Development process is currently being used to revise alternatives for **Mount Rushmore National Memorial, Haleakala National Park, and Hawaii Volcanoes National Park** ATMPs.

Legislative Amendments: National Park Service continued working with FAA and others on potential legislative amendments to the NPATMA through FAA authorizing legislation that would help streamline the ATMP process by increasing flexibility without compromising protection of park resources (e.g., voluntary agreements, modifications to IOA, discretionary exemptions to the ATMP process, etc).

Grand Canyon Alternative Dispute Resolution Process: Working with FAA and 20 stakeholders, Sounds Program assisted in the development of NEPA alternatives, provided acoustic expertise on the Grand Canyon Technical Committee, and participated in 2 Grand Canyon Working Group (GCWG) meetings. To ensure that decisions related to Grand Canyon are based on the most current scientific knowledge, Sounds Program staff initiated the development of a multidisciplinary team of acoustic and wildlife experts to ad-

dress technical issues and questions resulting from ADR activities.

Evaluation

The Sounds Program does not have any Government Performance Results Act goals of its own given the size and age of the program. However, with respect to the overall NPS and NRSS goals to assist parks in the protection of park resources and visitor enjoyment, in 2007 the Sounds Program assisted more than 25 parks in 49 specific projects related to the protection of park resources and values.

Sounds Program Activity—Number of Projects	
Acoustic Monitoring	13
Airport Projects	8
Air Tour Management Plan	9
Military Assistance	3
Social Science Research re Visitor Use	5
Soundscape Mgmt. Plan/Obj. and Stds	7
Other	4
Total	49



Chapter VI: Financial Details

This chapter presents financial details for Servicewide natural resource programs. Information in Chapters II, III, IV, and V describe program accomplishments and highlight programs that have benefited from the Natural Resource Challenge funding provided between FY 2000 and FY 2007, and how the programs were affected.

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 identifiable separate line items. In other cases, the Challenge funds are mixed with previous park or program bases.

Therefore, the Challenge funding cannot be distinguished in most of the program-by-program financial information. Details of the history of Challenge funding are included in Appendix A.

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

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

Natural Resource (NR) Funding of Parks Receiving NR Challenge Increases							
Park	FY 01 or FY 02 Challenge Increase	FY 2002 NR Total	FY 2003 NR Total	FY 2004 NR Total	FY 2005 NR Total	FY 2006 NR Total	FY 2007 NR Total
Acadia NP	345,000	849,827	794,395	755,087	752,395	695,273	726,254
Antietam NB	150,000	319,965	316,723	314,900	353,000	350,000	420,000
Appalachian National Scenic Trail	142,000	263,638	256,603	258,337	298,642	299,453	310,919
Big Cypress NPr ¹	399,000	1,033,640	1,010,000	1,108,140	1,108,140	1,085,907	1,104,663
Buck Island Reef NM ²	100,000	270,000	216,450	216,000	216,000	216,000	216,000
Catoctin Mountain Park ³	89,000	254,400	231,900	232,200	272,414	174,867	200,594
Channel Islands NP ⁴	498,000	1,406,622	1,406,622	1,440,607	1,891,222	1,891,222	1,891,222
Coronado NMem	60,000	94,993	105,231	95,236	108,000	60,000	60,000
Curecanti NRA	141,000	657,500	690,600	719,300	724,000	731,700	741,900
Dinosaur NM	189,000	501,800	559,375	568,874	571,152	524,200	627,280
Gates of the Arctic NP & Pr	148,000	362,401	363,039	349,164	377,345	357,517	342,014
Great Basin NP	126,000	331,450	315,756	375,939	367,080	382,600	454,600

Coronado National Memorial is one of the 32 parks that benefited from Natural Resource Challenge base funding increases.

Natural Resource (NR) Funding of Parks Receiving NR Challenge Increases							
	FY 01 or FY 02	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
Park	Challenge Increase	NR Total					
Great Sand Dunes NP	180,000	291,700	287,500	281,300	281,300	323,400	332,000
Great Smoky Mountains NP	402,000	1,245,100	1,152,700	1,003,200	1,231,700	476,000	353,200
Haleakala NP	480,000	1,561,660	1,372,200	1,196,400	1,196,400	1,404,882	1,458,403
Homestead NM of America	82,000	104,500	104,500	81,198	82,460	82,353	87,731
Hopewell Culture NHP ³	105,000	95,000	79,322	103,047	99,953	109,519	106,024
Jewel Cave NM	50,000	168,500	168,500	167,140	159,203	153,330	161,422
John Day Fossil Beds NM	95,000	129,000	130,000	115,000	127,101	119,000	129,000
Kalaupapa NHP	211,000	549,000	549,000	549,000	499,000	534,000	549,000
Lake Clark NP&Pr	147,000	321,500	319,810	250,000	262,600	245,800	261,032
Little River Canyon NPR ⁵	85,000	182,426	174,027	112,900	171,275	95,898	96,371
Mojave NPR ³	470,000	1,264,000	1,219,073	1,177,488	1,178,297	1,165,193	1,160,397
Monocacy NB ³	118,000	120,000	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
Padre Island NS	95,000	408,000	403,825	543,000	471,896	600,200	589,492
Pictured Rocks NL	55,000	194,650	207,000	211,000	237,000	238,832	243,664
Rock Creek Park ³	163,000	436,522	393,168	359,104	299,000	376,300	307,977
San Juan Island NHP	95,000	124,600	125,050	124,600	124,600	116,837	101,200
Saugus Iron Works NHS	58,000	58,000	58,000	69,900	58,000	58,000	58,000
Sequoia & Kings Canyon NPs ^{3 & 6}	112,000	1,446,000	1,424,400	1,424,400	1,457,400	1,563,600	1,590,600
Stones River NB	132,000	132,000	137,100	127,924	132,000	208,277	188,182
Sunset Crater, Walnut Canyon, & Wupatki NMs	100,000	166,762	171,227	186,341	191,683	196,426	208,661
Theodore Roosevelt NP	133,000	302,500	292,500	282,500	281,500	264,660	301,400
Virgin Islands NP ⁷	399,000	1,077,234	1,002,726	941,500	877,234	877,234	399,000
Zion NP	246,000	536,300	515,872	518,774	485,274	518,774	467,101
Totals	6,595,000	17,506,190	16,863,512	16,564,275	15,047,667	16,802,029	16,556,303

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

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

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

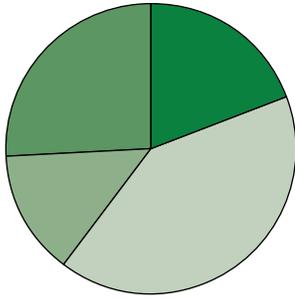
⁴ Received NRC money in FY2002 (\$498k for Santa Cruz Island restoration) and in FY2005 (\$477k for island fox recovery).

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

⁶ Also received a non-Challenge \$367,000 base increase in FY 2001

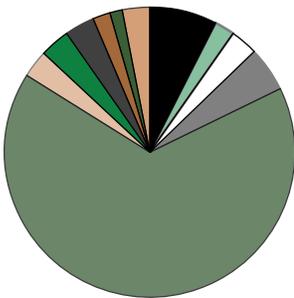
⁷ Also received Coral Reef Initiative base increase of \$300,000 and Prototype Monitoring increase of \$230,000 in FY 2001

Air Quality Program Funding by Categories



- Technical assistance
- Collaboration & Outreach
- Air quality monitoring, projects, and analysis
- Program Management & Implementation

Biological Resource Management Program Funding by Categories



- Vegetation Mapping
- Quantitative Ecology and Biostatistics
- Migratory Bird Program
- Invasive Plant Program
- Invasive Animal Program
- IPM
- Exotic Plant Management Program
- Endangered Species Program
- Ecological Restoration
- Natives Branch
- National Level Support

Air Quality Program

FY 2006 allocation	8,780,000
Net FY 2006 Decrease	88,000
Total Available in FY 2006	8,692,000
FY 2007 allocation	8,692,000
Classified Pay Increase	44,000
Net FY 2007 Decrease	
Total available in FY 2007	8,736,000
Change from FY 2006	44,000

Air Quality Program Funding by Categories

Program Management & Implementation	1,694,000
Air quality monitoring, projects, and analysis	3,580,000
Collaboration & Outreach	1,208,000
Technical assistance	2,254,000
Total available in FY 2007	8,736,000

Biological Resources Management Program

FY 2006 allocation	8,475,000
Net FY 2006 Decrease	-74,000
Total Available in FY 2006	8,401,000
FY 2007 allocation	8,401,000
Classified Pay Increase	44,000
Base adjustment ⁸	368,000
Invasive species increase	750,000
Highly Pathogenic Avian Influenza	375,000
Total available in FY 2007	9,938,000
Change from FY 2006	1,537,000

Biological Resource Management Program Funding by Categories

Biological Resource Projects - National Level Support	668,400
Natives Branch	175,500
Ecological Restoration	275,000
Endangered Species Program	425,000
Exotic Plant Management Program	5,690,000
Integrated Pest Management Program	275,000
Invasive Animal Program	275,000
Invasive Plant Program	280,000
Migratory Bird Program	175,000
Quantitative Ecology and Biostatistics	125,000
Vegetation Mapping	250,000
Wildlife Management and Health Program	949,100
BRMD base funding in FY 2007	9,563,000
Highly Pathogenic Avian Influenza	375,000
Total available funding in FY 2007	9,938,000

⁸ Transferred from I&M Program funding

Cave and Karst Research Institute	
FY 2006 allocation	333,000
Net FY 2006 Decrease	-5,000
Total available in FY 2006 ⁹	328,000
Funding allocation in FY 2007	\$328,000
Classified Pay Increase	
Total available in FY 2007	\$328,000
Change from FY 2006	No Change

Cooperative Ecosystem Studies Units	
Total allocation/available in FY 2006	127,000
Total allocation/available in FY 2007	127,000
Change from FY 2006	No Change

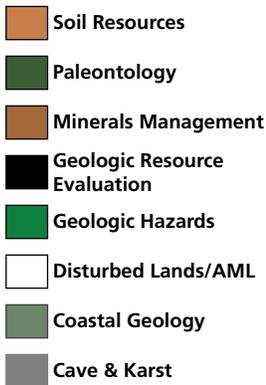
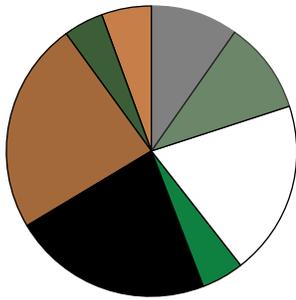
Cooperative Ecosystem Studies Units Funding Distribution¹⁰	
FY 2001 or 2003 funding	
Californian CESU—no Challenge funding	
Chesapeake Watershed CESU	155,000
Colorado Plateau CESU	155,000
Desert Southwest CESU	155,000
Great Basin CESU	155,000
Great Lakes-Northern Forest CESU	153,000
Great Plains CESU	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	

Geographic Information System Program	
FY 2006 Allocation	\$1,273,000
Classified FY 2006 Pay Increase	2,000
Net FY 2006 Decrease ⁹	-20,000
Total available in FY 2006	1,255,000
Funding allocation in FY 2007	1,255,000
Base Change	0
Net FY 2007 Decrease	0
Total available in FY 2007	1,255,000
Change from FY 2006	No Change

⁹ The FY 2006 net decrease is the sum of across-the-board reductions.

¹⁰ Distribution of initial funding from Natural Resource Challenge increases for CESUs shown. Does not show changes to base that may have occurred to funds transferred to regions.

Geologic Resources Program Funding by Categories



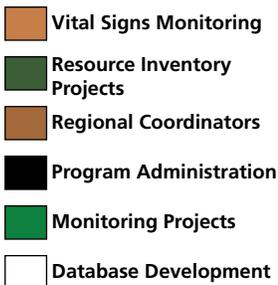
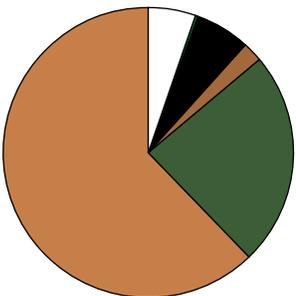
Geologic Resources Program

FY 2006 Allocation	2,647,000
Classified FY 2006 Pay Increase	68,000
Net FY 2006 Decrease ⁹	-43,000
Total available in FY 2006	2,672,000
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
Change from FY 2006	190,000

Geologic Resources Program Funding by Categories

Cave & Karst	\$286,000
Coastal Geology	\$292,000
Disturbed Lands/AML	\$554,000
Geologic Hazards	\$135,000
Geologic Resource Evaluation	\$638,000
Minerals Management	\$671,000
Paleontology	\$129,000
Soil Resources	\$157,000
FY 2007 Total	\$2,862,000

Inventory and Monitoring Program Funding by Categories



Inventory and Monitoring Program

FY 2006 Allocation	43,806,000
Net FY 2006 Decrease ⁹	-682,000
Total available in FY 2006	43,124,000
FY 2007 Allocation	43,124,000
Classified FY 2007 Pay Increase	169,000
Programmatic Increase	1,000,000
Net FY 2007 Decrease ¹²	-518,000
Total Available in FY 2007	43,775,000
Change from FY 2006	651,000

Inventory and Monitoring Program Funding by Categories

Database Development	2,400,000
Monitoring Projects	101,500
Program Administration	2,704,200
Regional Coordinators	890,800
Resource Inventory Projects	10,449,800
Vital Signs Monitoring	27,228,700
Total available in FY 2007	43,775,000

¹¹ Transferred from I&M Program funding.

¹² Transfer of I&M funding to BRMD (\$368K) and GRD (\$150K).

Allocation of Funding among Basic Natural Resource Inventories

Air Quality Related Values	325,000
Base Cartography Data	108,740
Biological Inventories ¹³	Completed
Geology Inventories	1,880,000
Meteorological Data	60,000
Soil Surveys	2,800,000
Species Lists	25,000
Vegetation Mapping—Alaska	500,000
Vegetation Mapping—Outside of Alaska	4,250,000
Water Resource Data	132,500
Other Natural Resource Inventories	368,640
Total	10,449,800

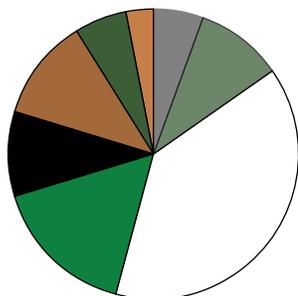
Allocation of Monitoring Funding among Networks and Prototypes¹⁴

Network	FY First Funded	FY 2007 Funding
North Coast and Cascades	2001	\$751,100
Northeast Coastal and Barrier	2001	\$782,000
Heartland	2001	\$709,400
Sonoran Desert	2001	\$676,900
Cumberland/Piedmont	2001	\$684,200
Central Alaska	2002	\$1,223,800
National Capital	2002	\$752,400
Northern Colorado Plateau	2002	\$977,000
San Francisco Bay Area	2002	\$758,600
Greater Yellowstone	2002	\$734,700
Appalachian Highland	2002	\$421,800
Mediterranean Coast	2002	\$308,000
Southwest Alaska	2002	\$1,455,100
Northeast Temperate	2003	\$786,700
Southern Colorado Plateau	2003	\$1,215,000
Pacific Island	2003	\$1,580,900
Great Lakes	2003	\$1,301,300
Gulf Coast	2004	\$933,100
Rocky Mountain	2004	\$639,000
Sierra Nevada	2004	\$662,000
Eastern Rivers and Mountains	2004	\$659,100
Klamath	2004	\$801,400
Arctic	2005	\$1,569,100
Southeast Coast	2005	\$1,275,400
Upper Columbia Basin	2006	\$527,200
Southern Plains	2006	\$392,500
Mojave Desert	2006	\$853,000
Southeast Alaska	2006	\$1,534,300
South Florida/Caribbean	2006	\$441,800
Mid-Atlantic	2006	\$303,100
Chihuahuan Desert	2007	\$740,000
Northern Great Plains	2007	\$778,800
Total		\$27,228,700

¹³ Biological inventories have been completed for the 270 parks.

¹⁴ Listed in the order that funding was received.

Allocation of NRPP Among Project Categories and Projects Funded



- USGS--BRD Technical Assistance
- Threatened & Endangered Species
- Small Park
- Servicewide
- Regional Block Allocation
- Natural Resource Management
- Disturbed Land Restoration
- Alaska Projects

National Natural Landmarks Program

FY 2006 Allocation	981,000
FY 2006 Program Change	-495,000
Classified FY 2006 Pay Increase	17,000
Net FY 2006 Decrease ⁹	-7,000
Total available in FY 2006	496,000
FY 2007 Allocation	496,000
Classified FY 2007 Pay Increase	16,000
Other Increase	298,000
Total available in FY 2007	810,000
Change from FY 2006	314,000

Natural Resources Data and Information Program

FY 2006 Allocation	1,500,000
Classified FY 2006 Pay Increase	33,000
Net FY 2006 Decrease ⁹	-23,000
Total available in FY 2006	1,510,000
FY 2007 Allocation	1,424,000
Classified FY 2007 Pay Increase	19,000
Total available in FY 2007	1,443,000
Change from FY 2006	-67,000

Natural Resources Preservation Program (NRPP)

FY 2006 Allocation	8,312,000
Net FY 2006 Decrease ⁹	-83,000
Total available in FY 2006	8,229,000
FY 2007 Allocation	8,229,000
Base Change	0
Net FY 2007 Decrease	0
Total available in FY 2007	8,229,000
Change from FY 2006	No Change

Allocation of NRPP Among Project Categories and Projects Funded

	Allocation	Projects
Alaska Projects	474,000	8
Disturbed Land Restoration	803,000	12
Natural Resource Management	3,190,000	31
Regional Block Allocation	1,324,000	72
Service-wide	776,000	22
Small Park	948,000	60
Threatened & Endangered Species	474,000	12
USGS/BRD Technical Assistance	240,000	Not reported

Natural Sound Program	
FY 2006 Allocation	1,413,000
Net FY 2006 Decrease ⁹	-14,000
Total available in FY 2006	1,399,000
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
Change from FY 2006	2,407,000

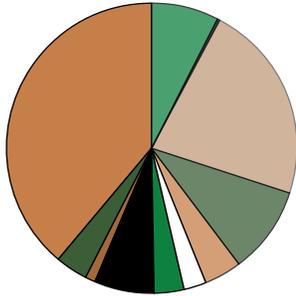
Resource Damage Assessment and Restoration Program¹⁴	
FY 2006 Allocation	1,341,000
Classified FY 2006 Pay Increase	25,000
Net FY 2006 Decrease ⁹	-22,000
Total available in FY 2006	1,344,000
FY 2007 allocation	1,344,000
Classified Pay Increase	17,000
Total available in FY 2007	1,361,000
Change from FY 2006	17,000

Resource Protection Fund	
FY 2006 allocation	290,000
Net FY 2006 Decrease ⁹	-4,000
Total available in FY 2006	286,000
FY 2007 allocation	286,000
Total available in FY 2007	286,000
Change from FY 2006	No Change

Water Resources Program	
FY 2006 allocation	12,436,000
Classified Pay Increase	85,000
Net FY 2006 Decrease ⁹	-196,000
Total available in FY 2006	12,325,000
FY 2007 allocation	12,325,000
Classified Pay Increase	74,000
Total available in FY 2007	12,399,000
Change from FY 2006	74,000

¹⁴ Combines two former line items: Oil Pollution Act and Resource Protection Act

Water Resources Program Funding by Categories



- Water Resource Technical Assistance
- Other Projects
- Marine Science Advisor
- Natural Resource & Watershed Condition Assessments
- WCAP Coastal Projects
- WCAP Critical Projects
- WCAP Competitive Projects
- Water Resource Protection—Aquatic Resource Professionals
- Water Quality Monitoring
- Other Projects
- Water Resource Protection

Water Resources Program Funding by Categories

<i>Water Resource Projects</i>	
Water Resource Protection	954,700
Other Projects	14,500
Water Quality Monitoring	2,781,300
Water Resource Protection—Aquatic Resource Professionals	1,205,000
<i>Watershed Condition Assessment Program</i>	
Competitive Projects	507,800
Critical Projects	306,600
Coastal Projects	422,000
Natural Resource and Watershed Condition Assessments	813,100
Marine Science Advisor	146,000
Other Projects	453,800
Water Resource Technical Assistance	4,794,200
Total	12,399,000

Allocation of Water Quality Monitoring Funding

Network	number of parks	FY 2007 funding
Central Alaska	5	95,700
Heartland	15	80,000
Northeast Coastal and Barrier	8	87,900
National Capital	11	69,300
Cumberland/Piedmont	14	57,600
Appalachian Highlands	4	68,300
Northern Colorado Plateau	16	105,400
Greater Yellowstone	3	69,300
Sonoran Desert	11	62,500
North Coast and Cascades	7	80,000
San Francisco Bay	6	68,300
Mediterranean Coast	3	74,200
Southwest Alaska	5	135,700
Northeast Temperate	10	58,600
Southern Colorado Plateau	19	121,000
Pacific Island	9	147,400
Great Lakes	9	120,100
Gulf Coast	8	86,900
Rocky Mountain	6	59,500
Sierra Nevada	3	61,500
Eastern Rivers and Mountains	9	61,500
Arctic	5	147,400
Klamath	6	74,200
Southeast Coast	17	118,100
Upper Columbia Basin	8	48,800
Southern Plains	10	28,300
Mojave Desert	6	78,100
Southeast Alaska	3	41,000
South Florida/Caribbean	6	143,500
Mid-Atlantic	11	43,000
Chihuahuan	6	71,300
Northern Great Plains	13	79,100
Servicewide Data Management		137,800
Total	272	2,781,300



Sam Smyrk, biotech for the long-term vegetation monitoring project, permanently marks a vegetation plot at Saint Croix National Scenic Riverway.

Appendix A: Natural Resource Challenge Funding History¹

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 Monitor 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 useable		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

¹ All funding shown in thousands of dollars.

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



Appendix B: NRPP Projects FY 2007

NRPP Natural Resource Management Fully Funded Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2007 FUNDING
Acadia National Park	Characterize Rocky Intertidal Shorelines at Newly Acquired Navy Base Lands	122,000	11,000
Apostle Islands National Lakeshore	Assess Economic Impact of Park Establishment and Wilderness Designation at Two Parks	98,000	98,000
Biscayne National Park	Assess the Conservation of Genetic Diversity of the Critically Endangered <i>Pseudophoenix Sargentii</i>	60,000	60,000
Black Canyon of the Gunnison National Park	Survey Boundary to Protect Park Resources	180,000	84,000
Buck Island Reef National Monument	Test Effectiveness of Buck Island Reef NM Expanded Marine Reserve	300,000	94,000
Canyonlands National Park	Acoustic Monitoring of Natural Soundscape	206,000	32,000
Channel Islands National Park	Establish Baseline of Newly Established Marine Reserves	564,700	108,700
Cumberland Island National Seashore	Establish Exotic Plant Management Program for Southeast Coast Network Parks	661,000	221,000
Gateway National Recreation Area	Efficient Surveillance, Targeted Management, Natural Transmission Dynamics of West Nile Virus	292,000	75,000
Glacier National Park	Evaluate the Prey Base for Lynx: Snowshoe Hare Abundance, Habitat Use, and Population Dynamics	433,000	134,000
Great Sand Dunes National Monument	Determine Grazing Ecology and Management Of Elk and Bison	450,000	190,000
Great Smoky Mountains National Park	Support for Predator Beetle Facility Needed to Control Exotic Hemlock Woolly Adelgids	396,000	87,000
Olympic National Park	Atmospheric Pollutant Loading: Link to Trans-Pacific Airmass	287,000	112,000
Padre Island National Seashore	Protecting Endangered Kemp's Ridley Sea Turtle Nests from Vehicular Traffic	295,000	96,000
Petrified Forest National Park	Excavation of Threatened Fossil Bone-bed	82,000	12,000
Saint Croix National Scenic Riverway	Document Habitat Requirements of the Winged Mapleleaf Mussel: Potential Habitat Degradation and Decline	219,000	75,000
Shenandoah National Park	Identify and Assess Cliff Resources and Visitor Use, Develop and Implement Cliff Management Planning	520,000	59,000
Voyageurs National Park	Assess the Impacts of International Lake Level Management by Using an Interdisciplinary Approach	899,000	74,000
Yellowstone National Park	Conserve Declining Yellowstone Pronghorn Population	376,000	112,000
TOTAL		\$6,440,700	\$1,734,700

NRPP Natural Resource Management New and Ongoing Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2007 FUNDING
Amistad National Recreation Area	Survey and Monument 41 Miles of Impacted Park Boundary	123,000	42,000
Bryce Canyon National Park	Protection and Restoration of Dark Night Skies	400,000	180,300
Canaveral National Seashore	Create Hydrologic Model of Mosquito Lagoon	280,000	100,000
Channel Islands National Park	Eradicate Dense Fennel and Facilitate Eradication of Feral Pigs	456,000	107,000
Glacier Bay National Park & Preserve	Investigate Causal Factors of Harbor Seal Decline	300,000	165,000

Inventories at Channel Islands National Park are providing a baseline against which the effectiveness of the newly created marine reserves can be evaluated.

NRPP Natural Resource Management New and Ongoing Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2007 FUNDING
Great Smoky Mountains National Park	Restore Rare Wetland Habitats Invaded by Exotic Plants	154,000	74,000
Jean Lafitte National Historical Park and Preserve	Assessing Fire for Control of Exotic Chinese Tallow in the Marshes of the Barataria Preserve	123,000	58,000
Kalaupapa National Historical Park	Exclude Ungulates From Northern Unit of Puu Alii Plateau	422,000	119,000
Point Reyes National Seashore	Control Exotic Deer	786,000	382,000
Saguaro National Park	Remove Invasive Exotic Plants from Critical Habitats	196,000	40,000
Upper Delaware Scenic & Recreational River	Identify Threatened Bald Eagle Habitat and Develop Management Plan	145,000	22,000
Wind Cave National Park	An Evaluation of the Movements and Distribution of Elk	176,000	88,000
TOTAL		\$3,561,000	\$1,377,300

NRPP Threatened and Endangered Species Fully Funded Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2007 FUNDING
Padre Island National Seashore	Determining Seasonal Movements, Habitat Use, and Abundance of Piping Plovers	144,000	35,500
Point Reyes National Seashore	Threatened Western Snowy Plover Recovery	150,000	25,000
Wind Cave National Park	Reintroduction of Black-Footed Ferrets to Wind Cave National Park - Phase II	146,000	70,000
TOTAL		\$440,000	\$130,500

NRPP Threatened and Endangered Species New and Ongoing Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2007 FUNDING
Big South Fork National River and Recreation Area	Propagate and Augment Federally Listed Mussels	144,000	64,000
Coronado National Memorial	Protect Mine Roosts of Endangered Lesser Long-Nosed Bats	77,500	5,500
Ebey's Landing National Historical Reserve	Implement Recovery Plan for Threatened Golden Paintbrush	96,397	36,500
Hawaii Volcanoes National Park	Begin Recovery of Mauna Loa Silversword in Park Addition	62,800	37,400
Kalaupapa National Historical Park	Habitat Use and Foraging of Endangered Monk Seal	95,531	62,900
Mojave National Preserve	Lake Ecology and Population Dynamics of Mohave Tui Chub	150,000	39,700
Organ Pipe Cactus National Monument	Sonoran Pronghorn Captive Breeding	150,000	50,000
Presidio of San Francisco	Restore Habitat for Two Federally Listed Plant Species	149,070	37,000
Santa Monica Mountains National Recreation Area	Investigate & Mitigate Pollen Limitation in <i>Pentachaeta lyonii</i>	65,200	10,500
TOTAL		\$990,498	\$343,500

NRPP Disturbed Lands Restoration Fully Funded Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2007 FUNDING
Glen Canyon National Recreation Area	Restoration of Springs on Navajo Point	66,000.00	15,500.00
Golden Gate National Recreation Area	Complete Restoration of Salmonid Habitat at the Banducci site on Redwood Creek	244,000.00	188,000.00
Great Basin National Park	Reclamation of the Lincoln Cirque Mining Exploration Area	90,000.00	44,700.00
Indiana Dunes National Lakeshore	Complete Restoration of 500 Acres of Wetland at Derby Ditch-Great Marsh	223,700.00	67,200.00
Joshua Tree National Park	Reclamation of Elton Mine Site	37,000.00	37,000.00
Sleeping Bear Dunes National Lakeshore	Platte River/Waterwheel Site Restoration	63,200.00	63,200.00
TOTAL		\$723,900	\$415,600

NRPP Disturbed Lands Restoration New and Ongoing Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2007 FUNDING
Big Bend National Park	Restoring Grasslands	248,100	64,600
Big South Fork National River and Recreation Area	Plug Eight Abandoned Wells and Perform Associated Surface Reclamation	249,200	186,900
Glacier National Park	Restore Severely Denuded, Eroding Parklands in Lunch Creek and Iceberg Lake High Visitor Use Areas	75,000	30,000
Hawaii Volcanoes National Park	Restore Kipuka Nene Campground	50,600	35,300
Mammoth Cave National Park	Restoration of Twenty-Six Abandoned Water Wells/ Cisterns and Three Dumps	115,900	18,000
Zion National Park	Test Riparian Revegetation Methods along the Virgin River	157,800	44,600
TOTAL		\$896,600	\$379,400

NRPP Alaska Special Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2007 FUNDING
Alaska Regional Office	Mapping and Scientific Management of Off-Highway Vehicle Trails in Alaska—Implementing BMPs	200,790	74,151
Alaska Regional Office	Resource Baseline Update for Alaska Parks Using High Resolution Satellite Imagery	1,706,900	99,683
Denali National Park & Preserve	Stratified Random Sampling for Baseline Soundscape Conditions in Large Alaskan Parks	69,972	34,636
Gates of the Arctic National Park & Preserve	Past and Present Habitat use by Muskoxen	61,450	30,665
Gates of the Arctic National Park & Preserve	Evaluating Nutritional Condition of Arctic Ungulates	48,480	23,998
Katmai National Park & Preserve	Genetic, Phenotypic, and Life History Analysis of Sockeye Origins	155,000	77,168
Wrangell-St. Elias National Park & Preserve	Evaluate Effects of International Caribou Recovery Program	148,950	49,154
Wrangell-St. Elias National Park & Preserve	Identifying Nesting and Foraging Habitat of Kittlitz's Murrelets in Icy Bay	197,005	97,733
TOTAL		\$2,588,547	\$487,188

NRPP Small Park Block Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2007 FUNDING
Agate Fossil Beds National Monument	Emergency Recovery of <i>Stenomylus</i> Remain	9,870	9,870
Arkansas Post National Memorial	Inventory, Mapping and Control of Exotic Plants	10,350	10,000
Bent's Old Fort National Historic Site	Assess Results and Refine Strategies During Implementation of an Integrated Pest Management Plan	22,272	18,200
Black Canyon of the Gunnison National Park	Determine Effects of Modified Aspinall Operations on Hydroelectric Power Generation	40,000	40,000
Boston Harbor Islands National Recreation Area	Provide Natural Resource Management Support for Small Parks	4,505	4,505
Cape Hatteras National Seashore	Develop Outer Banks Group Predator Management Plan	296,500	14,000
Carl Sandburg Home National Historic Site	Delineate and Restore Granitic Rock Outcrop Boundary	8,000	8,000
Carl Sandburg Home National Historic Site	Manage Invasive Exotic Plants and Insects and Monitor Natural Resources	81,600	19,000
Cedar Breaks National Monument	Survey Rare Plants and Establish Compliance with Conservation Agreement	39,981	20,000
Congaree National Park	Identify Genetic Differences within the Rare Carolina Bogmint Populations	15,765	15,000
Cowpens National Battlefield	Inventory & Plan for Threatened Dwarf-Flowering Heartleaf (<i>Hexastylis naniflora</i>)	68,566	19,000
Devils Tower National Monument	Control/Eliminate Exotic Invasive Plant Species	40,000	20,000
Florissant Fossil Beds National Monument	Develop Database for Paleontological Collecting Localities and Upgrade Inventory-Monitoring Database	11,776	7,700
Fort Bowie National Historic Site	Analyze and Rehabilitate Apache Spring Watershed	35,213	2,000
Fort Necessity National Battlefield	Control Exotic Honeysuckle within a 25-Acre American Woodcock Habitat	338,910	20,000
Fossil Butte National Monument	Understanding the Impact of Fire on Pygmy Rabbit Distribution, Abundance, and Movement	39,524	39,540
George Washington Carver National Monument	Develop Vegetation Management Plan	14,000	2,494
George Washington Memorial Parkway	Inventory Seven Groups of Insects in Turkey Run and Great Falls Parks, Virginia	29,800	9,000
Grand Portage National Monument	Forest Vegetation Characterization and Analysis	19,975	18,577
Grand Teton National Park	Just the Tip of the Talus Field—Understanding Alpine Biogeochemistry in Grand Teton & Glacier National Parks	40,000	11,800
Herbert Hoover National Historic Site	Creation of Database, Transfer of Legacy Data, and Analysis of Fire Effects	13,000	12,090
Homestead National Monument of America	Analyze Water Isotopes to Determine Impacts of Burning in Mesic Burr Oak Forest	18,343	17,059
Intermountain Regional Office	Inventory Rare and Listed Species at Sand Creek Massacre National Historic Site	36,372	6,600
Jewel Cave National Monument	Install Video Security at Historic Cave Entrance	5,000	5,000
John Day Fossil Beds National Monument	Distribution and Status of the Plants Endemic to the Paleosols of the Painted Hills Unit	27,142	4,000
Kaloko-Honokohau National Historical Park	Developing an Anchialine Pool Catalogue, Spatial and Temporal Database, and Collating "Lost" Pool Data	27,800	27,800
Kings Mountain National Military Park	Inventory and Treat Invasive Exotic Plant Species	124,910	18,000
Klondike Gold Rush National Historical Park	Inventory Lichens	19,600	9,414

NRPP Small Park Block Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2007 FUNDING
Knife River Indian Villages National Historic Site	Noxious and Exotic Species Control	10,000	9,300
Lewis and Clark National Historical Park	Noxious Weed Control on Newly Acquired Lands	21,368	11,368
Marsh-Billings-Rockefeller National Historical Park	Develop Silvicultural Inventory System for Forest Management	45,800	17,000
Morristown National Historical Park	Establish a Forest Demonstration Plot	40,065	34,065
Mount Rushmore National Memorial	Control Exotic Flora	27,400	6,231
Muir Woods National Monument	Control Invasive Plants to Protect Coast Redwood Ecosystems	32,050	15,750
Northeast Regional Director's Staff	Methods of Estimating Deer Abundance : Testing Model Assumptions and Logistical Feasibility	299,671	12,000
Obed Wild & Scenic River	Characterization of Ancient Red Cedar Communities in the Obed Wild and Scenic River	25,000	24,000
Obed Wild & Scenic River	Obed River Exotic Plant Survey and Eradication Project	15,000	8,000
Pea Ridge National Military Park	Treat Disturbed site following Removal of Utility Lines, Poles, and Right-of-Ways from Park Interior	17,000	27,734
Pipe Spring National Monument	Geophysical Investigations of the Groundwater System Feeding Pipe Spring	39,700	19,900
Pipestone National Monument	Tallgrass Prairie Restoration/Exotic Weed Control	14,985	13,936
Prince William Forest Park	Determine Community Structure, Movement Patterns, and Conservation Concerns for Carnivores	29,900	10,000
Pu'ukohola Heiau National Historic Site	Coastal Resources Threats, Inventory and Mapping for Multiple Parks	100,000	50,000
Richmond National Battlefield Park	Conduct Biological Inventories at Newly Acquired Park Sites	51,325	23,415
San Juan Island National Historical Park	Develop Protocols for Evaluating, Treating and Monitoring San Juan Island National Historical Park Forests	30,000	30,000
San Juan Island National Historical Park	Implement Native Prairie Restoration at Multiple Parks	60,000	15,182
San Juan National Historic Site	Update Integrated Pest Management Plan	40,000	5,200
Saugus Iron Works National Historic Site	Control Invasive <i>Phragmites australis</i> for Saugus River Restoration	2,595	2,345
Scotts Bluff National Monument	GIS Data Collection for Natural Resources & Physical Facilities	8,677	7,545
Sitka National Historical Park	Conduct Benthic Invertebrate and Algae Investigations to Determine Biological Water Quality Indexes	29,500	9,415
South East Regional Office	Exotic Vegetation Management through Partners at Guilford Courthouse National Military Park	3,500	3,000
Stones River National Battlefield	Chinese Yam Eradication And Site Restoration In The Stones River Watershed	78,901	24,000
Sunset Crater National Monument	Inventory & Map Unique Volcanic Features	39,482	20,000
Timpanogos Cave National Monument	Restoring the Natural Cave Soundscape	9,897	9,900
Timucuan Ecological and Historic Preserve	Feral Hog Impact Study	22,708	22,000
Tonto National Monument	Determine Lion Distribution in Southern Arizona Parks with High Potential for Human/Lion Conflicts	39,996	11,900

NRPP Small Park Block Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2007 FUNDING
Valley Forge National Historical Park	Development of Desired Conditions for Meadows at Valley Forge National Historical Park	2,500	2,500
Vicksburg National Military Park	Perform a Mussel Survey within Vicksburg National Military Park	10,000	10,000
White Sands National Monument	Map Tamarisk Park wide	16,000	16,000
Whitman Mission National Historic Site	Control Invasive Reed Canarygrass	9,900	9,900
Wilson's Creek National Battlefield	Savanna Tree Rehabilitation	32,998	13,950
TOTAL		\$2,644,692	\$904,185

NRPP Regional Block Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2007 FUNDING
Alaska Regional Office	Alaska Park Cooperative and Technical Assistance Projects	131,150	16,830
Alaska Regional Office	Alaska Scientific and Technical Reports	54,000	6,930
Alaska Regional Office	Arctic Park Science Symposium 2007–2008	50,000	17,940
Alaska Regional Office	Implementing Effective Aversive Conditioning of Bears in Alaska's National Parklands	31,950	31,631
Alaska Regional Office	Natural Resource Employees Professionalization and Technical Competency Enhancement	107,900	23,000
Alaska Regional Office	Produce <i>Alaska Park Science</i> Journal	216,885	30,000
Alaska Regional Office	Resource Baseline Update for Alaska Parks Using High Resolution Satellite Imagery	1,706,900	18,137
Alaska Regional Office	Update the Alaska Natural Resources Program Strategic Implementation Plan	10,000	7,000
Alaska Regional Office	Volunteer Crew for Invasive Plant Removal in Multiple Parks	66,308	32,822
Antietam National Battlefield	Characterization of Precipitation and Water Quality at Mumma Spring	20,000	10,000
Big Cypress National Preserve	Minerals Management Plan	298,000	15,000
Big South Fork National River and Recreation Area	Mitigating Trail Development Impacts Through Preconstruction Floristic Surveys	24,850	23,000
Boston Harbor Islands National Recreation Area	Restore Natural Biodiversity to Boston Harbor Islands	36,110	6,046
Canaveral National Seashore	Measure Sea Turtle Nest Predator Distribution and Abundance	25,000	24,000
Cape Cod National Seashore	Prepare Environmental Impact Statement for the Estuarine Restoration of Herring River	9,400,000	38,000
Catoctin Mountain Park	Investigate Ecological Succession in Forest Blowdowns Associated with Hurricane Ivan	26,600	8,400
Delaware Water Gap National Recreation Area	Measurement of Land Cover/Use Change Trends in the Upper Delaware River Basin and Growth Projection	21,250	11,250
Delaware Water Gap National Recreation Area	Tri-State Bend Watershed Scoping Summit	12,990	13,000
Denali National Park & Preserve	Implement Regional Integrated Pest Management Program to Insure Health of Natural Resources	39,050	4,000
Devils Tower National Monument	Control/Eliminate Exotic Invasive Plant Species	40,000	20,000
Effigy Mounds National Monument	Control and Survey New Garlic Mustard Populations	14,950	15,000
Fire Island National Seashore	Impacts of Beach Scraping and Artificial Dune Creation on the Natural Resources	76,732	38,519

NRPP Regional Block Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2007 FUNDING
Fire Island National Seashore	White-tailed Deer Population and Herd Composition Monitoring	150,440	10,000
Fort Pulaski National Monument	Shoreline Impacts of Vessel Generated Waves	7,976	15,000
George Washington Carver National Monument	Develop and Implement Integrated Pest Management Plan	6,000	2,885
George Washington Memorial Parkway	Assess Impacts of Deer/Invasive Plant Interactions on Native Vegetation at Potomac Gorge	59,600	20,000
George Washington Memorial Parkway	Create Digital Atlas of Breeding Wood Warblers at Turkey Run and Great Falls Parks	19,500	9,600
George Washington Memorial Parkway	Determine Pollination Biology of Three Rare Plants in Turkey Run and Great Falls Parks	20,000	10,000
George Washington Memorial Parkway	Inventory Insects in Turkey Run and Great Falls Parks	30,000	10,000
George Washington Memorial Parkway	Inventory Seven Groups of Insects in Turkey Run and Great Falls Parks, Virginia	29,800	900
Grand Portage National Monument	Site Assessment and Management Recommendations for Conifer Regeneration along Trail Corridor	17,995	11,617
Grand Teton National Park	Just the tip of the Talus Field—Understanding Alpine Biogeochemistry in Grand Teton & Glacier National Parks	40,000	28,200
Great Basin National Park	Re-establish Three Species of Extirpated Native Fish—Restore Entire Aquatic Community	73,639	25,900
Great Smoky Mountains National Park	Protecting Rare Species in Cades Cove Through High-resolution Mapping	21,120	20,500
Harpers Ferry National Historical Park	Conduct Resource Inventory of Rare Limestone Glade Habitat	15,000	8,500
Harpers Ferry National Historical Park	Inventory of Ferns	4,800	4,800
Isle Royale National Park	Conduct a Pilot Survey of Forest Mustelid Populations Inhabiting Isle Royale National Park	49,203	22,344
Isle Royale National Park	Conduct an Inland Lakes Creel Census	12,437	4,450
Jean Lafitte National Historical Park and Preserve	Control and Eradicate Exotic Plants at the Chalmette Battlefield	24,500	23,600
Kings Mountain National Military Park	Conduct Survey of <i>Odonata</i> and <i>Lepidoptera</i>	37,560	12,100
Lake Meredith National Recreation Area	Protect Natural and Cultural Resources by Constructing Boundary Fence in Urban Interface	39,516	19,800
Mammoth Cave National Park	Eliminate Invasive Lamp Flora in Park Caves	24,975	24,000
Manassas National Battlefield Park	Habitat Preferences of Birds Wintering in Restored Grasslands of the Mid-Atlantic Region	18,340	7,900
Manassas National Battlefield Park	Post Clear Cut Plant and Aquatic Community Monitoring	12,200	4,900
Midwest Regional Office	Train Resource Management staff in New Resource Management Planning Guidelines	162,112	20,384
Mojave National Preserve	Wildlife Monitoring in Mojave National Preserve	92,920	22,000
National Capital Regional Office	Augmenting and Enhancing Effective Park Management of Natural Resources	47,100	21,000
National Capital Regional Office	Demonstrating Leadership: Providing Opportunities for Professional Development of NCR Natural Resource Managers	41,170	19,000
National Capital Regional Office	Finalizing Vegetation Classification in the National Capital Region	131,180	34,000
North Cascades National Park	Status and Distribution of the Marbled Murrelet	65,425	25,350
Ozark National Scenic Riverways	Assess Spring Input and Water Quality	18,000	16,573
Pictured Rocks National Lakeshore	Determine Impacts of Spotted Knapweed on Wildlife	18,000	16,573

NRPP Regional Block Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2007 FUNDING
Pinnacles National Monument	Re-introduce Foothill Yellow-legged Frogs to Chalone Creek Drainage	132,277	44,850
Prince William Forest Park	Identify Orchid-Fungi Relationships for <i>Isotria Medeoloides</i>	30,000	10,000
Prince William Forest Park	Survey for Rare, Threatened, and Endangered Species Along Proposed New Access to Chopawamsic Backcountry Area	10,000	10,000
Rocky Mountain National Park	Identify and Survey Habitat for the Mexican Spotted Owl in Rocky Mountain and Great Sand Dunes National Parks	40,000	15,600
Saint Croix National Scenic Riverway	Evaluating the Habitat and Water Quality of the St. Croix NSR using a <i>Chironomidae</i> Community Survey	17,845	16,430
San Antonio Missions National Historical Park	Control of Non-Native Vegetation	33,600	24,310
San Juan Island National Historical Park	Implement Native Prairie Restoration at Multiple Parks	60,000	2,130
Santa Monica Mountains National Recreation Area	Implementation of a Three-Phase Containment, Eradication and Restoration Program for Harding Grass	88,017	22,408
Sequoia and Kings Canyon National Parks	Restoration of Mountain Yellow-legged Frogs in Upper Bubbs Creek of Kings Canyon National Park	77,941	21,362
Shenandoah National Park	Macroinvertebrate Sampling Associated with Headwater Streams Inventory	7,500	7,500
Shenandoah National Park	Remove Non-native Plants From A Globally Rare Community—Monitor Rare And Non-native Species Extent	43,500	16,000
Shenandoah National Park	Shenandoah Scientific Records Organization	8,000	8,000
Shenandoah National Park	Stop the Spread of Invasive Mile-a-minute Vine	24,892	36,815
South East Regional Office	NPS State of Science Workshop on Inventory Application to Management	24,600	23,900
Tonto National Monument	Research Ecology and Resource Requirements of Reptiles for Critical Resource Protection	39,992	20,000
Voyageurs National Park	Census Beaver Populations, A Biological Indicator of Aquatic System Health	13,291	12,237
Walnut Canyon National Monument	The Influence of Water Availability on Wildlife Communities in Walnut Canyon	24,006	16,200
Whiskeytown National Recreation Area	Determine the Hydrologic, Geochemical, and Historical Factors that Influence <i>Puccinellia howellii</i>	83,904	25,000
Yellowstone National Park	Is Extirpation of the Yellowstone Trumpeter Swan in our Immediate Future?	37,000	25,900
Zion National Park	Determine Impacts from Encroaching Development to the Threatened Desert Tortoise Population	34,605	17,100
TOTAL		\$14,532,102	\$1,258,123

NRPP Servicewide Projects			
PARK	PROJECT TITLE	TOTAL FUNDING	FY 2007 FUNDING
Air Quality - Washington Office	Completion of Western Airborne Contaminants Assessment Project	78,837	78,837
Assoc. Director, Natural Resource Stewardship & Science	Co-sponsor Natural Areas Conference	7,000	2,000
Assoc. Director, Natural Resource Stewardship & Science	Director's Annual Natural Resource Awards	95,000	30,000
Assoc. Director, Natural Resource Stewardship & Science	NPS Support for International Coral Reef Symposium	20,000	20,000
Assoc. Director, Natural Resource Stewardship & Science	Ocean Park Action Plan and Seamless Network Coordination	25,000	25,000
Assoc. Director, Natural Resource Stewardship & Science	Professional Organization Support—George Wright Society	47,500	5,000
Assoc. Director, Natural Resource Stewardship & Science	RLC Support FY 2007	30,000	30,000
Assoc. Director, Natural Resource Stewardship & Science	Serving as NPS Senior Scientist for ADNRSS and Director	150,000	50,000
Assoc. Director, Natural Resource Stewardship & Science	Support to World Commission on Protected Areas Steering Committee Meeting	5,000	5,000
Assoc. Director, Natural Resource Stewardship & Science	USGS-Park Oriented Biological Support	259,000	4,000
Environmental Quality Division - Washington Office	Continued Implementation of Emergency Response Function	100,000	100,000
Geologic Resources Division—Washington Office	Geologic Resources Management Technical Support for Parks	150,000	50,000
Natural Resource Program Center OCD, WASO	Advance NPRC Web Presence and Related Internal and External Communications	35,000	35,000
Natural Resource Program Center OCD, WASO	Make Essential Adjustments to RPRS to Meet new Security Requirements	51,000	51,000
Natural Resource Program Center OCD, WASO	<i>Natural Resource Year in Review</i>	70,000	70,000
Natural Resource Program Center OCD, WASO	NPS Nature & Science	22,500	22,500
Natural Resource Program Center OCD, WASO	<i>Park Science</i>	60,000	60,000
Natural Resource Program Center OCD, WASO	Production of a "Views of the National Parks" module on the Chesapeake Bay	35,000	45,000
Natural Resource Program Center OCD, WASO	Support for National Council Science and The Environment	10,000	5,000
NRSS Biological Resource Management Division	Ecological Integrity Assessment Framework	20,000	20,000
Social Science Division - Washington Office	Comprehensive Survey of the American Public to Assist in Park Management Planning	62,600	31,250
Social Science Division - Washington Office	Fund Regional Atlases of Socioeconomic Trends at Non-Fee Park Units	330,000	45,000
TOTAL		\$1,663,437	\$784,587



Appendix C: Biological Resource Projects—National Level Support

Park	Project Title	2007 Funding
Acadia NP	Winter Site Fidelity of Purple Sandpiper	\$15,300
Biscayne NP	Conserving Threatened and Endangered Sea Turtles in BISC	\$11,700
Big South Fork NRRRA	Exotic Plant Control in Biologically Sensitive Big South Fork Riparian Habitat	\$13,700
Buck Island Reef NM	Re-introduce Endangered St. Croix Ground Lizard to Buck Island Reef NM	\$46,000
Congaree NP	Quantify Change in the Old-growth Forests of Congaree National Park	\$25,000
Craters of the Moon NM	Locate and Control Leafy Spurge in Wilderness Study Area	\$30,300
Glacier NP	Effects of 2003 Fires on Fire-Dependent Bird Species	\$25,000
Glacier NP	Control Backcountry Invasive Weeds	\$21,500
Golden Gate NRA	Establish Endangered Tidewater Goby Population	\$20,000
Great Basin NP	Survey Invertebrate Cave Endemics	\$23,100
Great Basin NP	Sage Steppe & Fuels Management: Building the Knowledge Base	\$28,400
Grand Canyon NP	Supplemental feeding station for improving wild condor reproduction & reducing lead poisoning	\$20,000
Great Smoky Mountains. NP	Protection of American Chestnut Landscape through Detection and Development of a Native Resistant Strain	\$25,000
Grand Teton NP	The invasive New Zealand mudsnail vs the candidate threatened Jackson Lake spring snail in GRTE	\$36,600
Indiana Dunes NL	Enhance State Listed Species Through Habitat Modifications and Introductions	\$12,100
Jean Lafitte NHP&P	Characterize Changes in the Fisheries Population at the Barataria Preserve	20,000
Lake Clark NP&P	Conserving Sustainable Northern Pike Populations	\$39,700
Mammoth Cave NP	Restoration of Tall Grass Prairie	\$28,000
Mammoth Cave NP	Protect Rafinesque Bat Maternity and Hibernation Habitat	\$49,900
Mount Rainier NP	Assess Status Of Native Bull Trout & Cutthroat Populations	\$24,000
Ozark NSR	Genetic analysis of the hellbender (<i>Cryptobranchus alleganiensis</i>), a candidate endangered species	\$49,100
Prince William Forest Park	Investigate Pollution-sensitive Subterranean Fauna of Vulnerable Habitats in NCR	\$25,000
Voyageurs NP	Improve Limited Knowledge of Ecology and Population Status of Threatened Canada Lynx	\$30,100
War in the Pacific NHP	Develop Techniques to Restore Tropical Savanna Grasslands	\$23,900
Zion NP	Fire Management Effects on Native Bee Diversity & Abundance in Relation to Rare Plant Conservation	\$25,000
Total		\$668,400

Sampling sockeye salmon at Lake Clark National Park and Preserve.
NPS Photo: Dan Young



Appendix D: Water Resource Protection Projects

Water Resource Protection Projects—FY 2007

Park	Project Title(s)	FY 2007 Funding \$(000s)
Servicewide	Support to the Office of the Solicitor	183.2
Chickasaw NRA	Hydrologic Data Collection	10.0
Wind Cave NP	Groundwater Study	46.6
Montezuma Castle NM	Hydrologic Data Collection for the Verde River Adjudication	47.4
National Parks in Montana	Implementation of the Montana-NPS Compact	1.5
Saguaro NP	Investigation of Hydrology and Water Related Values	1.2
Arches NP	Hydrologic Data Collection	18.1
Kaloko-Honokohau NHP	Investigation of Hydrology and Water Dependent Values	65.0
Great Sand Dunes NP & Pr	Hydrogeologic Data Analysis	39.6
Theodore Roosevelt NP	Collection of Hydrologic Data	4.3
Death Valley NP	Participation in Groundwater Model Development	12.0
Grand Teton NP	Investigation of Hydrology of the Gros Ventre River	6.2
Great Basin NP	Investigation of Hydrogeology and Hydrologic Data Collection	81.6
Tuzigoot NM	Hydrogeology Study	23.5
Niobrara NSR	Investigation of Water Dependent Resources	50.0
Black Canyon of the Gunnison NP	Monitoring of Riparian System	30.0
Obed WSR	Investigation of Water Dependent Values	17.6
Servicewide	Technical Support to All Projects and Technical Assurances	226.0
Servicewide	Administrative Support to Projects and Technical Assurances	91.0
TOTAL		954.7

Water Resources Division Competitive Projects—FY 2007

Park	Project Title	FY 2007 Funding \$(000s)
Kaloko-Honokohau NHP	Determine Subterranean Groundwater Nutrient Input to Kaloko-Honokohau NHP's Coastal Ocean Ecosystem	27.0
Buffalo NR	Map and Characterize the Geology of Tomahawk Creek, Buffalo National River	50.0
Mount Rainier and Olympic NPs	Pre-Disaster Preventative Planning in MORA/OLYM	45.0
Yellowstone NP	Norris Geyser Basin: Effects of the Shallow Groundwater System on Visitor Safety	50.0
Multiple Pacific West Region	Assessment of Groundwater Resources in the Mojave Network	69.9
Cuyahoga Valley NP	Biological Assessment of Primary Headwater Streams	47.2
Saint Croix NSR	Manage Nonpoint Pollutants Through Watershed Modeling	69.5
Grand Teton NP	Baseline Water Quality of Four Western Tributary Streams in the Upper Snake River Basin	23.9
Multiple Pacific West Region	Map Wetlands in small NPW Parks	48.7
Big Bend NP	Determine the History of Channel Change of the Rio Grande River at Big Bend NP	41.6
Ebey's Landing NHR	Conduct Hydrologic Assessment of Ebey's Prairie, Ebey's Landing National Historical Reserve	35.0
Total		507.8

The octocoral *Anthelia edmonsoni* is pervasive in Kaloko-Honokohau National Historical Park, especially in areas of high subterranean groundwater discharge.
Photo: Eric Grossman, USGS



Appendix E: USGS—Biological Resources

Title of Project	FY07 Report
Distribution, population dynamics, and herbivory impacts of a pioneering elk herd on Chaco Culture National Historical Park	<p>Elk colonized the greater Chaco Culture National Historical Park area, a desert grass/shrubland in northwestern New Mexico, in January 2000. Most (63 percent) of the park has been protected from grazing by domestic livestock since 1948, the remainder (37 percent) since 1995, and no wild grazers were believed to occur on the land historically. Because of this, Chaco Culture provides a valuable baseline for essentially ungrazed desert/grassland in the Colorado Plateau eco-region. Colonization by elk raised questions over the suitability of these habitats for elk, and concerns over potential impacts of elk grazing on the park's grasslands because of prior absence of grazing. Project goals were to determine the health and population dynamics of this herd, assess habitat relationships, and determine any potential grazing impacts to the system.</p> <p>All cows in this population were captured each autumn and late winter from 2003 to 2006, and kept radio-collared for the duration of the project. Levels of body fat of lactating cows were measured to determine. Adult pregnancy and survival were high; whereas, calf survival was variable. Calf survival was positively related to maternal size, maternal condition, and cumulative annual precipitation through parturition, and all calf mortality occurred at or near parturition.</p> <p>Cover of live plants and species richness were greater on areas receiving more use by elk, and no grass species were used above recommended residual leaf height levels. In fact, relative elk use was positively related to residual biomass of the most common and palatable grasses, blue and black grama, suggesting possible herbivore optimization of grassland productivity by elk grazing in Chaco Culture. Similarly, water infiltration rates either did not differ among use or control sites, or were faster in use sites, indicating no soil compaction due to elk use. Since colonization, elk have increased from approximately 20 to greater than or equal to 53 individuals, a mean rate of increase of 15 percent per year, with annual increases limited only by variation in calf survival. At elk densities seen during this project (0.13–0.15/km²), no deleterious impacts to plants or soils were seen on Chaco Culture, whereas visitor interest in elk has been high. Further, the high sustained population growth rate indicates that desert grass/shrubland habitats are capable of supporting a productive elk population and merit consideration for elk management in the desert Southwest.</p>
Producing wolf-elk population model for Yellowstone National Park	<p>Due to a large-scale ecological linkage between the northern Yellowstone elk herd and the recently reestablished Yellowstone wolf population, wolf-elk ecology may greatly affect the park's ecological structure and function. Since wolves were reestablished into Yellowstone in 1995 and 1996, they have preyed primarily on elk, and the Greater Yellowstone population increased rapidly to about 300 wolves, currently. In Yellowstone, elk numbers dropped from an estimated 20,000 in 1995 to about 9,000. Thus there is a strong need to examine critical aspects of wolf-elk ecology, especially the effect of wolf predation on elk numbers and population trend.</p> <p>To understand specifically how wolves affect the elk population and to supply inputs for a wolf-elk population model, researchers tagged 85 cow elk and 151 neonate calves with mortality-sensing transmitters and measured their survival and causes of death. Adult cow survival averaged 80 percent per year. Human hunters (outside the park) and wolves caused equal amounts of cow mortality. Annual calf-survival was 22 percent per year, with bears accounting for 59 percent of deaths and wolves 14-17 percent. During FY 2007, attempts were made to use these figures to develop a wolf-elk population model. Researchers tested the Eberhardt (1987), the White and Lubow (2002) model, and the Cooper et al. (2003) models. However, none of these efforts accommodated the survival rates derived at Yellowstone. Analysis of why the models would not work led researchers to conclude that Yellowstone elk population abundance had been substantially underestimated in several years. Thus although it was not possible with existing elk demographic data to develop a cogent wolf-elk model, this research resulted in the valuable finding that there is a strong need to improve the demographic monitoring of Yellowstone elk, specifically by developing a sightability index for aerial censuses.</p>

At Ozark National Scenic Riverways, USGS Researchers are studying non-lethal sampling techniques to test fish for mercury.
 NPS Photo: Chuck Bloomingburg

Title of Project	FY07 Report
The development of a quantitative decision model for evaluating the effects of river regulation and water use on native fishes in the Chattahoochee River National Recreation Area	Identifying and quantifying the effects of river regulation and water development on native fish communities in the Chattahoochee River National Recreation Area are crucial for evaluating potential conservation and restoration strategies. During 2007, researchers built empirical models predicting the reproductive success of native stream fishes in the recreation area in response to changes in the hydrologic and thermal regimes of the river. The model was built using long-term data sets from regulated and unregulated warm-water streams. The final model predicted that native fish species richness in the Chattahoochee River under historic discharge and temperature regimes (i.e., before construction and operation of two upstream hydroelectric dams) was almost two times greater than under current (post dam) conditions. To verify these model predictions, researchers sampled fishes in the recreation area using a quadrat sample design to estimate native fish community structure at each study reach. Researchers found that model predictions of current native fish species richness in two sections of the river were, on average, within 20 percent of the measured values. Two versions of the model, each representing different sections of the river, were created in a user-friendly probabilistic decision model network format to allow the National Park Service to evaluate the influence of various water management scenarios on the abundance and distribution of native biota in the river.
Development of methods to improve trapping of free-roaming cats in National Parks	Free-roaming cats (<i>Felis catus</i>) are non-native predators and competitors of native fauna in units of the National Park System (parks). The adverse impacts of cats on wildlife have been well documented globally and cat control strategies range from local ordinances and public education to eradications involving trapping, poisoning, and hunting. Whereas cat control in remote parks may be accomplished via lethal means, these methods are not practical for the more urban parks because of the public's safety and concern for the animals' welfare. Therefore, cat removal in these parks primarily involves live trapping. Because cat populations in parks are sustained by reproduction and immigration from surrounding areas, cat trapping is a perennial activity. Traps are usually baited with food items which also attract native mammalian scavengers (e.g. raccoons, opossums, skunks, etc.). These native animals may be more likely to be trapped than cats because, in general, the scavengers are more abundant than cats and they also have a better sense of smell than cats, allowing them to locate the bait from greater distances. Parks have limited resources to devote to cat trapping and unintended trapping of non-target animals can strain the parks' cat removal efforts. The objective of this study is to develop a trapping scheme that will maximize cat trapping by minimizing non-target mammal catches. In 2007, researchers tested three trapping schemes (platform, live mice, dummy) at four parks within National Capital Parks East and at Catoclin Mountain Park. Researchers also videotaped the animals at these sites to observe their activity in response to the trapping schemes. Preliminary testing of methods (several models of video cameras, infrared illuminators, and trapping schemes) was conducted at two Maryland-National Capital Park and Planning Commission's parks, USFWS National Conservation Training Center, and the USGS Patuxent Wildlife Research Center, but not on parks to avoid biasing park animals prior to the actual study. Thus far, researchers have trapped nine cats (four cats using live mice and five cats using the platform method). The videotapes have been invaluable in documenting trap-selection behavior by cats. Raccoons, skunks, and opossums were observed on the videotapes, however no non-target species has been trapped. In FY 2008, testing will continue at Prince William Forest Park, National Capital Parks East, and/or Catoclin Mountain Park. The findings will benefit park resource managers by providing them with a more efficient cat trapping method.

Title of Project	FY07 Report
Fishes and riverine habitat of Badlands National Park, with emphasis on the sturgeon chub and other imperiled species	<p>The fish assemblage and aquatic habitats within Badlands National Park are unique because of harsh conditions (e.g., high turbidity, conductivity, intermittency, and temperature). The purposes of the study are: 1) document habitat and fishes present in aquatic habitats in the park; 2) compare habitat conditions at selected sites from a previous study; and 3) investigate the ecology of the sturgeon chub (<i>Machyobopsis gelida</i>), including spawning periodicity, age, and growth. Study results will identify possible issues related to biodiversity conservation and habitat management, bring focus to NPS lands where unique management opportunities may exist; and increase understanding of the status and ecology of imperiled species, particularly the sturgeon chub.</p> <p>Fieldwork was completed in August 2007. Researchers surveyed ponds (bison watering ponds), streams, and river habitats within Badlands and found 27 species of fish—16 species in the White River and 23 species in the Cheyenne River. Plains minnow and flathead chub were the dominant species. Researchers also recorded the presence of amphibians, reptiles, and aquatic plants. They made observations on the one-species fishery (largemouth bass) in bison ponds and the pond limnological conditions and zooplankton populations. Stable isotope analysis of several White River fish species is being conducted to determine the source of energy inputs to the river system. Sturgeon chub specimens from the White River and Cheyenne River main stems were used to compare various population metrics (age, growth, fecundity, diet). Droughts and floods hampered sampling somewhat both years, but all objectives were accomplished. The study will complete analysis and final report in FY 2008.</p>
Assessment of upland ecosystem conditions in the Salt Creek Watershed, Canyonlands National Park	<p>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 using a suite of quantitative and qualitative indicators related to the functioning of key ecosystem processes. Salt Creek is the only perennial stream in Canyonlands other than the Colorado River itself, and riparian and aquatic ecosystems associated with the Salt Creek drainage may be affected by upland watershed conditions impacted by past land-use practices (e.g., livestock grazing), visitor-use activities, or drought. This study is in conjunction with a companion project funded by The Nature Conservancy that was initiated on Bureau of Land Management (BLM) lands adjacent to Canyonlands in 2007. Both projects use 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 ongoing land-use activities, climate, and soil properties. Preliminary analyses suggest that soil stability and ground cover both tend to be higher in Canyonlands 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/ecological sites to interactive effects of climate and land-use activities.</p>

Title of Project	FY07 Report
<p>Development and validation of a potentially non-lethal sampling strategy for environmental contaminants of concern in the Ozark National Scenic Riverways</p>	<p>Trace metals emanating from mining and other sources have been identified as a high priority concern of the Ozark National Scenic Riverways of southeastern Missouri. Ongoing and proposed mining represent sources of lead, cadmium, and other metals to park waters. Smallmouth bass and other predatory fishes inhabiting waters of the Ozarks and other Missouri streams also contain comparatively high concentrations of mercury.</p> <p>Fish for contaminants monitoring in the Scenic Riverways and elsewhere in Missouri are collected by the Missouri Department of Conservation (MDC). The current protocol requires the periodic sacrifice of large numbers of fish to obtain fillet samples for analysis. Researchers are evaluating methods that may reduce or eliminate the need to sacrifice fish solely for estimating health risks associated with fish consumption by humans. Two fish species commonly sought by anglers (northern hog sucker and smallmouth bass) were collected by electrofishing at four sites in the Ozarks and two sites outside the park in September 2005. Fillet, blood, and muscle tissue (biopsy) samples were obtained from smallmouth bass. Blood and fillet samples were obtained from suckers.</p> <p>The mercury study has been completed. All the sub-lethal sampling methods yielded accurate and precise estimates of fillet mercury concentrations in smallmouth bass. Concentrations in the biopsy samples were directly comparable to the fillet values whereas the blood mercury concentrations were substantially lower. As a result of these findings, researchers assisted MDC in conducting a follow-up study of smallmouth bass survival after biopsy punch sampling. Twenty fish from each of three sites on the Eleven Point River (one of which was a 2005 site) were collected in September 2007 and transported to the Mammoth Spring (AR) National Fish Hatchery. Biopsy punch samples for mercury analysis were obtained from ten fish from each site and the other ten fish were handled identically but not sampled (controls). All fish were retained at the hatchery for 60 days for observation. After 60 days only one fish from each group had died and the punch wounds had healed. The fish were returned to their sites of capture and released. Based on these results, USGS will assist MDC to implement mercury biopsy sampling statewide (including the waters of the Ozarks) beginning in 2008.</p> <p>Chemical analyses of the 2005 sucker samples have been completed. All concentrations were low in samples collected within the park, and relations between sample types were difficult to discern. Additional samples from two sites contaminated to differing degrees by mining were collected in October 2007 for inclusion in the data set. Analysis, interpretation, and reporting of results are scheduled for 2008.</p>
<p>Baseline Analysis of Floodplain Soils Prior to Dam Removal, Elwha River, Olympic National Park</p>	<p>During FY 2007, researchers completed field data collection, initiated laboratory analyses, and engaged in new collaborations, which has leveraged the value of this project. Soil, forest floor, and related information were collected from 56 permanent vegetation quadrats along the Elwha River. The quadrats were selected to represent 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 and the two soil samples were composited. Samples were divided into four groups, for different physical, chemical and biological analyses. Soil texture, chemistry, and mycorrhizae are being analyzed.</p> <p>The primary utility of this work for the National Park Service is in the context of the planned dam removals on the Elwha River. These removals were delayed another few years (most likely to occur in 2012 at the earliest). This work will quantify baseline conditions, to which future sampling can be compared. Following dam removal, 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>

Title of Project	FY07 Report
Effects of Invasive Exotic Plants on Habitat Conditions and Performance of the Federally Endangered Shivwits Milkvech (<i>Astragalus Ampullarioides</i>), Zion National Park	<p>The purpose of this project is to provide Zion National Park with scientific information to inform conservation of the federally endangered Shivwits milk-vech (<i>Astragalus ampullarioides</i>)—an edaphically restricted species that is endemic to southwestern Utah. In fall 2006, researchers initiated field experiments in Zion to evaluate effects of the invasive exotic grass red brome (<i>Bromus rubens</i>) on growth, reproductive output, and mycorrhizal status of Shivwits milk-vech. As a result of drought, the field experiment is being repeated during fall 2007 through spring 2008. Experimental plots were re-established in September 2007. Precipitation and soil moisture will be monitored throughout the fall-winter-spring period, and efforts will be made to water plots if necessary to maintain the experiment.</p> <p>In 2007 researchers also built upon their improved knowledge of milk-vech—habitat relations to develop a GIS-based spatial predictive model of potential habitat for the species based on substrate (geology) and climatic parameters. During spring 2007, preliminary model results were used to select 60 field sampling locations for comparing soil and vegetation conditions between areas of predicted potential habitat and areas of known milk-vech occurrence. Soil samples currently are being analyzed. Results will be analyzed and the predictive modeling effort will be completed during winter 2007–2008. In addition to the predictive model, soil samples were collected in spring 2007 to determine densities of milk-vech seeds in the soil seed bank. Soil samples were collected and will be processed during winter 2007–2008 to quantify milk-vech seed densities. Results of descriptive studies conducted in 2006, field experiments, predictive habitat modeling, and soil seed-bank studies will be used to inform the development of management strategies and recovery efforts conducted by Zion National Park, the Bureau of Land Management, the U.S. Fish and Wildlife Service, and the Shivwits Band of the Paiute Indian Tribe.</p>
Experimental control of invasive ant species in Hawaii Volcanoes National Park.	<p>Approximately 20 species of invasive ants have been recorded in Hawai'i Volcanoes National Park. The ecological impacts of these species in Hawai'i are poorly documented, but Argentine ants (<i>Linepithema humile</i>), big-headed ants (<i>Pheidole megacephala</i>), and long-legged ants (<i>Anoplolepis gracilipes</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. Few options are available to park managers for controlling ant species. The primary goal of our research is to develop control methods for Argentine ants and big-headed ants in the park. To develop tools for controlling Argentine ants, researchers tested the efficacy of three baits in FY 2007. None of the baits eradicated ants, but Xstinguish® and Maxforce® performed the best, decreasing ant abundance 99 percent and 92 percent, respectively, after one week, and 98 percent after eight weeks. In contrast, Distance® decreased ant abundance 82 percent after one week but ants rebounded to at least 39 percent of control levels after the ninth week. While ant abundances were dramatically reduced, our results indicate that further work is needed before this species can be eradicated even on a relatively small scale. In FY 2008, researchers will test baits to control big-headed ants using a similar experimental design. Results will help park managers protect critical populations of native arthropods (e.g., native pollinators) from invasive ants and will provide managers with new tools for removing or reducing incipient populations of ants from special ecological areas.</p>

Title of Project	FY07 Report
Movements and activities of cougars in high visitor use areas of Zion National Park, Utah	<p>Zion National Park and neighboring communities have experienced increased sightings of cougars (<i>Puma concolor</i>) near people and residences during the last seven years. Park managers requested that USGS provide them with an understanding of cougar movements and ecology in the park so that they could better ensure human safety and better address concerns of non-park stakeholders that the park was a source of problem animals. Researchers initiated an investigation of cougars in and near Zion during 2006 with the objectives of documenting movements and locations of ranges relative to Zion boundaries, and of documenting and modeling habitat use relative to human facilities. During February 2006–January 2007 researchers deployed four GPS collars on cougars along the northwestern and eastern boundaries of Zion, one each on an adult male, a subadult male, and two adult females. Two of these collars delivered locations daily via Argos satellite uplinks and were deployed on an experimental basis for one year to determine how well the Argos feature performed in Zion’s steep topography. The other two collars stored GPS locations “on board” to be retrieved when the collars were recovered after a planned deployment of two years. Researchers obtained 986 good-quality GPS fixes from an Argos-fitted female that was harvested by sport hunters after 11 months of collar deployment. The collar from the other Argos-fitted animal, a subadult male, provided 1,356 good fixes when recovered after a full one-year’s deployment. Researchers visited 18 sites defined by clusters of Argos-delivered GPS locations and found remains of cougar kills at 15 of them, including 14 adult mule deer (<i>Odocoileus hemionus</i>) and one adult male elk (<i>Cervus elaphus</i>). Researchers determined that the Argos feature performed well in the study area and so will deploy GPS-Argos collars on an additional two cougars planned for capture during the winter of 2007–2008. The two currently deployed store-on-board collars will automatically release during March–April 2008. Researchers plan to integrate data from cougars monitored during this study at Zion with data from an additional three cougars monitored around Capital Reef National Park, 28 cougars monitored in Grand Canyon National Park, and 23 cougars monitored in and near the Flagstaff Area National Monuments to produce robust spatially-explicit models of habitat use and vital rates applicable to the southern Colorado Plateau. These models would be based on an anticipated c. 60 animal-years of survival data and c. 80,000 GPS locations. Researchers also plan to integrate the kill data from Zion with the c. 1,200 documented kills anticipated from our other southern Colorado Plateau studies to describe and model cougar foraging behaviors. These anticipated analyses and related products will be published in scientific journals after the broader cougar-focused research program on the southern Colorado Plateau concludes during 2009–2010.</p>
Using Acoustic Sampling of Bat Assemblages to Monitor Ecosystem Trends in Yosemite National Park	<p>In November 2006, researchers deployed eight newly assembled and four previously operational solar powered bat monitors in triangular arrays in four Yosemite meadows to evaluate variability in species detection among monitors at the same station with differing orientation. Winter bat activity at these elevations is generally low. The detection configuration was maintained into early summer 2007 to capture a sample of increased warm season activity. In early July 2007, after road access across the Sierra Nevada reopened, all monitors were recovered, and sensitivity calibration checked. One monitor was reinstalled in each of the four previously sampled meadows for seasonal continuity and eight were redeployed individually to higher meadows in non-wilderness areas (i.e., four detectors each in three elevation strata). The high and mid-elevation monitors were removed prior to winter road closures in late October 2007. Researchers are exploring and modifying data management options. Analysis of nightly presence-absence patterns in the two data sets is in progress, with the winter data set requiring more extensive one-time investigator review. While there are expected trends toward lower nightly duration of activity with increasing elevation, individual meadows within elevation strata may show marked differences in activity for less common species. In FY 2008 (with the project ending June 2008), investigators will 1) redeploy monitors for winter 2007 to assess within and among meadow variability at an intermediate spatial scale (low and mid elevation strata, lower between-meadow distances), and 2) focus on methods for data management and analysis, using the two prior data sets both as binary coded nightly presence/absence data and as continuous activity variables by species or acoustic guild.</p>

Title of Project	FY07 Report
Assessing the Distribution and Effects of Chytrid Fungus on Amphibians in Grand Teton National Park	<p>Chytridiomycosis, a disease caused by <i>Batrachochytrium dendrobatidis</i> (Bd), has been linked to amphibian declines worldwide. Boreal toad (<i>Bufo boreas</i>) populations in Colorado have declined markedly from Bd while those in Grand Teton National park, Wyoming, appear stable. Research last year determined that boreal toads from the area surrounding Grand Teton were susceptible under laboratory conditions to a Bd isolate that originated from the same area as the toads in Wyoming, indicating that the Bd in this area is pathogenic to boreal toads. The results of these challenge studies suggest environmental factors may play an important role in the manifestation of chytridiomycosis in the Grand Tetons and surrounding area. Last year, researchers determined that Bd was present at all known boreal toad breeding sites within or surrounding Grand Teton.</p> <p>In the summer of 2007, investigators compared the effect of relative humidity and skin wetness on the manifestation of chytridiomycosis. Boreal toads from Colorado were exposed to Bd and housed under either high or low relative humidity. Half of the individuals in each of these humidity groups were provided with a ramp to permit them to dry off. None of the exposed toadlets died of chytridiomycosis; however, they all became infected, and individuals housed in containers with high humidity and no ramp to dry off were more infected than individuals housed in containers with low humidity and ramps. Furthermore, toadlets that were moved from the high humidity containers with no ramp to low relative humidity containers with ramps after infection with Bd had a reduction in the level of Bd in their skin sheds. The results suggest availability of dry basking areas and relative humidity may play a role in the ability of Bd to propagate on the skin of boreal toads.</p>
Human/black bear interactions in Canyon de Chelly National Monument, Arizona: development of a cooperative management strategy with the Navajo Nation	<p>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 inform a strategy to deal with the issue. Additionally, Canyon de Chelly is currently 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, in response to the loss of this food source, adjust their feeding habits and movement patterns potentially relying more on human crops and livestock. To understand how bears will respond to the loss of Russian olive in Canyon de Chelly, this project was designed to collect information on population size, feeding habits, movement patterns, and habitat use of bears in the monument. During 2007, researchers began collecting scat and vegetation data throughout Canyon de Chelly to determine food habits and availability. Despite a variety of bear foods found in vegetation plots, scat data suggest bears are using Russian olive disproportionately to its availability in the monument. Nearly 80 percent of scats contained Russian olive, suggesting that the presence of the exotic Russian olive in Canyon de Chelly could be maintaining the bear population at a higher density than could be maintained by natural foods alone. Further study 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 (thus creating increased bear/human conflicts) as alternative food sources. Researchers also developed a database for monitoring and tracking bear sightings and conflicts to understand the exact nature of bear/human interactions in Canyon de Chelly. Initial results indicate that local residents have misperceptions about bear ecology and behavior, and that accurately informing and educating these residents about bears and bear behavior in Canyon de Chelly may help to resolve many conflicts. Research efforts next summer will focus on live-trapping and fitting bears with GPS collars to better track their movement patterns and habitat use. 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. Results of this research will be used by natural resource managers to develop a bear management strategy for the monument.</p>

Title of Project	FY07 Report
The sugar pine dilemma: prescription burning and the management of a declining species	<p>Sugar pine (<i>Pinus lambertiana</i> Douglas) in the Sierra Nevada of California is in decline due to high post-fire mortality coupled with the ongoing effects of an introduced pathogen (white pine blister rust). This project aims to tease apart the effects of both causes of decline and test a simple, cost effective method for mitigating fire effects (i.e., fuels removal). Field data collection continued for this project in 2007, with the installation of two additional sampling sites in Yosemite National Park. Researchers are now tracking the fates of more than 1,200 individual stems at five locations. The high-fire risk status of the 2007 burn season prevented additional plots from being burned during the study period. A one-year post-fire forest health assessment was conducted for two previously burned sites. Researchers have presented the rationale and initial results of the work to NPS resource managers.</p> <p>During winter 2007–2008, investigators will analyze preliminary data using structural equation models. Assuming two more sites are burned in late fall of 2007, researchers also anticipate a substantial amount of time in the field conducting the immediate post-fire forest health assessments. The field season of 2008 will see our final site burned (and the execution of the post-burn surveys). Two-year post-fire evaluations will also be done on the previously burned plots.</p>
National Park Service Wildlife Disease Reporting Technical Assistance	Project delayed with no additional progress in 2007.
Snowy Plovers at Point Reyes National Seashore: Unraveling the Mystery of Mercury	<p>Environmental mercury may compound problems, such as human disturbance or predation, affecting survival of the federally listed snowy plover at Point Reyes National Seashore. This study of food web sources of mercury may provide managers with criteria to mitigate exposure of snowy plovers to elevated levels of mercury. Researchers reported in FY 2006 elevated mercury in invertebrate prey of snowy plovers at all sites sampled at Point Reyes compared to similar habitat at Coal Point, just north of Santa Barbara in southern California. Invertebrates infesting marine mammal carcasses had mercury concentrations two to four times higher than other shoreline invertebrates at Point Reyes. Mercury concentrations in eggs of snowy plovers from Point Reyes were greater than that reported in eggs from San Francisco Bay, California, known for elevated mercury because of contamination from historic hydraulic mining runoff in the Sierra Nevada Mountains.</p> <p>In FY 2007, researchers sampled invertebrates from snowy plover habitat at gradients just north and south of Point Reyes in order to establish the extent of mercury contamination in this region. Researchers continued monitoring mercury in addled snowy plover eggs from Point Reyes and also from the San Francisco Bay National Wildlife Refuge in order to confirm the pattern of high mercury concentrations at Point Reyes. No marine mammal carcasses were present for sufficient time in spring or summer 2007 to collect invertebrates; thus, monitoring will continue through fall 2007 for carcasses. All tissue samples collected this fiscal year have been processed and are currently being analyzed for mercury. Researchers are also analyzing all samples for stable isotopes to determine which invertebrate prey may be more important to snowy plovers.</p> <p>Mercury is elevated at Point Reyes compared to other snowy plover habitat in California. In years when marine mammal carcasses are abundant efforts may be necessary to bury carcasses to keep them from the invertebrate/avian food chain. Further study of snowy plover productivity relative to elevated mercury is crucial to understanding potential impacts at Point Reyes.</p>

Title of Project	FY07 Report
<p>Developing a coral conservation strategy for the global warming era in the National Park of American Samoa</p>	<p>Coral reefs are endangered by the dual threat of global warming and local human impacts. However, some coral colonies and coral reef habitats possess biological and physical features that increase the tolerance of corals to global warming. This project carries out experiments to identify such features within the National Park of American Samoa, with a special emphasis on areas where biological and physical features overlap, as these may be the most resilient to global warming. Delineation of biological and physical features can create "target areas" for applying a coral conservation strategy to counter global warming. Reduction of localized human impacts on the target areas will increase the likelihood that the corals in them will survive, or recover from, bleaching events so they can provide seed populations for reefs on which corals have been killed.</p> <p>Study results indicate that reef habitats with highly fluctuating factors of the physical environment such as the Ofu back reef pools may maintain resilience of broadcast-spawning, reef-building corals to disturbance such as warming events because: 1) the pools usually provide a high growth environment, with low growth conditions (elevated seawater temperatures and high irradiance levels) moderated by environmental factors such as semi-diurnally intermittent flow and possibly temperature fluctuations; and 2) host coral exposure to these relatively extreme conditions maintains capacity to tolerate them in the population (via plasticity) or in the species' gene pool (via polymorphism); and 3) for some coral species, flexibility in the symbiosis between host coral and symbiont (i.e., the number and diversity of zooxanthella genotypes within a given host colony) is maintained by exposure of the host coral colony to diurnally and seasonally fluctuating back reef conditions. This information can help identify desirable criteria for conservation target areas. Reef areas meeting some or all of the criteria can be prioritized according to how many criteria they meet, thereby identifying the highest priority areas for current or future conservation efforts.</p>
<p>Demography of Sea Turtle Nesting Populations in the Caribbean.</p>	<p>Most sea turtle species are listed under the Endangered Species Act as threatened or endangered. The hawksbill turtle (<i>Eretmochelys imbricata</i>) is the most endangered sea turtle in the Eastern Caribbean. Management to recover sea turtle populations includes conservation management, protection of nesting females and their nests, and restrictions on associated critical nesting, developmental, and foraging habitats, such as coral reefs and mangrove areas. Whereas monitoring of sea turtles consists in most places of simple counts of nests, in some places, such as Buck Island Reef National Monument in St. Croix, U.S. Virgin Islands, intensive tagging studies are conducted. Such studies can more directly inform management decisions related to sea turtles, because tagging data can better determine whether changes in population status are due more to changes in mortality or recruitment. The purpose of this project is to conduct a demographic analysis of the tagging data from Buck Island, and then use this information in developing guidelines useful to the NPS sea turtle monitoring program in general. In FY 2007 researchers visited the field site to see how data were being collected (study design, field procedures) and discuss management questions, analysis needs, and database structure. The FY 2007 field season represented the 20th year of the program. In FY 2008 researchers will receive the final 20-year dataset from the Park Service, conduct the demographic analysis, and conduct simulations for developing recommendations for future monitoring.</p>

Title of Project	FY07 Report
<p>Soil Chemistry Changes Affected by Pine Trees and Exotic Plants in Native and Disturbed Pine Rockland, Everglades National Park</p>	<p>South Florida pine rockland is considered a globally imperiled habitat and is one of the centers of vascular plant diversity in Florida. While Everglades National Park contains the vast majority of the extant Miami Rock ridge pinelands, it also contains a sizeable area of former pine forest destroyed before the land was acquired by the federal government. Approximately 200 ha (494 acres) of the 2,000 ha (4,492 acres) of abandoned farmland known as the Hole-in-the-Donut was originally pine rockland. This project deals with efforts to restore some semblance of pine rockland vegetation in disturbed areas within Everglades. The results should be applicable to restoring areas in Miami-Dade County outside the park where remnant pinelands adjoin farmland. The objective of this study is to determine the effect of pine trees and non-native vegetation on changes in soil chemistry. Study funding arrived late in FY 2007 and a cooperative agreement with the University of Florida through the University of Miami CESU was completed in September. A post-doctoral associate has been identified to work on the project, and substantial work on the project will begin in FY 2008. Researchers will examine changes in nutrient availability by sampling former pineland soils that have been fallow for 40 plus years to see if they are continuing to trend toward characteristics of native pineland soils. They will assess soils down to bedrock in several areas within the Hole-in-the-Donut, compare the results to earlier data, and also assess soils from undisturbed pine rockland for reference. They will test the hypothesis that pine trees hasten these changes by sampling soils beneath pine trees planted in formerly farmed areas. Soils will be sampled along four radii extending from next to the trunk to several meters away, where there should be no influence of the pine canopy.</p>
<p>An Evaluation of the Impact of Two Introduced Cichlids on Native Fish Communities in Everglades Wetlands</p>	<p>Understanding the ecological effects of non-indigenous species is a critical element in managing and conserving NPS lands because non-indigenous species presently represent a major threat to biodiversity. In the three south Florida parks, more than 12 species of non-indigenous fishes have established, but little is known about their potential impact on native biota. Managers also know little about how interactions among the non-indigenous species may affect their relative invasiveness and impact. The jewel cichlid (<i>Hemichromis letourneuxi</i>) is one of the most recently established non-indigenous fishes. This cichlid is a highly aggressive omnivore, whose relative abundance and invaded range continue to increase since its first appearance in the Everglades wetlands in 2002. Researchers are assessing the effects of <i>H. letourneuxi</i> and the Mayan cichlid (<i>Cichlasoma urophthalmus</i>) on the aquatic community of longer-hydroperiod marshes through an in situ enclosure experiment. The experiment started later in the wet season than originally planned because of low rainfall. Once the wet season experiment is completed, researchers plan to repeat the experiment at the beginning of the dry season to examine the influence of water depth on predation. Field work should be completed this calendar year. Researchers are using a combination of multivariate and univariate statistical techniques to assess variation in community composition and species densities among treatments. Data collected in this study will be used to assess the potential effects of <i>H. letourneuxi</i> throughout the greater Everglades ecosystem, and determine if those effects may be influenced by the presence of previously established non-indigenous fishes. Insights from this study may have broad implications for the management of aquatic habitats faced with repeated introductions of non-indigenous fishes.</p>

Title of Project	FY07 Report
An Ecological Approach to Sustainable Control of Italian Thistle	<p>The Italian thistle (<i>Carduus pycnocephalus</i> L.) is a rapidly spreading noxious weed in and around Sequoia National Park. The park's current management strategy for this weed is to contain it like a wildfire at the head and flanks and then work on long-term restoration of the interior. The objective of this 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 thought 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 winter 2007–2008 researchers will apply the restoration treatments and in spring 2008 and spring 2009 will re-inventory the plots. The effectiveness of the thistle control and native plant restoration methods will be assessed both in 2008 and 2009. The park's Division of Natural Resources is actively involved in planning and implementing the project. In FY 2007 both USGS and NPS provided equipment and personnel to collect and grow native seeds and apply the thistle reduction treatments. This arrangement will continue in 2008 and 2009. Both agencies have a vested interest in this project's success.</p>
Seagrass Condition Assessment Within the NPS North Atlantic Coastal Parks: Site Selection, Training, and Integration with National Programs	<p>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 national park units. Investigators are developing a hierarchical approach to seagrass assessment that will be applicable to northeastern parks with extensive seagrass resources (Acadia National Park, Cape Cod National Seashore, Fire Island National Seashore, and Assateague Island National Seashore). Work in FY 2007 focused on developing a prototype monitoring program for system-wide implementation, training NPS cooperators, and developing mechanisms for data input, management, and integration.</p> <p>Development of a Prototype Monitoring Program Researchers conducted a preliminary bay-wide survey of eelgrass (<i>Zostera marina</i>) in Little Pleasant Bay, Cape Cod, during midsummer 2006. Repeated measures analysis of variance revealed an increase in eelgrass cover between 2006–2007 that is correlated with formation of a new inlet and increased tidal flushing of the system. Based on these results, researchers will recommend a rapid-assessment protocol incorporating fixed stations with four subsampling locations per station. This bay-wide survey approach yields reliable estimates of seagrass status and trends that can be accomplished in a time of approximately 1 week. Within the hierarchical monitoring framework, this bay-wide survey forms a link between large-scale mapping and high-resolution monitoring of index sites. Site-Selection and Training USGS assisted NPS in recruiting and training a cooperator to implement bay-wide and high-resolution seagrass monitoring at Fire Island to ensure future consistent implementation of Vital Signs protocols.</p> <p>Data Management and Integration Researchers collaborated with NPS data managers and database developers to create a database for seagrass data entry and management. Researchers also initiated collaboration with data managers for the global seagrass monitoring program, SeagrassNet, to develop an automated mechanism to link NPS seagrass data with the global network, thus allowing interpretation of data from northeast regional parks within a broader context.</p> <p>FY 2008 Plans Researchers will test our Cape Cod seagrass monitoring prototype within two small estuaries at Acadia to ensure regional applicability. Based on results gathered at Cape Cod, Fire Island, and Acadia, researchers will finalize a protocol for monitoring system-wide seagrass resources within Northeastern Region national parks. They will also synthesize the monitoring data collected during this protocol development study into a baseline assessment of seagrass condition at these three parks. USGS will continue the collaboration to complete the NPS seagrass monitoring database and facilitate integration of NPS data with other networks. Results of the project will allow NPS to assess seagrass condition on regional scales for reporting to the nation on NPS marine systems health, and to contribute to regional, national, and global assessments of coastal habitat condition.</p>

Park Index

A

Acadia National Park 45, 62, 81, 105, 109, 121, 131, 145
Agate Fossil Beds National Monument 97, 124
Alibates Flint Quarries National Monument 38
Amistad National Recreation Area 121
Aniakchak National Monument and Preserve 74
Antietam National Battlefield 28, 29, 109, 126
Apostle Islands National Lakeshore 50, 98, 121
Appalachian National Scenic Trail 44, 109
Arches National Park 97, 133
Arkansas Post National Memorial 70, 124
Assateague Island National Seashore 38, 97, 145

B

Badlands National Park 97, 104, 137
Bent's Old Fort National Historic Site 38, 124
Bering Land Bridge National Preserve 26
Big Bend National Park 79, 97, 123, 133
Big Cypress National Preserve 10, 54, 101, 109, 126
Big Hole National Battlefield 86
Big South Fork National River and Recreation Area 79, 101, 122, 123, 126, 131
Big Thicket National Preserve 51
Biscayne National Park 62, 92, 121, 131
Black Canyon of the Gunnison National Park 97, 121, 124, 133
Blue Ridge Parkway 37, 42, 84, 85
Boston Harbor Islands National Recreation Area 124, 126
Bryce Canyon National Park 81, 103, 121
Buck Island Reef National Monument 11, 22, 25, 64, 65, 109, 121, 131, 143
Buffalo National River 133

C

Cabrillo National Monument 56
Canaveral National Seashore 46, 73, 97, 121, 126
Canyon de Chelly National Monument 84, 141
Canyonlands National Park 62, 97, 121, 137
Cape Cod National Seashore 30, 42, 45, 53, 57, 96, 126, 145
Cape Hatteras National Seashore 63, 83, 97, 124
Cape Krusenstern National Monument 25, 26, 74
Cape Lookout National Seashore 63, 96, 97
Capitol Reef National Park 42

Capulin Volcano National Monument 38
Carl Sandburg Home National Historic Site 9, 124
Carlsbad Caverns National Park 10, 57, 81, 97
Catoctin Mountain Park 9, 20, 28, 109, 126, 136
Cedar Breaks National Monument 124
Chaco Culture National Historical Park 98, 102, 135
Channel Islands National Park 11, 23, 63, 98, 109, 121
Charles Pinckney National Historic Site 63
Chattahoochee River National Recreation Area 63, 136
Chesapeake and Ohio Canal National Historical Park 5, 9, 29, 58
Chickamauga and Chattanooga National Military Park 37
Chickasaw National Recreation Area 38, 87, 105, 133
Chiricahua National Monument 50
Colorado National Monument 46
Congaree National Park 54, 56, 63, 69, 124, 131
Coronado National Memorial 109, 122
Cowpens National Battlefield 124
Craters of the Moon National Monument and Preserve 38, 50, 97, 131
Cumberland Island National Seashore 63, 96, 121
Curecanti National Recreation Area 23, 109
Cuyahoga Valley National Park 133

D

Death Valley National Park 81, 86, 97, 101, 133
Delaware Water Gap National Recreation Area 38, 126
Denali National Park and Preserve 37, 57, 58, 73, 74, 97, 123, 126
Devils Postpile National Monument 86, 104
Devils Tower National Monument 96, 97, 124, 126
Dinosaur National Monument 20, 22, 100, 109
Dry Tortugas National Park 10, 11, 65, 96

E

Ebey's Landing National Historical Reserve 84, 122, 133
Effigy Mounds National Monument 27, 71, 126
El Malpais National Monument 97, 100
Everglades National Park 15, 16, 48, 54, 97, 109, 144

F

Fire Island National Seashore 53, 126, 127,

- A**
- Acadia National Park 45, 62, 81, 105, 109, 121, 131, 145
 - Agate Fossil Beds National Monument 97, 124
 - Alibates Flint Quarries National Monument 38
 - Amistad National Recreation Area 121
 - Aniakchak National Monument and Preserve 74
 - Antietam National Battlefield 28, 29, 109, 126
 - Apostle Islands National Lakeshore 50, 98, 121
 - Appalachian National Scenic Trail 44, 109
 - Arches National Park 97, 133
 - Arkansas Post National Memorial 70, 124
 - Assateague Island National Seashore 38, 97, 145
- B**
- Badlands National Park 97, 104, 137
 - Bent's Old Fort National Historic Site 38, 124
 - Bering Land Bridge National Preserve 26
 - Big Bend National Park 79, 97, 123, 133
 - Big Cypress National Preserve 10, 54, 101, 109, 126
 - Big Hole National Battlefield 86
 - Big South Fork National River and Recreation Area 79, 101, 122, 123, 126, 131
 - Big Thicket National Preserve 51
 - Biscayne National Park 62, 92, 121, 131
 - Black Canyon of the Gunnison National Park 97, 121, 124, 133
 - Blue Ridge Parkway 37, 42, 84, 85
 - Boston Harbor Islands National Recreation Area 124, 126
 - Bryce Canyon National Park 81, 103, 121
 - Buck Island Reef National Monument 11, 22, 25, 64, 65, 109, 121, 131, 143
 - Buffalo National River 133
- C**
- Cabrillo National Monument 56
 - Canaveral National Seashore 46, 73, 97, 121, 126
 - Canyon de Chelly National Monument 84, 141
 - Canyonlands National Park 62, 97, 121, 137
 - Cape Cod National Seashore 30, 42, 45, 53, 57, 96, 126, 145
 - Cape Hatteras National Seashore 63, 83, 97, 124
 - Cape Krusenstern National Monument 25, 26, 74
 - Cape Lookout National Seashore 63, 96, 97
 - Capitol Reef National Park 42
 - Capulin Volcano National Monument 38
 - Carl Sandburg Home National Historic Site 9, 124
 - Carlsbad Caverns National Park 10, 57, 81, 97
 - Catoctin Mountain Park 9, 20, 28, 109, 126, 136
 - Cedar Breaks National Monument 124
 - Chaco Culture National Historical Park 98, 102, 135
 - Channel Islands National Park 11, 23, 63, 98, 109, 121
 - Charles Pinckney National Historic Site 63
 - Chattahoochee River National Recreation Area 63, 136
 - Chesapeake and Ohio Canal National Historical Park 5, 9, 29, 58
 - Chickamauga and Chattanooga National Military Park 37
 - Chickasaw National Recreation Area 38, 87, 105, 133
 - Chiricahua National Monument 50
 - Colorado National Monument 46
 - Congaree National Park 54, 56, 63, 69, 124, 131
 - Coronado National Memorial 109, 122
 - Cowpens National Battlefield 124
 - Craters of the Moon National Monument and Preserve 38, 50, 97, 131
 - Cumberland Island National Seashore 63, 96, 121
 - Curecanti National Recreation Area 23, 109
 - Cuyahoga Valley National Park 133
- D**
- Death Valley National Park 81, 86, 97, 101, 133
 - Delaware Water Gap National Recreation Area 38, 126
 - Denali National Park and Preserve 37, 57, 58, 73, 74, 97, 123, 126
 - Devils Postpile National Monument 86, 104
 - Devils Tower National Monument 96, 97, 124, 126
 - Dinosaur National Monument 20, 22, 100, 109
 - Dry Tortugas National Park 10, 11, 65, 96
- E**
- Ebey's Landing National Historical Reserve 84, 122, 133
 - Effigy Mounds National Monument 27, 71, 126
 - El Malpais National Monument 97, 100
 - Everglades National Park 15, 16, 48, 54, 97, 109, 144
- F**
- Fire Island National Seashore 53, 126, 127, 145
 - Florissant Fossil Beds National Monument 97, 124
 - Fort Bowie National Historic Site 50, 124
 - Fort Frederica National Monument 63
 - Fort Larned National Historic Site 39
 - Fort Necessity National Battlefield 124
 - Fort Pulaski National Monument 63, 127

- Fort Sumter National Monument 63
Fort Union National Monument 39
Fossil Butte National Monument 97, 124
Fredericksburg and Spotsylvania National Military Park 38
- G**
Gates of the Arctic National Park and Preserve 26, 74, 109, 123
Gateway National Recreation Area 30, 53, 63, 121
George Washington Carver National Monument 124, 127
George Washington Memorial Parkway 29, 72, 124, 127
Glacier Bay National Park and Preserve 26, 52, 56, 74, 92, 121
Glacier National Park 26, 52, 56, 64, 74, 79, 80, 81, 92, 97, 101, 121, 123, 124, 127, 131
Glen Canyon National Recreation Area 67, 87, 93, 96, 123
Golden Gate National Recreation Area 67, 103, 123
Governors Island National Monument 105
Grand Canyon National Park 81, 91, 93, 97, 103, 104, 105, 106, 131
Grand Portage National Monument 124, 127
Grand Teton National Park 44, 79, 80, 84, 85, 87, 97, 124, 127, 131, 133, 141
Great Basin National Park 6, 20, 25, 48, 50, 57, 66, 81, 86, 97, 104, 109, 112, 123, 127, 131, 133
Great Sand Dunes National Park and Preserve 63, 90, 97, 110, 121, 128, 133
Great Smoky Mountains National Park 5, 42, 43, 56, 64, 65, 79, 81, 90, 97, 103, 104, 105, 110, 121, 122, 127, 131
Guadalupe Mountains National Park 10, 100
Gulf Islands National Seashore 32, 95, 96
- H**
Hagerman Fossil Beds National Monument 86, 97
Haleakala National Park 87, 103, 104, 106, 110
Harpers Ferry National Historical Park 9, 127
Hawaii Volcanoes National Park 39, 103, 104, 106, 122, 123, 139
Herbert Hoover National Historic Site 27, 124
Homestead National Monument of America 110, 124
Hopewell Culture National Historical Park 19, 22, 110
Horseshoe Bend National Military Park 63, 85
Hovenweep National Monument 62
- I**
Indiana Dunes National Lakeshore 50, 57, 66, 123, 131
Isle Royale National Park 50, 87, 127
- J**
Jean Lafitte National Historical Park and Preserve 8, 32, 91, 95, 122, 127, 131
Jewel Cave National Monument 100, 110, 124
John Day Fossil Beds National Monument 86, 98, 110, 124
Joshua Tree National Park 80, 98, 123
- K**
Kalaupapa National Historical Park 20, 100, 106, 110, 122
Kaloko-Honokohau National Historical Park 52, 69, 84, 85, 86, 96, 105, 124, 133
Katmai National Park and Preserve 74, 123
Kennesaw Mountain National Battlefield Park 63
Kings Mountain National Military Park 124, 127
Klondike Gold Rush National Historical Park 7, 74, 96, 124
Knife River Indian Villages National Historic Site 125
Kobuk Valley National Park 26
- L**
Lake Clark National Park and Preserve 26, 74, 110, 131
Lake Mead National Recreation Area 5, 86, 87, 93, 103, 104
Lake Meredith National Recreation Area 39, 127
Lava Beds National Monument 100
Lewis and Clark National Historical Park 86, 125
Little River Canyon National Preserve 85, 110
Lyndon B. Johnson National Historical Park 39
- M**
Mammoth Cave National Park 57, 79, 81, 87, 97, 123, 127, 131
Manassas National Battlefield 29, 72, 127
Marsh-Billings-Rockefeller National Historical Park 125
Minute Man National Historical Park 84, 103, 105
Mojave National Preserve 21, 110, 114, 117, 122, 127, 133
Monocacy National Battlefield 19, 28, 29, 110
Moores Creek National Battlefield 63
Morristown National Historical Park 125
Mount Rainier National Park 11, 44, 62, 94, 97, 103, 131, 133
Mount Rushmore National Memorial 28, 68, 105, 106, 125
Muir Woods National Monument 103, 104, 105, 125
- N**
National Capital Parks East 136
National Park of American Samoa 143
Natural Bridges National Monument 7, 62, 79

Niobrara National Scenic River 28, 84, 87, 133

Noatak National Preserve 25, 26

North Cascades National Park 62, 103, 127

O

Obed Wild and Scenic River 101, 110, 125, 133

Ocmulgee National Monument 63

Olympic National Park 44, 62, 90, 121, 133, 138

Oregon Caves National Monument 86, 99

Organ Pipe Cactus National Monument 122

Ozark National Scenic Riverways 5, 6, 71, 127, 131, 138

P

Padre Island National Seashore 64, 65, 97, 100, 110, 121, 122

Pea Ridge National Military Park 28, 125

Pecos National Historical Park 39, 84

Petrified Forest National Park 10, 64, 81, 97, 121

Pictured Rocks National Lakeshore 50, 102, 110, 127

Pinnacles National Monument 31, 43, 86, 128

Pipe Spring National Monument 125

Pipestone National Monument 70, 125

Point Reyes National Seashore 43, 65, 122, 142

Presidio of San Francisco 122

Prince William Forest Park 125, 128, 131, 136

Pu'uhonua o Honaunau National Historical Park 86

Pu'ukohola Heiau National Historic Site 86, 125

R

Richmond National Battlefield Park 8, 96, 125

Rock Creek Park 20, 29, 110

Rocky Mountain National Park 9, 15, 79, 80, 81, 83, 93, 97, 114, 117, 128

S

Saguaro National Park 122, 133

Saint Croix National Scenic Riverway 63, 118, 121, 128

San Antonio Missions National Historical Park 128

Sand Creek National Historic Site 38

San Juan Island National Historical Park 22, 46, 110, 125, 128

San Juan National Historic Site 103, 125

Santa Monica Mountains National Recreation Area 72, 73, 122, 128

Saugus Iron Works National Historic Site 19, 68, 69, 110, 125

Scotts Bluff National Monument 97, 125

Sequoia and Kings Canyon National Parks 19, 24, 57, 79, 80, 81, 104, 110, 128

Sequoia National Park 145

Shenandoah National Park 28, 30, 31, 43, 73, 121, 128

Sitka National Historical Park 52, 125

Sleeping Bear Dunes National Lakeshore 38, 67, 88, 123

Statue of Liberty National Monument 105

Stones River National Battlefield 110, 125

Sunset Crater National Monument 110, 125

T

Theodore Roosevelt National Park 19, 21, 22, 110, 133

Timpanogos Cave National Monument 70, 125

Timucuan Ecological and Historic Preserve 125

Tonto National Monument 125, 128

Tuzigoot National Monument 133

U

Upper Delaware Scenic and Recreational River 38, 122

V

Valley Forge National Historical Park 30, 126

Vicksburg National Military Park 70, 126

Virgin Islands Coral Reef National Monument 65

Virgin Islands National Park 11, 65, 110

Voyageurs National Park 6, 62, 121, 128, 131

W

Walnut Canyon National Monument 110, 128

War in the Pacific National Historical Park 131

Washita Battlefield National Historic Site 39

Whiskeytown National Recreation Area 46, 72, 102, 128

White Sands National Monument 126

Whitman Mission National Historic Site 126

Wilson's Creek National Battlefield 126

Wind Cave National Park 28, 57, 65, 97, 122, 133

Wrangell-St. Elias National Park and Preserve 9, 73, 74, 101, 123

Wupatki National Monument 110

Y

Yellowstone National Park 27, 62, 63, 78, 86, 91, 92, 94, 97, 103, 121, 128, 133, 135

Yosemite National Park 32, 49, 79, 81, 97, 103, 104, 105, 140, 142

Yukon-Charley Rivers National Preserve 74

Z

Zion National Park 24, 49, 83, 87, 91, 92, 105, 110, 123, 128, 131, 139, 140

USGS scientist, Dr. Eric Grossman, installs sensor to measure time-series of nearshore water temperature and salinity at Kalo-Honokohau National Historical Park.
Photo: Josh Logan, USGS



U.S Department of the Interior

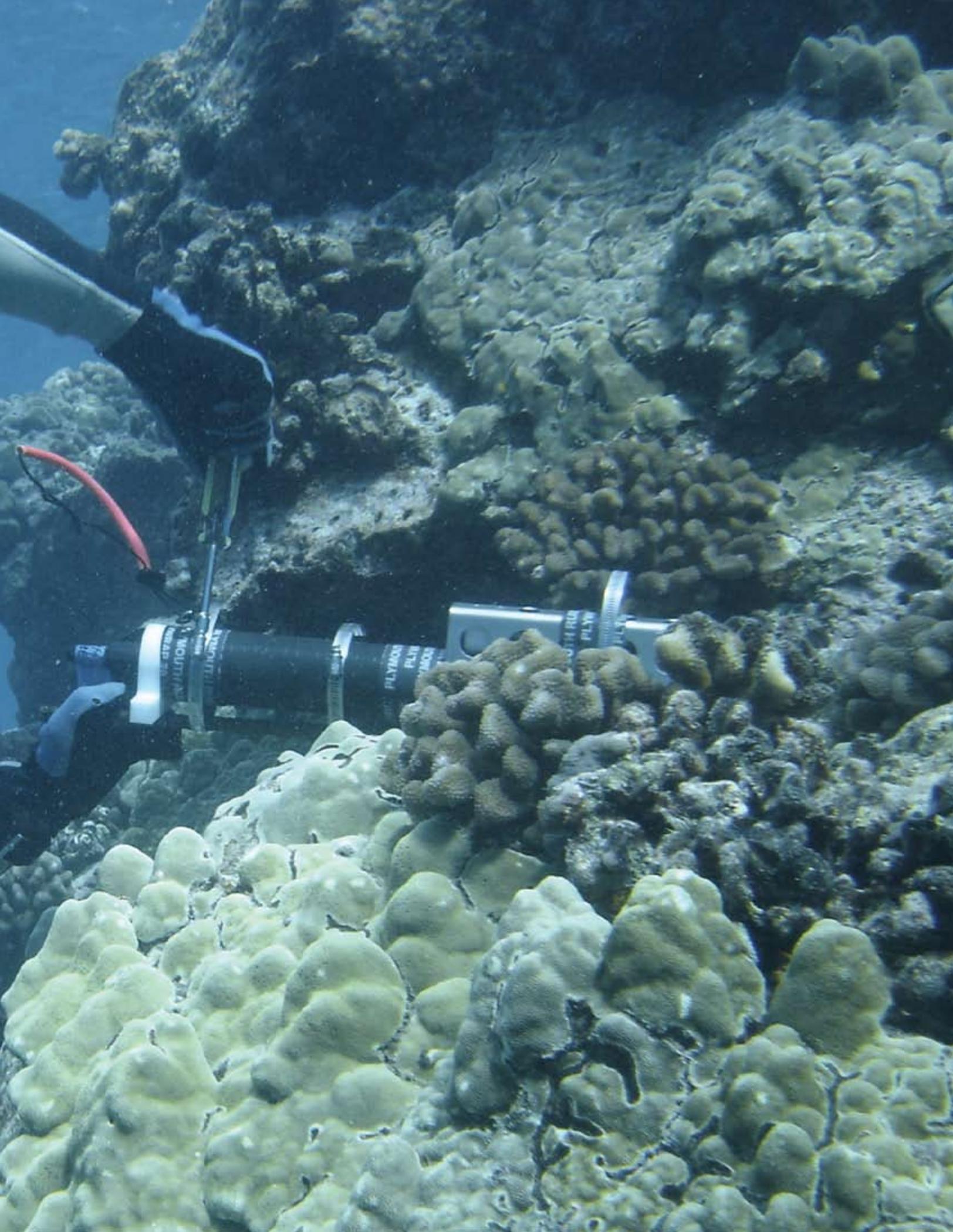
The mission of the Department of the Interior is to protect and provide access to our nation's natural and cultural heritage and honor our trust responsibilities to tribes. We:

- 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.



National Park Service

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