National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Funding the Natural Resource Challenge

FY 2009 Report to Congress

Cover: Endangered tidewater goby (*Eucyclogobius newberryi*) surveys in Tomales Bay, Golden Gate National Recreation Area, California. NPS photo by Mason Cummings.

Funding the Natural Resource Challenge

FY 2009 Report to Congress

Natural Resource Stewardship and Science
Washington, DC

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

Contents

Colorado's Black Canyon of the Gunnison National Park received a water rights settlement in FY 2009. NPS photo by Lisa Lynch.

Natural Resources and National Parks: A Decade of Accomplishments and Our Complex Challenges Ahead

One hundred years ago, America faced the prospect of dramatic changes to our natural heritage because of the Industrial Revolution and the rush to develop natural resources. America met this challenge by establishing parks, refuges, forests, and other protected areas for the benefit of all citizens. Our forebears also established a new generation of directives to manage federal lands for the protection of irreplaceable resources.

Today, we face a challenge of similar historical significance in the form of global climate change, loss of biodiversity, and habitat fragmentation because of widespread human-induced land and water-use changes. Conservation requires action, and action requires organization. Confronted by a rapidly increasing range of critical resource stewardship issues, the National Park Service must provide both tactical and long-term responses for addressing high-priority park needs.

In the coming decade, we will develop guiding principles and advance stewardship and science to meet the complex challenges we face in retaining the natural legacy that inspired the establishment of national parks over a century ago. With the creation of the Natural Resource Challenge in 1999, the National Park Service heeded the call of resource preservation and restoration through strong, science-based programs. Park managers at many levels have participated to improve natural resource management Service-wide. We have established a vital signs ecological monitoring program for all parks with significant natural resources. Expertise has increased, and the knowledge of natural resources, ecosystem dynamics, and key species has expanded.

We must continue on the path toward increased knowledge and understanding to confront the challenges now faced by national parks. Park managers must build upon existing decision-making frameworks to include more robust science and increased comprehension of cause and effect relationships confronting heritage resources. The consequences of inaction are as severe as the complex challenges that lie ahead.

The National Park Service recognizes that issues transcend jurisdictions, and natural resource management must move beyond the constraints of political boundaries to consider ecological ranges. With responsibility for so many of America's most treasured landscapes, waters, and wildlife, the National Park Service must increase collaboration with federal agencies, states, tribes, landowners, and other partners to further these priorities. Coordination with broader scientific and environmental communities and international economic and social institutions must increase, along with transparency and accountability of how management decisions affect ecosystems.

Park managers can transform how the National Park Service conserves nature in the 21st century. Natural resource programs must effectively engage partners and the public. This commitment will ensure that America's natural resources continue to flourish, leaving the nation's natural heritage and legacy intact. Present park managers must lead the National Park Service toward an innovative course of action that builds upon the successes of the Natural Resource Challenge and helps us rise to the challenges of the future as we approach the National Park Service centennial in 2016.

Jonathan B. Jarvis
Director
National Park Service

Dr. Herbert C. Frost
Associate Director
Natural Resource Stewardship and Science
National Park Service

Prairie falcon (*Falco mexicanus*) in Pinnacles National Monument, California. NPS photo by Gavin Emmons.


NATIONAL PARK SERVICE

Chapter 1: Natural Resource Challenge Funding and Progress

Many of America's most scenic and ecologically diverse lands are located within units of the National Park System. Mandated by the 1916 Organic Act 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," the National Park Service (NPS) has endeavored to protect these lands for nearly 100 years. We cannot protect what we do not understand, however, and so the Natural Resource Challenge was born in 1999 to improve our knowledge of natural resources across the National Park System. Ten years later, thanks to Natural Resource Challenge funding, park managers are better equipped to study, protect, and restore natural resources; share information; confront critical issues; and plan for the future. The National Park Service is rising to the challenge in a time of unprecedented complexity and rapid change affecting natural resources.

Natural Resource Challenge

On August 12, 1999, then-NPS Director Robert Stanton launched the Natural Resource Challenge (the "Challenge") to "recommit ourselves to natural resource preservation and restoration" through "strong, effective science-based programs." The goal of the Challenge was to understand, measure, and improve the health of park ecosystems. It addressed three main challenges:

- protecting native species and their habitats,
- providing leadership for a healthy environment, and
- connecting parks to protected areas and parks to people.

The Challenge included a series of natural resource funding requests developed by park superintendents and subject matter experts to meet natural resource management needs. Congress approved the first funding increases in Fiscal Year (FY) 2000; subsequent increases followed for the next seven years, totaling $77,552,000 through FY 2007 (Table 1-1). These increases have improved natural resource management in sites across the National Park System. While 36 parks benefitted directly through base increases to natural resource programs, natural resource programs in other parks also benefitted from the Challenge through the creation of regional and park-based specialist positions designed to assist multiple parks with natural resources projects and through funding increases to 11 Servicewide natural resource programs (Table 1-2).

Challenge funding has increased the professional expertise of natural resource managers; introduced and expanded research, protection, and restoration projects; improved education efforts; and supported cooperative programs that engage partners in studying natural resources.

Reporting and Measuring Progress

When the Challenge was first funded in FY 2000, Congress requested that the National Park Service report on Challenge-related expenditures and accomplishments. By providing financial details for FY 2009, this report responds to that request. To provide a more complete picture of the state of natural resource funding and accomplishments across the National Park System, this report also includes information about expenditures for Servicewide natural resource stewardship programs that are not part of the Natural Resource Challenge (e.g., Natural Sounds Program, Environmental Quality Program).

To measure the effectiveness of its natural resource programs, the National Park Service uses the performance goals outlined in the *Department of the Interior 2007–2012 Strategic Plan*, which was established in accordance with the Government Performance and Results Act (GPRA) of 1993. Table 1-3 lists strategic plan targets, FY 2009 results, and Servicewide natural resource programs supporting park performance. The table compares FY 2009 actual performance to projected planned performance as set forth in the National Park Service's FY 2010 Budget Justification for all GPRA goals reported to Congress.

Surveying the leaves of cutleaf coneflower (*Rudbeckia lacianata*) for injury caused by high levels of ozone, Rocky Mountain National Park, Colorado. NPS photo by Colleen Flanagan.

Table 1-1. Natural Resource Challenge funding increases, FY 2000–2007

Challenge Program Elements	Funding increases by year (in thousands of dollars)								Total increases through 2007
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	
Inventory and Monitor Resources									
Basic inventories (except vegetation mapping)	7,309			1,987					9,296
Vegetation mapping (with USGS)		1,746		2,235					3,981
Park air emissions inventory		200							200
Monitor vital signs in park networks		4,191	4,200	6,855	4,939	3,068	3,9311[1]	1,000	28,184
Monitor water quality in park networks		1,272		497	592	521			2,882
Watershed assessment				3,080					3,080
Expand air quality monitoring and related activities			2,600						2,600
Make natural resources data usable		1,098							1,098
Fix Critical Problems									
Natural Resource Preservation Program project funding	2,875		4,000				-3,9311[1]		2,944
Alaska natural resource projects				497					497
Establish resource protection fund			300						300
Water resource protection and restoration/project funds		823							823
Water resource protection and restoration/ field specialists			1,000	200					1,200
Native/nonnative species management and Exotic Plant Management 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/ threatened and endangered species recovery		3,395	3,200						6,595
Attract Scientists									
Establish Research 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] Funding was shifted from the Natural Resource Preservation Program to vital signs monitoring in FY 2006.

Table 1-2. Comparison of Natural Resource Stewardship Program funding in the National Park Service in FY 1999 (prior to the Natural Resource Challenge) and FY 2009

	Funding (thousands of dollars)		
Program components	**FY 1999**	**FY 2009**	**Change**
Natural Resource Challenge-affected programs			
Air Quality Program	6,285	8,784	2,499
Biological Resource Management Program [1]	0	9,833	9,833
Cooperative Ecosystem Studies Units [2]	0	125	125
Geologic Resources Program [3]	1,918	3,341	1,423
Inventory and Monitoring Program	5,787	45,039	39,252
Natural Resource Data and Information Program	1,424	1,911	487
Natural Resource Preservation Program	5,432	8,099	2,667
Research Learning Centers (20 centers total, 12 funded by the Challenge) [4]	0		
Resource Damage Assessment and Restoration Program [5]	873	1,425	552
Resource Protection Fund	0	283	283
Water Resources Program	4,754	12,472	7,718
SUBTOTAL – Natural Resource Challenge-affected programs	26,473	91,312	64,839
Programs not affected by Natural Resource Challenge			
Everglades—Comprehensive Restoration Plan (CERP)	0	4,699	4,699
Everglades—Critical Ecosystem Studies Initiative [6]	12,000	3,849	-8,151
Everglades Task Force Support	800	1,303	503
Glen Canyon Adaptive Management Program	0	96	96
Natural Sounds Program (formerly Overflight Program) [2]	200	3,132	2,932
Social Science Program [7]	850	1,761	911
SUBTOTAL – Non-Natural Resource Challenge programs	13,850	14,840	990
SUBTOTAL – SERVICEWIDE NATURAL RESOURCE PROGRAMS	40,323	106,152	65,829
NATIONAL PARK SYSTEM UNITS, OTHER FIELD UNITS, AND CENTRAL OFFICE NATURAL RESOURCE STEWARDSHIP PROGRAMS	66,708	115,343	48,635
TOTAL NATURAL RESOURCE STEWARDSHIP	107,031	221,495	114,464

[1] Total includes avian flu funding ($332,000).
[2] Total reflects program funding after transfers to parks or regions.
[3] Total includes National Cave and Karst Research Institute funding ($323,000) transferred in FY 2008.
[4] Total reflects funding after transfers to 12 Challenge-funded Research Learning Centers in FY 2001 ($898,000) and FY 2002 ($1,800,000). The remaining eight centers are funded by park base and partner funds.
[5] Figures include Oil Spill Pollution Act.
[6] The FY 1999 figure is corrected from previous reports due to a printing error in the Everglades Critical Ecosystems Studies Initiative funding (correct FY 1999 funding was $12 million not $1.2 million).
[7] The Public Use Statistics program became part of the Natural Resource Stewardship and Science Directorate in FY 2003, with $264,000 in base funding. The change includes the added Public Use Statistics funding.

Webcam image of federally threatened Canada lynx (*Lynx canadensis*), Voyageurs National Park, Minnesota.

Measuring water quality in Redoubt Creek near Redoubt Volcano, which erupted in March and April 2009, Lake Clark National Park and Preserve, Alaska.

Table 1-3. NPS Strategic Plan targets and results for FY 2009

Goals related to strategies to restore, maintain, sustain, and protect resources	Servicewide natural resource program supporting park performance
BUR Ia3A Visibility: Visibility in 95% of NPS reporting parks has remained stable or improved. Actual: 95.5% (147 of 154 parks). **(met)** BUR Ia3B Ozone: Ozone in 86% of NPS reporting parks has remained stable or improved. Actual: 100% (161 of 161 parks). **(exceeded)** BUR Ia3C Atmospheric Deposition: Atmospheric deposition in 76% of NPS reporting parks has remained stable or improved. Actual: 92.5% (49 of 53 parks) remained stable or improved. **(exceeded)**	Air Quality
BUR Ia1B Invasive Plants: 0.6% (9,650 of 1,609,565) of acres infested with invasive plants being maintained as free of invasive plants and 2.7% of acres (42,986 of 1,609,565 acres) treated. Actual: 0.71% (11,409.9 of 1,609,565) of acres controlled and 5.3% (85,849 acres) of acres treated. **(exceeded)** BUR Ia2A Threatened and Endangered Species: 33.9% (335 of 986) of federally listed species in parks making progress toward recovery. Actual: 35.09% (346 of 986). **(exceeded)** BUR Ia2B Species of Management Concern: 12.24% (584 of 4,770) of park populations of native species of management concern are managed to desired condition. Actual: 13.58% (648 of 4,770). **(exceeded)** BUR Ia2C Invasive Animals: 13.85% (114 of 823) of park populations of exotic (i.e., non-native) invasive animal species are effectively controlled. Actual: 14.46% (119 of 823). **(exceeded)**	Biological Resources Management
BUR Ia1A Disturbed Lands Restoration: 2.78% (7,112 of 255,787) of disturbed parkland acres targeted in a park plan for restoration have been treated for restoration. Actual: 4.26% (10,909 of 255,787) **(exceeded)** BUR Ia9 Paleontological Sites: 40.7% (1,742 of 4,280) of paleontological localities in good condition. Actual: 42.78% (1,831 of 4,280). **(exceeded)**	Geologic Resources
BUR Ia4A Water Quality Miles: 99% (146,000 of 147,470) of surface water stream miles in parks meet state and federal water quality standards as defined by the Clean Water Act. Actual: 99% (146,000 of 147,470). **(met)** BUR Ia4B Water Quality Acres: 74.2% (3,339,000 of 4,502,650) of surface water acres in parks meet state and federal water quality standards as defined by the Clean Water Act. Actual: 74.2% (3,339,000 of 4,502,650). **(met)**	Water Resources

Chapter 2: Natural Resource Programs in the National Park Service

The natural resource program in the National Park Service operates on park, region, network, and Servicewide levels. The Natural Resource Challenge improved the capacity of programs at every level to deal with complex issues that affect our ability to preserve natural resources in units of the National Park System. This chapter describes those programs and how they are better equipped to deal with resource issues today thanks to the Challenge. Brief FY 2009 accomplishments are included here; detailed accomplishments can be found in Chapters 4–11. Chapter 3 includes progress over the 10 years of the Challenge.

Park and Regional Natural Resource Programs

Natural resource programs in parks are central to the NPS effort to preserve resources. The Challenge provided base increases to 36 parks to be used for basic natural resource capability in small parks, invasive species control, threatened and endangered species recovery, and native species efforts. These parks continue to benefit from Challenge funding today with an increased capacity for dealing with threats to natural resources (see Appendix A for natural resource funding in parks receiving Challenge increases).

Regional programs also benefited from the Challenge, which provided funding to establish specialist positions with focused knowledge and skills, such as aquatic resource professionals, to assist multiple parks with resource management issues.

While funding from the Challenge remains today, some parks and regions report an erosion of these funds as fixed costs, such as salaries, rise. This leaves less money to fund both natural resource projects in parks and park-based positions funded by the Challenge (e.g., annual funding transfers for the aquatic resource specialist positions established by the Challenge are now less than the full cost). To help compensate, parks leverage Challenge funding through partnerships, project funding such as the Natural Resource Preservation Program, and Flexible Base Increases. In FY 2009 Servicewide funding to offset annual cost of living increases helped take some pressure off regional offices and park units.

Along with the many accomplishments detailed in Chapters 4–11, parks and regional offices reported some challenges in FY 2009. Many park resource managers had increased workloads due to the need to address natural resource concerns associated with park projects funded by the American Recovery and Reinvestment Act (ARRA). Continued erosion of funding resulted in lapsed positions and limited funding for travel to professional meetings and, for regional staff, to parks to provide technical assistance. In some parks, particularly small parks where natural resource staff juggle duties outside resource management, limited staff struggle to provide adequate protection for resources.

Network Programs

Increasingly complex and challenging natural resource issues require park managers to obtain a broad-based understanding of the status and trends in natural resource conditions, work with other agencies, and communicate with the public. In recognition of this, the Challenge funded four programs that link parks into biogeographic networks across the country: Cooperative Ecosystem Studies Units, Exotic Plant Management Teams, Inventory and Monitoring Networks, and Research Learning Centers. These network programs allow parks to accomplish much more together than they could individually—and the networks save on costs by consolidating efforts and leveraging limited funding with partners. Working side-by-side with park resource programs, the NPS Natural Resource Program Center, federal and state agencies, universities, nonprofit organizations, and other partners

Montana-Yellowstone Archaeological Project students working through the Rocky Mountain CESU excavate test units at a large prehistoric stone ring.

National Capital Region Exotic Plant Management Team crew member treating Japanese hops (*Humulus joponicus*) along the Shenandoah River in Harpers Ferry National Historical Park, West Virginia. NPS photo by Geoff Clark.

that share similar resource protection goals, these networks were established as four separate entities to remain accountable for meeting their individual goals and objectives.

Cooperative Ecosystem Studies Units (CESU)

Cooperative Ecosystem Studies Units are multiagency partnerships between universities, federal agencies, and other institutions. The National Park Service is one of 13 federal agencies within the CESU network, which was established in FY 1999 with leadership from the National Park Service, U.S. Geological Survey, and other federal agencies. In FY 2009 a total of 200 universities (including 43 minority institutions) and 50 non-federal research partners participated in the CESU network. Participation in CESUs enables the National Park Service to obtain high-quality science, usable knowledge for resource managers, responsive technical assistance, continuing education, and cost-effective research programs.

CESUs operate within all regions of the National Park Service. In FY 2009 Challenge funding supported NPS participation in 12 CESUs. The funds, allocated through base transfers to NPS regions, are used to station a coordinator at the CESU host university. Remaining funds support research, technical assistance, and educational activities as well as operating expenses. Host universities provide office space and administrative support to the coordinators as well as access to university faculty, students, staff, and resources. Host universities may offer adjunct or affiliate status to the coordinators. NPS coordinators are "brokers," working with NPS park and program managers to identify research, technical assistance, and education needs and to provide specialized expertise and assistance available from the universities and other federal agency partners. In FY 2009 NPS coordinators were stationed at 15 CESU host universities.

Five CESUs do not receive Challenge funding. Instead, NPS regional offices support these CESUs through funding, collateral duties of regional office staff, and/or assignment of duties to coordinators of other CESU networks. An equal level of funding ($154,920) is allocated to the 12 CESUs supported by the Challenge; the rest of the funding ($125,960) provided administrative support and coordination activities at the NPS and Department of the Interior levels. In FY 2009 CESUs facilitated 806 projects across the country and supported a diverse range of funding sources that totaled nearly $38 million (Table 2-1). Since FY 2001 the CESU network has initiated 5,624 projects totaling more than $268 million (Table 2-2).

Major themes within the CESU network in FY 2009 include:

- *New partners*: Individual CESUs continue to add new partners, including the Department of Defense and the U.S. Fish and Wildlife Service (Rocky Mountain CESU); U.S. Forest Service, St. Mary's University, and Winona State University (Great Rivers CESU); and Bat Conservation International and the University of West Florida (Gulf Coast CESU).
- *Opportunities for interagency and interuniversity projects*: Many projects, such as the pilot project on the San Juan River on the Colorado Plateau, involve ecosystem-level research.
- *Climate change projects*: CESUs continue to focus on climate change issues, working with the Servicewide climate change coordinator to carry out scenario planning workshops and serving as a partner on joint meetings and workshops.
- *Key services for the Inventory and Monitoring Network*: Coordinators help locate expertise and facilitate projects for conducting inventories, developing conceptual models and monitoring protocols, and peer-reviewing reports and papers.
- *Student involvement*: Undergraduate and graduate students at participating CESU institutions participate in NPS CESU projects through project activities, internships, fellowships, and student career positions, providing field experience for future researchers.

Exotic Plant Management Teams (EPMT)

Native communities of plants and animals and landscapes across the National Park System are threatened by invasive plant species. Exotic Plant Management Teams were established to respond to the expanding invasive plant problem across the country. They contribute to invasive plant control goals Servicewide by working closely with other NPS programs and

Table 2-1. Project activity and funding by region and individual Cooperative Ecosystem Studies Unit (CESU), FY 2009

		Total partners, projects, and funding from all sources, FY 2009		
Region	**CESU**	**Partners [1]**	**Projects**	**Funding ($)**
Alaska	North and West Alaska [2]	12	29	937,000
Intermountain	Colorado Plateau	29	169	5,156,674
	Desert Southwest	20	56	1,890,448
	Rocky Mountains	20	186	10,714,835
Midwest	Great Lakes-Northern Forest	39	59	1,325,540
	Great Plains	24	14	337,699
	Great Rivers [2]	24	7	629,617
National Capital	Chesapeake Watershed	18	33	1,470,922
Northeast	North Atlantic Coast	15	22	1,450,000
Pacific West	Californian [2]	26	27	1,235,679
	Great Basin	21	25	1,462,415
	Hawaii-Pacific Islands [2]	17	21	1,814,420
	Pacific Northwest	28	54	2,467,971
Southeast	Gulf Coast	39	27	1,514,728
	Piedmont-South Atlantic Coast [2]	25	24	1,207,233
	South Florida/Caribbean	19	39	3,700,000
	Southern Appalachian Mountains	21	14	632,007
TOTAL			806	37,947,188

[1] Because some agencies partner with more than one CESU, total would equal more than the total listed in text.
[2] Five CESUs are not funded by the Natural Resource Challenge.

Table 2-2. Cooperative Ecosystems Studies Unit (CESU) projects and funding, FY 2001–FY 2009

Fiscal year	CESUs in network	Projects initiated	Total funding ($)
2001	8	260	10 million
2002	12	380	15 million
2003	16	540	19 million
2004	17	650	27 million
2005	17	635	32 million
2006	17	728	39 million
2007	17	848	43 million
2008	17	777	45 million
2009	17	806	38 million
TOTAL		5,624	268 million

through cooperation and collaboration with other agencies, adjacent landowners, and academic institutions. Exotic Plant Management Teams participate in all aspects of invasive plant management including prevention, inventory, monitoring, and treatment.

Sixteen teams serve more than 200 parks across the country, providing a framework and first response to exotic plant invasions. The teams are headquartered in a region or park unit and operate over a wide geographic area, serving as many as 28 parks per team. Staffed by highly trained individuals with expertise in plant identification, plant ecology, invasive plant management, and pesticide use, the teams have emerged as local and regional invasive plant experts.

In FY 2009 EPMTs inventoried 402,627 acres, located 102,651 acres infested with invasive plants, and treated more than 250 species on 16,006 acres. In addition, 8,007,831 acres were inventoried under a joint project with the State of Florida.

Inventory and Monitoring Networks (I&M)
The Inventory and Monitoring Program is an essential part of the National Park Service's effort to revitalize the natural resource program and to improve park management through greater reliance on scientific information. At the start of the Challenge in FY 2000, the National Park Service organized 270 parks with significant natural resources into a system of 32 bioregional networks that share core funding and a professional staff. For most parks, the I&M Program provides 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. The I&M networks have become a key source and supplier of reliable, organized, and retrievable information about park natural resources. Two factors have been key to the I&M Program's success: 1) leveraging limited funding and staffing through partnerships with other programs and agencies and 2) linking to park management and planning.

The I&M Program provides funding, technical assistance, and coordination for parks to complete 12 basic natural resource inventories and to monitor the condition, or "health," of park natural resources based on key vital sign parameters. The I&M Program has also led the development of the Integrated Resource Management Applications data system, which is transforming the way the National Park Service manages and delivers natural resource information to parks, partners, and the public.

The purpose of the basic natural resource inventories is to assess and document the current condition and knowledge of natural resources in the parks and to establish a solid baseline for making scientifically sound management decisions and long-term monitoring plans that ensure the future health of the parks. The natural resource inventories being conducted as part of the Challenge are revealing many new and exciting insights into the natural resources contained in parks. The investigations are both increasing our knowledge and understanding about park resources and providing information to address a wide variety of resource management issues and activities.

Challenge increases have allowed the National Park Service to increase significantly the number of basic natural resource inventories completed. In FY 2009 the I&M Program completed 2,455 data sets (88.7 percent), exceeding the goal set for FY 2009 (2,450 of 2,767 data sets complete). See Table 2-3 for more information.

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

Vital signs monitoring provides scientifically sound information on park natural resources to support management decision making, park planning, research, education, and public understanding of park resources. More than 1,000 scientists, resource specialists, park managers, and data managers actively contributed to the design and implementation of this long-term program. This collaborative effort developed an integrative, park-based program with a strong link between inventory and monitoring information and management needs. Each network developed a monitoring program tailored to the highest needs of their parks by defining network goals and objectives, identifying and prioritizing potential vital signs, and selecting a modest set of vital signs for long-term monitoring.

As of September 30, 2009, all 270 I&M parks (100 percent) have identified their vital signs, developed a state-of-the-art monitoring plan, and implemented operational monitoring of priority resources; 253 (94 percent) have completed at least one year of field data collection and are able to estimate current condition for specific vital signs. As a direct result of the efficiencies gained through the network approach, the majority of parks can now provide "current condition" estimates for key measurements of the condition of high-priority natural resources (Table 2-4). The National Park Service's performance goals for vital signs monitoring have been met or exceeded every year.

The intent of vital signs monitoring is to track a subset of physical, chemical, and biological

Table 2-3. Number of Inventory and Monitoring Program parks, out of the total 270 parks in the program, that received the minimal set of inventory products identified in 1992, FY 2001–FY 2009

	Fiscal year								
Inventory	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Natural resource bibliography	257	263	270	270	270	270	270	270	270
Base cartography data	248	260	270	270	270	270	270	270	270
Air quality data	250	250	250	270	270	270	270	270	270
Air quality related values	0	0	0	48	100	150	175	210	240
Climate inventory	0	197	270	270	270	270	270	270	270
Geologic resources inventory	2	14	17	52	68	92	117	138	164
Soil resources inventory	37	57	57	59	70	100	141	171	190
Water body classification	0	220	270	270	270	270	270	270	270
Baseline water quality data	225	270	270	270	270	270	270	270	270
Vegetation inventory	22	27	36	51	62	80	127	155	173
Species lists	210	270	270	270	270	270	270	270	270
Species status/distribution	0	0	0	3	44	100	200	270	270
TOTAL	1,251	1,828	1,982	2,103	2,234	2,412	2,650	2,834	2,928
Completed before 2001	473	473	473	473	473	473	473	473	473

Table 2-4. Annual accomplishments of the 270 Inventory and Monitoring Program parks in completing the planning and design of their long-term monitoring programs and implementing operational monitoring of vital signs, FY 2006–FY 2009, and projected completion, FY 2010–FY 2011. 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.

Actual and projected accomplishments for vital signs monitoring and resource assessments		**Number of parks completed by end of fiscal year**				**Number of parks projected**	
		2006	**2007**	**2008**	**2009**	**2010**	**2011**
Planning and design phase	Identify and synthesize existing information	270	270	270	270	270	270
	Prioritize and select vital signs	250	270	270	270	270	270
	Monitoring plan completed, peer-reviewed, and approved—operational monitoring begun	157	197	253	270	270	270
	"Current condition" values available for specific vital signs—operational monitoring ongoing	104	157	197	253	253	270
Monitoring and assessments completed	Park Natural Resource Condition Assessments Completed	0	0	1	8	20	40
	Park Resource Stewardship Strategy plans completed that incorporate results from vital signs monitoring and Natural Resource Condition Assessments	1	1	2	4	10	14

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. 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, parks have augmented Challenge funds with personnel and funding from other sources and have established partnerships to leverage funds. In addition, it is often possible to monitor several vital signs and parameters together. The number of networks and parks that expect to monitor a vital sign in various categories with currently available funding is summarized in Table 2-5. 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 negotiates with partners on options for implementing monitoring in as many sites as possible.

Periodic program reviews are an essential component of quality assurance for any long-

Identifying wetland plants, Devils Postpile National Monument, California. NPS photo by Linda Mutch.

Fish monitoring crew conducting snorkeling survey, Olympic National Park, Washington. NPS photo by Sam Brenkman.

term monitoring program. The I&M Program has now completed reviews of 18 of the 32 networks to help them get off to a good start in developing a practical, sustainable monitoring program that provides parks with timely, relevant information. Based on an anonymous survey sent out prior to the review meeting for each network, 90 percent of the park superintendents, park resource chiefs, and other park and network staff who responded to the survey agreed or strongly agreed with the question "I think the network is off to a good start, and I'm confident that the network will deliver relevant, useful data and information that will help us understand and manage the natural resources of the parks in our network." The percentage of "happy customers" increased to about 98 percent based on informal "exit surveys" conducted after the park managers and other key participants met to review the network's progress.

Two of the goals of the I&M Program, namely "integrate natural resource inventory and monitoring information into National Park Service planning, management, and decision making" and "share National Park Service accomplishments and information with other natural resource organizations and form partnerships for attaining common goals and objectives," can only be achieved through the development of a modern information management infrastructure (e.g., staffing, hardware, software) and procedures to ensure that relevant natural resource data collected by NPS staff, cooperators, researchers, and others are entered, quality-checked, analyzed, reported, archived, documented, cataloged, and made available to others for management decision-making, research, and education. The I&M Program made significant progress in FY 2009 with the integration of what was previously five separate data systems into the Integrated Resource Management Applications (IRMA) data system. The IRMA system is based on service-oriented architecture, the Department of Interior (DOI) and industry standard and "best practice," that will allow data exchange and integration among different data systems within and external to DOI agencies. As part of DOI efforts to address climate change, pilot projects with the U.S. Fish and Wildlife Service and U.S. Geological Survey were done this year to demonstrate how the department can use service-oriented architecture to develop effective and efficient means of finding, retrieving, using, and sharing the best available data and information to address the significant challenges posed by climate change.

The results of inventories and monitoring are used in Natural Resource Condition Assessments and park planning documents and are provided to managers, planners, interpreters, scientists, and the general public through numerous approaches. Combined with an effective education program, inventory and monitoring results can contribute not only to solving park issues, but also larger quality-of-life issues that affect surrounding communities and to the environmental health of the nation. As a direct result of Challenge funding, the I&M Program has become a significant component of the overall scientific and information management infrastructure and expertise of the National Park Service.

Table 2-5. Number of parks in the Inventory and Monitoring Program 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.

Vital sign category	Example measures (varies by network)	Number of parks
Weather and climate	Temperature, precipitation, wind speed, ice on/off	246
Water chemistry	pH, temperature, dissolved oxygen, conductivity	211
Land cover and use	Area in each land cover and use type; patch size and pattern	203
Invasive/exotic plants	Early detection, presence/absence, area	200
Birds	Species composition, distribution, abundance	189
Surface water dynamics	Discharge/flow rates (cfs), gauge/stage height, lake elevation, spring/seep volume, sea level rise	158
Ozone	Ozone concentration, damage to sensitive vegetation	140
Wet and dry deposition	Wet deposition chemistry, sulfur dioxide concentrations	114
Visibility and particulate matter	IMPROVE network; visibility and fine particles	113
Fire and fuel dynamics	Long-term trend of fire frequency, average fire size, average burn severity, total area affected by fire	105
Vegetation complexes	Plant community diversity, relative species/guild abundance, structure/age class, incidence of disease	101
Mammals	Species composition, distribution, abundance	93
Forest/woodland communities	Community diversity, coverage and abundance, condition and vigor classes, regeneration	93
Soil function and dynamics	Soil nutrients, cover and composition of biological soil crust communities, soil aggregate stability	91
Stream/river channel characteristics	Channel width, depth, and gradient, sinuosity, channel cross-section, pool frequency and depth, particle size	89
Aquatic macroinvertebrates	Species composition and abundance	86
Threatened and endangered species and communities	Population estimates, distribution, sex and age ratios	85
Air contaminants	Concentrations of SOCs, PCBs, DDT, Hg	71
Groundwater dynamics	Flow rate, depth to ground water, withdrawal rates, recharge rates, volume in aquifer	69
Amphibians and reptiles	Species distribution and abundance, population age/size structure, species diversity, percent area occupied	54
Grassland/herb communities	Composition, structure, abundance, changes in treeline	51
Fishes	Community composition, abundance, distribution, age classes, occupancy, invasive species	50
Insect pests	Extent of insect-related mortality, distribution and extent of standing dead/stressed/diseased trees, early detection	50
Riparian communities	Species composition and percent cover, distribution and density of selected plants, canopy height	45
Nutrient dynamics	Nitrate, ammonia, DON, nitrite, orthophosphate, total K	45
Primary production	Normalized differential vegetation index (NDVI), change in length of growing season, carbon fixation	41
Wetland communities	Species composition and percent cover, distribution and density of selected plants, canopy height, aerial extent	40
Microorganisms	Fecal coliform, *E. coli*, cyanobacteria	30
Water toxics	Organic and inorganic toxics, heavy metals	30
Invasive/exotic animals	Invasive species present, distribution, vegetation types invaded, early detection at invasion points	29
Coastal/oceanographic features and processes	Rate of shoreline change, sea surface elevations, area and degree of subsidence through relative elevation data	29

2009 BioBlitz at the Schoodic Education and Research Center, Acadia National Park's Research Learning Center in Maine. NPS photo by David Manski.

Research Learning Centers (RLC)

Beginning in FY 2001 under the Challenge, the National Park Service created 20 Research Learning Centers to foster new and cutting-edge knowledge about park resources through research, education, and public engagement. Challenge funding supports 12 RLCs; eight RLCs are funded through partner support and existing park base funds. Centers are typically park-based but generally provide research and educational services to a network of parks.

The mission of the RLCs is to increase the effectiveness of both research and communication of science results in the national parks by

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

Partnerships are the key to RLC success. RLCs engage hundreds of park partners including universities; schools; non-profit organizations; community groups; federal, state, and tribal agencies; and NPS programs. They implemented and pioneered multiple citizen science programs, including "BioBlitzes" and longer-term programs to monitor the health of a species or ecosystem. Adaptable and skilled professional staff and numerous partnerships allow RLC programs to respond quickly when unforeseen park information needs arise.

In FY 2009 RLC research coordinators helped establish and implement more than 1,000 research projects through collaboration with researchers; many of these projects directly informed park management decisions. Cumulative RLC efforts helped produce more than 100 peer-reviewed journal articles and involved more than 450 university students in park research. Efforts to communicate science included on-line multi-media products, publications, and exhibits; workshops and seminars on topics such as invasive species, mercury, and wildlife conservation; and hands-on science activities.

Climate change continues to be a focal point for RLCs. Because they are at the nexus of research, education, and outreach programs, RLCs foster collaboration and partnerships to increase parks' capacity to assess resource conditions and vulnerabilities to climate change. RLCs increase the National Park Service's ability to plan for and adapt to climate change at the local, regional, and landscape scales; implement appropriate responses; and assist with internal and external communication of climate change issues.

Servicewide Natural Resource Programs

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

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

National Park Service natural resource management includes a number of other programs outside of the Challenge that provide Servicewide leadership in specialized areas:

- Environmental Quality
- Natural Sounds
- Social Sciences
- Climate Change Response

Total FY 2009 funding for each program is included in Appendix B.

The efforts of these Servicewide programs, as well as park and regional programs, are supported by two natural resource project funding sources. The Resource Protection Program offers project funding for resources at risk. Natural Resource Preservation Program (NRPP) funding allows parks to undertake natural resource management projects beyond the scope of park budgets.

Note: Within this chapter, each program name is followed by an abbreviation, which will be used to indicate program leads for the accomplishments listed in Chapters 4–11.

View from web camera at Purchase Knob, Great Smoky Mountains National Park, North Carolina, on a good visibility day.

Air quality monitoring equipment in Klondike Gold Rush National Historical Park, Alaska.

Air Quality Program (AQ)

The Air Quality Program is responsible for preserving, protecting, and enhancing air quality and air quality-related values in the National Park System in accordance with the NPS Organic Act and the Clean Air Act. Working in regulatory and policy arenas to accomplish this goal, the Air Quality Program emphasizes the collection and analysis of credible air quality information to support scientifically sound resource management decisions in parks and pursues collaborative efforts with regulators, the scientific community, and other stakeholders to improve air quality in parks. The Air Quality Program has six main focus areas:

- *Collaborations*: The program coordinates with states, the Environmental Protection Agency (EPA), and other stakeholders to help develop air policies and strategies that are consistent with preserving and protecting air quality in parks. In FY 2009 in collaboration with the U.S. Forest Service and the U.S. Fish and Wildlife Service, staff reviewed 23 state regional haze plans and consulted with many other states in an effort to reduce visibility-impairing pollutants. Visibility in parks will be significantly improved once these plans are implemented.
- *Prevention of Significant Deterioration and the National Environmental Policy Act*: 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 (AQRVs), including visibility, of Class I areas. To help assess whether emissions would cause or contribute to an adverse impact on AQRVs, staff review source applications for projects proposing to locate near NPS-managed areas and routinely suggest better pollution control technology to minimize emissions, and thereby impacts, on NPS areas. Staff also conduct independent air quality impact assessments and review and comment on environmental impact statements issued by other federal agencies for projects that may impact air quality resources in NPS units (e.g., oil and gas development activities in the West). In FY 2009 staff reviewed 20 new source permit applications.
- *Regulatory Review*: Staff review proposed EPA standards, strategies, and regulations relating to air quality, such as the EPA's proposed ozone monitoring strategy and standards for oxides of nitrogen and oxides of sulfur in FY 2009.
- *Interpretation and Outreach*: The program's outreach efforts promote public knowledge and appreciation of air quality conditions and effects in NPS areas. Such efforts include synthesizing data from NPS air quality monitoring programs, disseminating this information to parks, and facilitating air quality-related interpretive projects and activities. The program operates an air quality web camera network consisting of 16 digital cameras ("web cameras") at 15 park areas; these popular websites had more than five million "visits" in FY 2009. Staff assisted several park areas (e.g., **Acadia National Park (ME), Great Smoky Mountains National Park (NC, TN), Mammoth Cave National Park (KY), Rocky Mountain National Park (CO), Sequoia and Kings Canyon National Parks (CA),** and **Yosemite National Park (CA)** with ozone and fine particle health advisory programs used to alert visitors and employees when concentrations have the potential to reach unhealthy levels.
- *Monitoring and Analysis*: Staff provide air quality assessments for most park units with significant natural resources, respond to park-specific monitoring issues, and identify the status and trends of ambient air quality conditions in national park units. Identifying the state of air quality and AQRVs in the parks is crucial to determine the strategies necessary to protect the resource and visitor health and enjoyment. Because air quality is an ecosystem health indicator, I&M networks rely on the program for guidance and support for air quality monitoring. Staff also cooperate with other national and state programs that monitor ambient gases, meteorology, deposition chemistry, particulate matter, and visibility. In FY 2009 staff deployed portable ozone monitoring systems in several parks and conducted a study in **Rocky Mountain National Park (CO)** to measure nitrogen oxides that are precursors to ozone formation and to determine the spatial distribution of ozone within the park.
- *Ecosystem Effects Projects*: The Air Quality Program has identified natural resources sensitive to air pollutants in more than 200

Gray wolves. USFWS photo.

Wildlife Health Team member and cooperators taking blood samples from an elk in Rocky Mountain National Park, Colorado.

parks. In FY 2009 staff continued to assist parks in setting appropriate resource and air quality management goals by coordinating projects that identify pollutant thresholds for specific ecosystem responses such as aquatic and terrestrial indicators. The results can be used to establish park management goals, report and communicate more effectively on resource trends and condition, and ultimately help protect sensitive resources in parks.

Biological Resource Management Program (BRM)

The Biological Resource Management Program provides professional, science-based support to protect, preserve, and manage biological resources and related ecosystem processes in the National Park System. In addition to supporting Exotic Plant Management Teams, the Biological Resource Management Program focuses its efforts in nine areas:

- *Ecosystem Management and Restoration*: The program supports ecosystem approaches to management and consistency to policy and practices in parks. In FY 2009 staff participated in the NPS Climate Change Science and Stewardship Working Group to develop strategic approaches to filling park needs in response to climate change, participated in a collaborative effort to develop guidelines for the implementation of the Western Governor's Association's goals for wildlife corridors, and engaged with the Department of Homeland Security on border issues.
- *Human Dimensions of Biological Resource Management:* The focus of the Human Dimensions Program is to improve the capacity of regions, support offices, and parks to integrate social science into biological decision making. Systematic understanding of visitor and stakeholder perceptions of biological resources and management actions improves the National Park Service's ability to protect resources while providing for enjoyment, ensures that diverse views are represented in the planning process, identifies potential partners, and ensures that parks remain relevant. In FY 2009 staff coordinated the Human-Wildlife Habituation Steering Committee, which is developing a Systemwide strategy to reduce wildlife habituation and food conditioning in parks while providing visitors with outstanding opportunities for wildlife-dependent recreation, and the Biodiversity Discovery Steering Committee, working with parks involved in All-Taxa Biodiversity Inventories, BioBlitzes, and related activities that typically involve citizens in data collection.
- *Integrated Pest Management (IPM)*: 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 use of IPM strategies was noted in the October 2009 Executive Order on Federal Leadership in Environmental, Energy, and Economic Performance. Servicewide, staff reviewed 2,590 pesticide use proposals in FY 2009, responded to approximately 225 technical assistance requests, and held two IPM training sessions for 55 employees.
- *Invasive Species*: This program focuses on expanding NPS technical expertise and the ability to respond to an increasing invasive species presence in parks. In FY 2009, 823 populations of invasive animals were reported; 119 of those populations were considered to be controlled. Staff contributed to regional plans to minimize the introduction and spread of a variety of invasive species through interagency cooperative efforts, including python and other exotic reptiles in the Everglades and south Florida; viral hemorrhagic septicemia in the Great Lakes; forest insects and diseases, addressing their spread through transportation of firewood in parks; quagga mussels across the western United States; and lionfish at **Biscayne National Park (FL)**.
- *Migratory Birds*: The Park Flight program works to protect shared migratory bird species and their habitats in U.S. national parks. The program develops bird conservation and education projects and creates opportunities for technical exchange and cooperation between U.S. national parks and protected areas in Canada, Latin America, and the Caribbean. Sixteen international interns from eight Latin American countries contributed to bird monitoring and education efforts at nine NPS units, contributing 6,927 hours.
- *Threatened and Endangered Species*: This program works to restore and stabilize threatened and endangered (T&E) species

that are listed under the Endangered Species Act and species considered by parks as Species of Management Concern (SOMC). The program provides compliance, consultation, and funding for T&E projects and technical expertise for SOMC projects. In FY 2009 staff coordinated placement of 14 Chicago Botanic Garden interns in parks to work on T&E, pest, and exotic plant management projects and led the Department of the Interior Bison Conservation Initiative.

- *Vegetation Inventory*: This program is tasked with developing vegetation inventory products such as taxonomic classification, vegetation keys, digital maps and associated databases, accuracy assessment reports and contingency tables, and project reports for the 270 NPS sites in the I&M Program. This information fills and complements a wide variety of resource assessment, park management, and conservation needs. The program provided vegetation inventory products for 18 additional parks in FY 2009 and has ongoing projects in 166 national parks.
- *Wildlife Health*: The Wildlife Health Team provides professional veterinary and wildlife management support on the policy and technical aspects of wildlife diseases and their management, preventive health actions, fertility control, field anesthesia, and animal welfare issues. In FY 2009 they collaborated with NPS Office of Public Health to implement a joint Disease Outbreak Investigation Team, prepared a guidance memo for parks and regions titled *Interim Guidance on White-nose Syndrome in Bats*, convened a workshop to develop Servicewide guidance on plague management, provided technical support to the development of elk management plans at **Wind Cave National Park (SD)** and **Theodore Roosevelt National Park (ND)**, and consulted on bird management to avoid airline-bird strikes in two regions.
- *Project Support*: Biological Resource Management competitive funds are used for park projects that address resource management issues regarding aquatic and terrestrial plants and animals throughout the National Park System. In FY 2009, 21 projects were funded in 19 parks for a total of $624,545 (see Appendix C for a list of FY 2009 projects).

Geologic Resources Program (GR)

The Geologic Resources Program provides leadership and guidance for the protection and management of the geologic and interdependent ecosystem resources of the National Park System. The program carries out an array of activities under six categories:

- *Geologic Features, Landscapes, and Processes*: This program provides parks with assistance related to paleontological resources, cave and karst resources, coastal geology, and active geological processes. In FY 2009 staff worked with partners and contractors to complete five new paleontological resource I&M network reports encompassing 63 parks. They assisted with the development of several cave and karst management plans, organized a workshop to develop cave monitoring protocols, and led the federal partnership with the National Cave and Karst Research Institute. Staff completed and delivered digital geologic maps to 30 parks, held scoping meetings for 17 parks to discuss mapping needs and geologic resource management issues, completed geologic reports for 16 parks, and worked with the Natural Resources Conservation Service and the National Cooperative Soil Survey to complete soil resource inventories for 21 parks. Coastal geology staff assisted park staff with such issues as hurricane and storm impacts, restoration, and coastal resource inventory and monitoring and continued to provide Servicewide support on climate change topics such as sea level rise and coastal adaptation.
- *Energy and Mineral Development*: Staff provide park managers, including the NPS Director's Office, with assistance in addressing energy and mineral development issues both inside and adjacent to park boundaries through expertise in mining, petroleum geology, petroleum engineering, regulations, policy, reclamation, and impact mitigation. Staff also coordinate with experts in other disciplines to ensure that park issues are being comprehensively identified and addressed. In FY 2009 the Geologic Resources Program spearheaded efforts across the National Park Service to elevate attention to and address park protection concerns with conventional and renewable energy development outside park boundaries. This entailed establishing a

Directional well outside Aztec Ruins National Monument, New Mexico.

network of energy contacts across the National Park Service and initiating dialogues and engagement with a number of counterparts in other agencies responsible for permitting energy projects on lands adjacent to parks. In addition, the program provided assistance on energy- and mineral-related issues to more than 100 parks in six regions. At present, more than 200 parks could be impacted by conventional and renewable energy development outside park boundaries. Thirty-two parks contain nearly 750 active private mineral or oil and gas operations within their boundaries.

- *Restoration—Disturbed Lands and Abandoned Mineral Lands*: Staff prepare technical guidance, review park work plans for technical adequacy, and provide oversight on cost accounting and accomplishments reporting for the NRPP–Disturbed Lands Restoration. In FY 2009 the program disbursed $790,335 to 14 park projects, seven of which were completed in FY 2009. Staff oversee the implementation of the Department of the Interior Inspector General's recommendations for dealing with human health and safety issues at abandoned mineral lands (AML) on NPS sites. Staff also coordinated the development of a Service-wide list containing $28.4 million in AML projects, of which $22.4 million was funded by the American Recovery and Reinvestment Act of 2009.
- *Geologic Resource Information for Park Planning Documents*: Staff provide geoscience data for individual planning documents and nonfederal oil and gas planning efforts in parks, and offer resource-specific technical assistance and data (e.g., paleontology, coastal, geohazards, and oil and gas development) and technical reviews of park planning documents. In FY 2009 planning activities centered on the continuation of NRPP projects started in FY 2008. Staff contributed to at least 18 NPS planning documents in 17 parks; provided geoscience information for and comments on specific projects, such as environmental assessments for well plugging at **Big South Fork National River and Recreation Area (KY, TN)** and for a trails management plan at **Chattahoochee River National Recreation Area (GA)**; and participated in the Planning Technical Advisory Group (PTAG), working with PTAG members and the NPS Natural Resource Program Center (NRPC) staff to address NRPC-wide planning issues.
- *Climate Change Impacts and Vulnerabilities*: The Geologic Resources Program helps parks face the challenge of managing resources with respect to climate change (e.g., rates of shoreline erosion in parks are increasing as sea level rises, storms intensify, and storm surges reach further inland). In FY 2009 staff coordinated a storm hazard project and completed storm vulnerability assessments at **Kaloko-Honokohau National Historical Park** and **Pu'ukohola Heiau National Historic Site (HI)** and **George Washington Birthplace National Monument (VA)**.
- *Active Geological Processes and Hazards*: Staff help parks assess and evaluate active geological processes such as erosion, landslides, rock falls, and tsunamis, which helps parks develop appropriate restoration plans for disturbed lands and protect park visitors and infrastructure from the effects of these active processes. In FY 2009 staff provided incident-related technical assistance for nine projects in seven parks across five NPS regions.

Water Resources Program (WR)

The Water Resources Program provides leadership for the preservation, protection, and management of the water and aquatic resources in NPS units. Water resource issues include policy, planning, and regulatory review; water quality; water rights; floodplain management; erosion and sediment control; fisheries management; protection of wetland and riparian habitats; and ocean and coastal resources. The Water Resources Program helps parks address these issues through seven main programmatic areas:

- *Water Resource Protection Projects*: With an increase of $832,000 in the water resource protection project budget beginning in FY 2001, Challenge funding expanded the National Park Service's ability to fund data collection and analyses to describe surface and ground water flow regimes and the dependence of park resources upon water. Results are used to help support federal regulatory, state water rights, and federal or state court process documents and may support settlement negotiations or imple-

Water quality monitoring at Old Bates Wilson Spring, Canyonlands National Park, Utah. NPS photo by Dusty Perkins.

California's Point Reyes National Seashore, one of 74 ocean and Great Lakes parks. NPS photo by Lynn Davison.

mentation. FY 2009 funds were used to develop modeling capabilities for predicting effects of large-scale development in regional ground water flow systems in the West and to perform hydrologic studies on the effects of impoundments on surface river systems in the East. In addition, projects studied water-dependent resources such as riparian/wetland vegetation, fish migration, water-related fish habitat requirements, anchialine ponds, and geomorphology.

- *Water Quality Monitoring*: Challenge funding of more than $2.5 million helps track and support the attainment of water quality standards in the National Park System and monitor long-term status and trends in the nation's most pristine watersheds. Because water quality is a key vital sign in determining overall aquatic ecosystem health, planning and design of the program is implemented in full integration with the NPS Park Vital Signs Monitoring Program; full program funding was allocated to all 32 I&M networks in FY 2009 (see Appendix B, Table B-8). The program provides national program administration and reporting, establishes baseline inventories and analyses of available water quality data, supports digitization of legacy data from analog reports and other archival materials, maintains a Servicewide STORET water quality database, and enhances the transfer of physical, chemical, and biological data from the networks into STORET. In FY 2009 staff enhanced NPSTORET, adding the ability to compare water quality data to user-defined, state, or national water quality standards and the ability to display the results of water quality analyses spatially using Google Earth.
- *Natural Resource Condition Assessments*: This program works toward the goal of funding a "Natural Resource Condition Assessment" project for each of the 270 parks in the NPS Vital Signs Monitoring Program. Relying on existing data from multiple sources and best professional judgment, each assessment provides an interdisciplinary synthesis and report on current condition status, critical data gaps, and existing or emerging vulnerability/risk factors for important park natural resources and strives to develop overall condition ratings for park areas. Parks receiving these assessments will be in an enhanced position to define natural resource conservation indicators and targets via park planning and report to land health goals in the Department of Interior's Strategic Plan. The program includes coastal park natural resource assessments for Great Lakes and coastal parks, initiating 47 assessments and completing 29 reports since 2003. In FY 2009 the program provided funding to support 50 new or ongoing park condition assessments.
- *Ocean and Coastal Resources*: This program increases the National Park Service's organizational and scientific capacity to protect the biological and recreational values of 74 ocean and Great Lakes parks across 26 states. Efforts include performing condition assessments that measure the status of marine, estuarine, and Great Lakes natural resources and identify threats to watershed health; mapping submerged habitats; addressing critical science and management needs related to storm hazards and coastal vulnerability; and evaluating "no-take" marine reserves in NPS areas. In FY 2009 in partnership with the I&M Program, staff initiated habitat mapping projects for submerged resources in two parks and completed habitat maps for three parks. Gap analyses were initiated for eight parks to obtain and evaluate available ecological, oceanographic, socioeconomic, cultural, and remote sensing datasets; synthesize relevant available datasets into a common integrated system; and provide a custom web portal to access data and metadata resources.
- *Water Resource Protection—Aquatic Resource Professionals*: Aquatic resource specialists provide park managers with expertise to address high-priority aquatic resource needs, including fisheries biology, hydrology, and marine and aquatic ecology. Of the 15 specialists, 12 are duty-stationed in parks; the remaining three are located in the Sonoran Desert Network office, the Center for Urban Ecology in the National Capital Region, and the Utah State Office.
- *Water Resource Protection—Water Resource Technical Assistance*: The Water Resources Program provides direct assistance to parks on high-priority needs, using a combination of its own staff and expertise acquired through cooperative agreements. Technical assistance is provided for such things

Placing sediment bags for seagrass restoration and evaluating injuries to a coral reef caused by a grounding at Biscayne National Park, Florida.

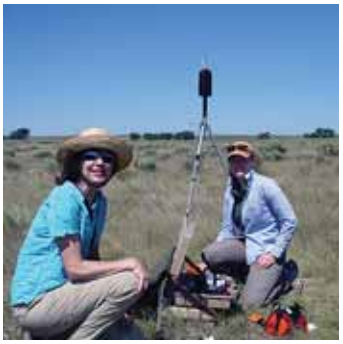
as wetland and floodplain compliance and restoration, surface and ground water hydrology, fisheries protection, water rights protection, park-based planning, water quality monitoring and compliance, and marine resource protection. More than 160 parks obtained technical assistance from the Water Resources Program in FY 2009.

- *Water Resource Protection Project Support*: The Water Resources Program provides funding for projects benefitting water resources across the National Park System. In FY 2009 the program distributed $817,700 for water resource protection projects in nine parks within eight states and for Servicewide support and assistance (see Appendix D for a list of FY 2009 projects).

Environmental Quality Program (EQ)

The 1916 Organic Act and the National Environmental Policy Act of 1969 (NEPA) require that the National Park Service make informed decisions that promote the conservation of park resources unimpaired for current and future enjoyment. Further, NEPA requires that all federal agencies prepare studies of the impacts of and alternatives to proposed actions, use those studies in deciding whether to proceed with those actions, and diligently attempt to involve the affected public before any decision is made. The Environmental Quality Program helps parks fulfill this requirement through its Environmental Compliance Program, Resource Protection Program (formerly called the Environmental Response, Damage Assessment, and Restoration Program), and External Review Program. Many of the projects are multi-year efforts that involve other agencies at the federal and state levels.

- *Environmental Planning and Compliance*: This program provides policy development, technical assistance, training, and project management to parks in the areas of impact analysis and conservation planning under NEPA and related statutes. Staff help parks with complex, controversial, and potentially precedent-setting NEPA analyses and decisions and provide assistance that is generally not available at the park or regional levels. In FY 2009 the Environmental Compliance Program managed more than $4 million of environmental planning work in 25 parks. Projects supported include the *Off-Road Vehicle Management Plan/Environmental Impact Statement* for **Cape Hatteras National Seashore (NC)**, *Plan for Protecting and Restoring Native Ecosystems by Managing Non-Native Ungulates* at **Hawaii Volcanoes National Park (HI)**, *Cultural Landscape Report/Environmental Assessment* for **Vicksburg National Military Park (MS)**, and the *Elk Management Plan/Environmental Impact Statement* for **Theodore Roosevelt National Park (ND)**.
- *Resource Protection Program:* This program provides technical assistance, training, case management, and restoration project management to help parks address incident-caused injuries to resources. Under the Park System Resource Protection Act; Oil Pollution Act; Park System Resources Protection Act (16 U.S.C. 19jj); and Comprehensive Environmental Response, Compensation, and Liability Act, the National Park Service is authorized to take actions to prevent or minimize injuries, assess and seek recovery of compensatory damages, and restore injured resources associated with discharges of oil, releases of hazardous substances, and other incidents that injure NPS resources. In FY 2009 the program recovered more than $1.5 million in damages for 18 parks and managed more than $2.8 million of restoration project work. FY 2009 highlights included the Palmerton Zinc Superfund settlement, coral reef restoration at **Biscayne National Park (FL)**, and initiation of planning for the Grand Ditch Breach Restoration in **Rocky Mountain National Park (CO)**, the settlement for which is the largest ever achieved under the Park System Resource Protection Act
- *External Review*: This program is the focal point for NPS external environmental reviews. Program responsibilities include the operation, management, review, and tracking of environmental documents having shared interests or concerns. The program is responsible for the distribution of non-NPS documents to appropriate NPS professionals as a source of information pertaining to significant environmental developments. External Review Program staff facilitate NPS reviews and comments on the potential impacts of applicants' proposals on NPS resources and values. These reviews help applicants avoid or mitigate impacts to NPS resources and values as well as to NPS programs administered under



Natural Sounds Program staff setting up sound monitoring equipment at Sand Creek Massacre National Historic Site, Colorado. NPS photo by Theresa Ely.

statutory or administrative authorities. Program functions also include coordinating NPS comments for each external environmental review and consolidating comments into one response. Each year the program manages between 1,400 and 1,800 external reviews.

Natural Sounds Program (NSP)

The Natural Sounds Program was established in 2000 to provide parks with assistance, guidance, and a Servicewide consistent approach to managing acoustic environments (soundscapes) in a way that balances the diverse expectations of park visitors with the protection of park resources and values. The Natural Sounds Program protects, maintains, and restores soundscape resources and values by working in partnership with parks and others to increase scientific and public understanding of the value and character of park soundscapes.

An important element of this mission is working with the Federal Aviation Administration (FAA) to implement the National Parks Air Tour Management Act of 2000, which comprises approximately 65–75 percent of the program's budget and staff resources. Specifically, the 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. In FY 2009 the Natural Sounds Program, working with the FAA and Department of Transportation's Volpe Center, continued work on six existing Air Tour Management Plans and initiated six new plans (**Acadia National Park [ME], Death Valley National Park [CA, NV], Governors Island National Monument [NY], Mount Rainier National Park [WA], Petrified Forest National Park [AZ],** and **Statue of Liberty National Monument [NY]**).

Emerging issues relative to acoustic environments in NPS units include impacts from energy development projects in and near parks, impacts to soundscapes as species adapt to changes in climate, cultural and historic soundscapes, and noise impacts underwater (oceans/coastal parks). To help address these issues, program staff assisted more than 62 parks with 89 projects related to the protection of park resources and values and completed 27 acoustic reports characterizing park soundscapes in FY 2009. Acoustic monitoring has now been completed for more than 150 park units. Staff also published six papers in peer-reviewed journals and spearheaded social science research relative to visitor responses to noise in **Rocky Mountain National Park (CO), Sequoia and Kings Canyon National Parks (CA),** and **Yosemite National Park (CA)**.

Outreach and education efforts increase awareness of the importance of natural soundscapes in parks. In FY 2009 program staff completed development of an online interactive acoustic toolbox for use by park staff, concessionaires, and partners to help reduce noise footprints in and around park units; provided acoustic equipment and interpretive materials to Global Explorers (Connecting Kids to Parks), a non-profit organization; completed development of a *Key Resource Information and Issues Handbook* for park interpreters as part of an interpretive toolbox; and completed development of a soundscape module as part of a wilderness training course for the Arthur Carhart National Wilderness Training Center.

Social Science Program (SS)

The Social Science Program conducts and facilitates research that provides public input into park planning and management; investigates economic interactions between parks and nearby communities; develops methods and techniques to improve management of visitor use; and supports improved NPS management. The National Park Service uses this information to improve visitor services, enhance civic engagement, protect natural and cultural resources, and manage parks more effectively. Staff focus their efforts in the following program areas:

- *Comprehensive Survey*: Through its periodic Comprehensive Survey of the American Public, the program provides key insights into public opinions, knowledge, and behavior regarding parks.
- *Money Generation Model (MGM2)*: MGM2 helps estimate the economic impacts of NPS visitor spending on a local region. Like the original Money Generation Model, MGM2 estimates the impacts that park

Visitors at Yavapai Point in Grand Canyon National Park, Arizona, and along the Eberhart Trail in Little River Canyon National Preserve, Alabama. NPS photos by Patrick Gregerson (top) and Larry Beane (bottom).

visitors have on the local economy in terms of their contribution to sales, income, and jobs in the area. The Money Generation Model produces quantifiable measures of park economic benefits that can be used for planning, concessions management, budget justifications, policy analysis, and marketing. The *National Park Visitor Spending and Payroll Impacts 2008* report, issued in FY 2009, reported that visitor spending in local gateway regions surrounding all parks supported 205,000 jobs, $4.4 billion in labor income, and $6.9 billion in value added.

- *Public Use Statistics*: The Public Use Statistics Office coordinates visitor counting protocols Servicewide and provides visitation statistics and forecasts for areas administered by the National Park Service. In FY 2009 the office issued its *Statistical Abstract 2008*, which reported a total of almost 275 million recreation visitors to all units of the National Park System.
- Social Science Studies Collection: This collection is part of the effort to conduct and promote state-of-the-art social science related to the mission of the National Park Service and deliver usable knowledge to NPS managers and the public. It reflects a growing demand by park managers for information on the relationship between people and parks. Currently, it includes more than 260 records including study reports, images, and other documents produced by or for the National Park Service from disciplines such as recreation resource management, economics, geography, psychology, political science, and sociology. The electronic version of the collection is now available on the NPS Focus Digital Library & Research Station website (http://npsfocus.nps.gov/).
- *Technical Assistance*: The Social Science Program provides technical assistance, ranging from technical advice on survey design and implementation to developing social science research plans and training, to parks and regions, the Department of the Interior, and NPS partners. The program is also responsible for working with parks and regions to help them obtain Office of Management and Budget (OMB) approval for surveys, following Paperwork Reduction Act requirements; in FY 2009, 33 survey approvals were obtained from OMB.
- *Visitor Survey Card*: Visitor Survey Cards are mail-back customer satisfaction cards similar to surveys successfully used by major U.S. corporations. The survey is used annually by all NPS units to systematically measure and report performance related to the Government Performance and Results Act (GPRA) goals IIa1 (visitor satisfaction) and IIb1 (visitor understanding and appreciation). Results for 13 indicators (including park facilities, visitor services, and recreational opportunities) are reported at the park, regional, and national levels.
- *Visitor Services Project (VSP)*: The VSP conducts in-depth visitor studies, offers technical assistance to parks, develops new evaluation tools, and provides Servicewide training. Customized VSP studies provide managers and planners with valuable and otherwise unavailable information about visitors: who they are, what they do, and their needs and opinions. Park managers use these data to improve operations, protect resources, and better serve the public. In FY 2009 the Social Science Program completed 12 VSP studies and reports in 10 parks and published the annual *Serving the Visitor* publication, which reports summary results from both the VSP and Visitor Survey Card efforts.

Climate Change Response Program (CCRP)

The Climate Change Response Program was established in 2008 to provide guidance, scientific information, and recommendations that support NPS actions to protect our natural and cultural heritage from detrimental impacts due to rapid climate change. The program collaborates with partners in other agencies and organizations, integrates across the National Park Service to build understanding, synthesizes information, and coordinates landscape-scale adaptation and mitigation actions. The NPS Climate Change Response Program has played a key role in the Department of Interior's climate change initiative.

Servicewide working groups were established to foster communication, explore the needs and issues of parks, and begin to define both strategies and actions for moving forward on this critical issue. Representatives from parks, regions, and national programs have participated in these working groups. In early 2009 a Servicewide Climate Change Response Steering Committee was created to serve as

an advisory body to the NPS director and the National Leadership Council. The steering committee is in the process of developing a Climate Change Response Strategy that outlines key goals and objectives under four broad components: science, mitigation, adaptation, and communication. Once finalized, the strategy will serve as the framework for a detailed implementation plan to guide the National Park Service in understanding, communicating, and coping with the effects of climate change on park resources and infrastructure. Congress approved the request for new funding to support the program, which will receive its first year of full funding in FY 2010.

Resource Protection Program (RP)

The Resource Protection Program supports projects that propose innovative approaches involving natural resource specialists, protection rangers, researchers, and partners from other agencies to focus on resources at risk. In FY 2009 the Resource Protection Program distributed $283,000 for such projects. A list of all Resource Protection projects active in FY 2009 is included in Appendix E.

Natural Resource Preservation Program (NRPP)

The Natural Resource Preservation Program provides funding to parks for natural resource management projects beyond the scope of park budgets. The NRPP supports diverse activities in areas such as wildlife, fisheries, and vegetation management; specialized inventories; planning; mitigation actions; and restoration activities.

Challenge funding has had a significant impact on the program. Funding increased from $5,432,000 in FY 2000 to $12,693,000 in FY 2003. Budget cuts, however, have decreased NRPP funding: since 2003, the NRPP has lost $4,594,000. These reductions translate into 20–25 fewer on-the-ground projects in parks per year—and reduced performance outcomes.

Despite this, 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 (SCC) guidance continue to increase the accountability and efficiency of this funding source. Nearly half of NRPP funds are available for general park-level natural resource management projects; the balance target specific needs such as small park projects, disturbed lands restoration, threatened and endangered species, and funds that are distributed to the regions for their use for natural resource projects in parks (Table 2-7). A list of FY 2009 NRPP projects in all categories is included in Appendix F.

Alaska Special Projects (**NRPP–AK**) funding was established to allow the National Park Service to undertake projects that improve the protection and management of NPS units in Alaska, which are managed under the Alaska National Interest Lands Conservation Act and other Alaska-specific requirements. Funding focuses on the highest priority natural resource projects that lack adequate funding from other sources. New projects initiated in FY 2009 included studies to monitor subsistence fisheries, caribou habitat, wolf distributions and predation, paleontological inventories, and lake disappearance in areas of continuous permafrost.

Table 2-7. Natural Resource Preservation Program (NRPP) project totals and funding by category, FY 2009

NRPP funding categories	Number of projects	FY 2009 funding ($)
Alaska Special Projects	12	467,000
Disturbed Lands Restoration	14	790,000
Natural Resource Management	31	3,139,000
Regional Block Allocation	70	1,303,000
Small Park Block Allocation	60	933,000
Servicewide Projects	21	764,000
Threatened and Endangered Species	9	467,000
Park-Oriented Biological Support	18	236,000
TOTAL	217	8,099,000

Disturbed Lands Restoration (**NRPP–DLR**) provides funding for parks to restore disturbed lands—lands where the natural conditions and processes have been degraded, damaged, or destroyed by development (e.g., facilities, roads, mines, dams) and/or by agricultural practices. The land disturbances and human safety hazards at abandoned mineral lands (AML) sites continued to be major issues on NPS lands in FY 2009; approximately 3,100 AML sites with 8,400 individual features are estimated to exist in 126 units of the National Park System. Restoration is the process of assisting the recovery of these disturbed areas through direct manipulation of degraded ecosystem components. In FY 2009 the DLR program funded 14 park projects in five NPS regions. The seven DLR projects completed in FY 2009 restored approximately 457 acres of severely disturbed land.

Natural Resource Management (**NRPP–NRM**) projects make up the largest segment of the NRPP. Projects eligible for funding through this source include resource management actions; tactical biological studies; development of new physical science theory, management approaches, and protocols; and combined research and follow-up resource management or mitigation actions. In FY 2009 NRM funding was distributed to 31 projects in 23 states in seven NPS regions.

NRPP funding is provided to regions to distribute between Regional Block Allocation and Small Park Block Allocation projects.

Regional Block Allocation (**NRPP–RB**) projects improve natural resource knowledge and condition, including projects such as specialized inventories currently outside the scope of the Servicewide I&M Program and mitigation actions (e.g., fossil inventories and invasive plant or invasive animal control). In FY 2009 Regional Block Allocation funding was allocated to 70 projects in 54 parks (Table 2-8).

Small Park Block Allocation (**NRPP–SP**) funding provides project funds for parks that fall in the lower third of funding for all parks and helps small parks achieve their natural resource goals. In FY 2009 the program funded 61 projects in at least 54 parks (Table 2-9).

Servicewide (**NRPP–SW**) projects address the needs of Servicewide programs (e.g., Air Quality, Water Resources, etc.) that are not met within the budgets of the programs.

Table 2-8. Natural Resource Preservation Program–Regional Block Allocation projects by region, FY 2009

Region	Number of parks	Number of projects	Funding ($)
Alaska	4	11	187,000
Intermountain	9	9	186,000
Midwest	10	10	186,000
National Capital	8	12	186,000
Northeast	8	12	186,000
Pacific West	6	7	186,000
Southeast	9	9	186,000
TOTAL	54	70	1,303,000

Table 2-9. Natural Resource Preservation Program–Small Park Block Allocation projects by region, FY 2009

Region	Number of parks	Number of projects	Funding ($)
Alaska	2	2	19,000
Intermountain	12	14	242,000
Midwest	11	13	170,000
National Capital	2	2	19,000
Northeast	9	10	116,000
Pacific West	7	9	161,000
Southeast	11	11	206,000
Total	54	61	933,000

Some projects are designed to provide tools or capacity that will benefit many programs and components of the National Park Service, while others respond to issues that are beyond the capacity of the base programs to fund, such as assessing the vulnerability of coastal parks to climate change. These special projects are often interdisciplinary in nature and may include activities with professional organizations, publications, or Servicewide databases. In FY 2009 NRPP–SW funding supported 21 projects, including evaluation of the carbon storage potential for NPS ecosystems, implementation of the emergency response program, and activities of the Night Sky Program.

Threatened and Endangered Species (**NRPP–T&E**) projects are on-the-ground conservation efforts that contribute to the long-term goal of the NPS Threatened and Endangered Species Program to increase the number of park populations of listed species that are making progress toward recovery and to restore these species when they have been extirpated from parks. FY 2009 projects addressed endangered species in **Coronado National Memorial (AZ)** and **Santa Monica Mountains National Recreation Area (CA)**.

The NPS Natural Resource Preservation Program and the U.S. Geological Survey–Biological Resources Discipline jointly fund USGS biological projects that provide exploratory research and technical assistance for parks. In FY 2009 the National Park Service contributed $236,000 and the USGS Biological Resources Discipline contributed $320,750 to funding these projects, which collectively are termed *Park-Oriented Biological Support* (POBS) projects. Information on topics and accomplishments of projects active in FY 2009 is found in Appendix G.

Chapter 3: Progress Over 10 Years

In FY 2000 when the Natural Resource Challenge received its first funding from Congress, resource managers were realizing the need to manage natural resources instead of assuming that natural systems and processes would take care of them. The 1999 *Natural Resource Challenge: The National Park Service's Action Plan for Preserving Natural Resources* ("the action plan") called for active and informed management to save natural resources from threats such as nonnative species, pollution, and incompatible uses of resources.

Ten years later, with more than $77 million in increases from the Challenge, the National Park Service has made significant progress in addressing the three major challenges outlined in the plan (protecting native species and their habitats, providing leadership for a healthy environment, and connecting parks to protected areas and parks to people), placing us in a better position to protect natural resources in parks and to confront emerging issues that threaten our resources.

Protecting Native Species and Their Habitats

Changes to the American landscape threaten the survival of native species. National parks serve as refuges for these species, where they are protected from development and other threats. However, some of these threats, such as invasive species, don't respect borders. The Challenge provided funding both to fight invasive species and to restore threatened and endangered species. In the years since the Challenge began, the National Park Service has made substantial progress on both fronts.

Invasive Species

The Challenge provided funding directly to some parks to expand their invasive species control efforts. **Sequoia and Kings Canyon National Parks (CA)**, for example, established an exotic plant management program in 2002 using their Challenge increase. Since that time, they have surveyed almost 62,000 acres, treated 11 million invasive plants, controlled more than 150 acres, and expanded outreach efforts with park neighbors and visitors. In FY 2009 **Acadia National Park (ME)** reported that purple loosestrife (*Lythrum salicaria*), an invasive plant that has invaded wetlands throughout the United States, was not recorded in the park for the first time in 20 years, representing a major milestone in protecting native communities.

Servicewide programs received Challenge funding to assist in the effort to protect native species—and their accomplishments reflect the value of that funding. Over the past seven years, Exotic Plant Management Teams inventoried more than 11,500,000 acres and recorded information on more than 600 invasive plant species. In FY 2000 with only a few teams in operation, only 17 species were treated; that number increased to more than 250 in FY 2009 with 16 teams in operation. Vegetation inventory products provide up-to-date habitat information, helping locate invasive species and assisting in the management of native species; 173 of the 270 I&M parks have a completed vegetation inventory, up from 22 in FY 2001.

Threatened and Endangered Species

The Challenge also provided funding to protect and restore threatened and endangered species. The success of the island fox and Kemp's ridley turtle restoration programs demonstrate the impact of Challenge funding on this effort.

Island foxes (*Urocyon littoralis*) on San Miguel, Santa Rosa, and Santa Cruz islands in **Channel Islands National Park (CA)** were listed as endangered by the U.S. Fish and Wildlife Service in 2004 after catastrophic declines in their populations. In 2008 only four years after the listing and well before the release of an official recovery plan, island foxes on the northern Channel Islands numbered more than 1,500 and are close to meeting biological criteria for de-listing. This represents one of the fastest recoveries of any listed species, due to a successful captive breeding program and live-capture and re-

Island fox (*Urocyon littoralis*) captured during trapping for annual population monitoring on Santa Rosa Island, Channel Islands National Park, California. NPS photo by Tim Coonan.

moval of golden eagles, the primary predator of island foxes. Additional efforts to remove feral pigs (a major food source for golden eagles) from Santa Cruz Island and to restore bald eagles to the island ecosystem will help ensure that golden eagles do not become reestablished. The Challenge has funded island fox recovery efforts since FY 2005.

Padre Island National Seashore (TX) received a Challenge increase targeted to recovery of endangered Kemp's ridley sea turtles (*Lepidochelys kempii*). Since 2002 Challenge funding has helped fund staff to work with the Kemp's Ridley Sea Turtle Monitoring Program, enhancing sea turtle monitoring and science efforts and expanding community and partner participation. The number of Kemp's ridley turtle nests found in the seashore continues to increase, with 117 found in FY 2009. These nests constitute 59.3 percent of the nests found in Texas and 57.1 percent of the nests documented in the United States. Numbers recorded during FY 2009 and recent years indicate that nesting by this endangered species is becoming reestablished at the seashore, which is the most important Kemp's ridley nesting beach in the United States.

Providing Leadership for a Healthy Environment

The natural resources within national parks—as well as the quality of visitor experiences—depend upon clean air and water. The Challenge, therefore, expanded NPS programs that maintain and restore air quality and water resources.

Air Quality

Challenge funding expanded the air quality monitoring network, focusing on parks most threatened by air pollution or most vulnerable to degradation caused by air pollution. By FY 2009 all I&M 270 parks had received their baseline air quality data inventory; 240 had received their air quality related values inventory. In many cases enhanced analytical capacity and scientific research allowed baseline information to be generated using interpolation or risk assessments. Significant accomplishments include:

- Air quality conditions and trends are now being reported for 228 park units (147 for visibility, 148 for ozone, and 58 for atmospheric deposition), compared to around 30 parks in 2000.
- Monitoring for toxic air pollutants has been done in 20 parks, with surprising results that garnered worldwide interest (e.g., monitoring found 70 of the 100 contaminants examined; bioaccumulation of some toxins exceeded thresholds for consumption by wildlife and/or humans; and intersex fish were discovered in remote parks).
- The National Park Service has been actively involved in the development of new pollution control programs to protect visibility in national parks in all 50 states.

Water Resources

The Challenge expanded water resources protection by providing funding for water quality monitoring and water resource protection project funds and field specialists. Prior to the Challenge, there was no Service-wide water quality monitoring program; water quality monitoring is now routinely occurring in parks in all 32 I&M networks. Challenge-funded water resource protection projects have contributed to the successful quantification, acquisition, and protection of park water rights such as those at **Black Canyon of the Gunnison National Park (CO), Great Sand Dunes National Park and Preserve (CO),** and **Death Valley National Park (CA, NV)**. The 15 park-based aquatic resource protection positions funded by the Challenge serve multiple parks in their respective regions, thereby substantially enhancing access to parks for specialized technical assistance.

Connecting Parks to Protected Areas and Parks to People

Managing natural resources first requires understanding them. The action plan proposed to do this through the establishment of a biogeographic network of parks that could facilitate collaboration and information sharing among parks, federal agencies, nonprofit organizations, the scientific community, and the public. Each network would perform vital inventory and monitoring tasks to increase knowledge of natural resources in parks and monitor changes. NPS research efforts would be enhanced and information shared through the establishment of Cooperative Ecosystem Studies Units and Research Learning Centers.

Locating a rare *Minuartia groenlandica* population on Old Rag Mountain, Shenandoah National Park, Virginia. These plants of special concern are monitored in the park's I&M Program. NPS photo by Wendy Hochstedler.

Today, due to Challenge funding, that collaborative system is a reality. Thirty-two I&M networks collect basic inventory data and monitor vital signs for 270 parks with significant natural resources. Before FY 2001 only 473 of the basic inventory products were complete; by FY 2009, 2,928 were complete. Of the 270 parks, 253 have at least one year of field data collection and are able to estimate current condition for specific vital signs; by 2011, the monitoring effort is projected to be fully implemented for all parks.

Challenge funding enabled NPS participation in Cooperative Ecosystem Studies Units (CESUs) and staffing of Research Learning Centers (RLCs) as they work to expand research efforts and share knowledge gained. In FY 2001, eight CESUs facilitated 260 projects totaling $10 million; in FY 2009, 17 CESUs facilitated 804 projects totaling $38 million. The Challenge supports 12 of these CESUs.

Four RLCs were funded by the Challenge in FY 2001; in FY 2009, 12 Challenge-funded RLCs are in operation, engaging researchers, students, and the public in NPS science.

The Full Picture

The progress the National Park Service has made toward these three challenges provides only a partial picture of the accomplishments since the Challenge was first funded. In reality, the accomplishments are much broader, improving all aspects of natural resource management in the National Park Service. The timeline on the following pages showcases natural resource accomplishments over the life of the Challenge, and the FY 2009 accomplishments listed in Chapters 4–11 provide examples from parks, regions, and Servicewide programs, demonstrating how far the National Park Service has come in improving science-based management of natural resources.

NPS Natural Resource Highlights: 1999–2009

"This Action Plan represents our strong commitment to preserving our country's precious natural heritage for this and future generations. . . . Preserving our natural resources far into the future now requires active and informed management based on sound science."
—Robert G. Stanton
NPS Director, 1999

A Wildlife Health Program is initiated to provide professional veterinary consultation and technical assistance to help parks conserve wildlife.

Sixteen parks receive base increases to fight nonnative species and increase threatened and endangered species recovery.

The Air Quality Program expands to monitor conditions at more national parks. Collaboration with states and tribes begins for improving visibility in national parks and wilderness areas.

The first California condor chick to fledge in the wild since 1982 takes to the skies over Grand Canyon National Park.

National Park Service Director's Order 14, "Resource Damage Assessment and Restoration," is published.

The first National Park Service Comprehensive Survey of the American Public is completed to provide information on both park visitors and non-visitors.

1999

National Park Service Director Robert G. Stanton launches the Natural Resource Challenge to create an expanding source of scientific knowledge and information.

The first Oil and Gas Management Plan helps guide decision making for nonfederal oil and gas operations in national parks.

2000

Congress authorizes the first Natural Resource Challenge funding increases. National Park Service sites are organized into 32 Inventory and Monitoring Networks, linking 270 parks with significant natural resources by ecoregion.

Rapid response Exotic Plant Management Teams are established to help parks control invasive plant species.

2001

The first Cooperative Ecosystem Studies Units and Research Learning Centers facilitate cutting-edge research in national parks.

Sixteen field-based aquatic resource specialists are funded to provide parks expertise in fisheries biology, marine and freshwater ecology, and hydrology.

2002

Twenty additional national park units receive base increases through Natural Resource Challenge funding.

An Alaska special projects category is established to fund activities that protect and manage Alaska's natural resources.

2003

The Natural Resource Condition Assessment Program begins to assess existing conditions for ecological resources in national parks.

New and historic photographs at Lake Clark National Park and Preserve document retreating glaciers.

2004

Funding increases support 22 of 32 Inventory and Monitoring Networks to initiate long-term park vital signs monitoring. Together these 22 networks represent 76 percent of parks with significant natural resources.

BACKGROUND: GRAND TETON NATIONAL PARK
©JERRY MEGENITY

Nine *BioBlitzes* are offered by the Appalachian Highlands Science Learning Center and numerous partners to assist in national park field research.

The Ocean and Coastal Resources Branch of the Water Resources Program forms to coordinate NPS ocean responsibilities and policies.

After nine years, a captive breeding program for the endangered island fox in Channel Islands National Park ceases due to excellent survival and reproduction rates in the wild.
PHOTO: ©RUSS FINLEY / FINLEY-HOLIDAY FILMS

"Climate change is potentially the most far-reaching and consequential challenge to our mission than any previously encountered in the entire history of the National Park Service."
—Jonathan B. Jarvis
NPS Director, 2009

The Night Sky Program advances stewardship of park natural lightscapes with guidelines to mitigate light pollution.

A multiagency reef fish monitoring protocol published for the Florida Keys Coral Reef Ecosystem provides regional data extending to Dry Tortugas National Park.
PHOTO: NOAA

A new protocol is developed for constructing wildland fuel load maps to help minimize wildfire risk to people living within and next to parks.

The Natural Sounds Program assists 39 parks with acoustic data collection and analysis, monitoring, and planning to develop plans for mitigating noise impacts.

A climate change coordinator position is established to foster communication and define strategies and actions for addressing this critical issue.

Great Sand Dunes National Park and Preserve receives a water right decree that protects groundwater within the park.

The Gulf Coast Network acquires new imagery and lidar (light distance and ranging) data shortly after Hurricane Katrina for use in natural resource studies and to plan reconstruction of park infrastructure.

Working with state and federal partners, the National Park Service begins adaptive management of marine reserves in four ocean parks to restore the integrity, stability, and beauty of depleted ocean park resources.

Quagga mussels, a close relative of the zebra mussel and an exotic species, are discovered in Lake Mead, the first detection of this species in the western U.S., leading to an immediate response by the National Park Service.

A new Human Dimensions Program is initiated to provide Servicewide policy guidance, technical assistance, and consultation for integrating social science into biological decision making.

The Climate Change Response Program is established to provide guidance, scientific information, and recommendations for protecting our natural and cultural heritage from the detrimental impacts of global climate change.

2005 2006 2007 2008 2009


LUND

Chapter 4: Alaska Region Accomplishments

Alaska is expansive and diverse. Its magnitude is difficult to comprehend, but its rewards are many and apparent. Its climate and topography constitute a virtual subcontinent. The state's National Park Service areas protect representative natural, cultural, and historic features of this immense landscape. Ten were created by the 1980 Alaska National Interest Lands Conservation Act.

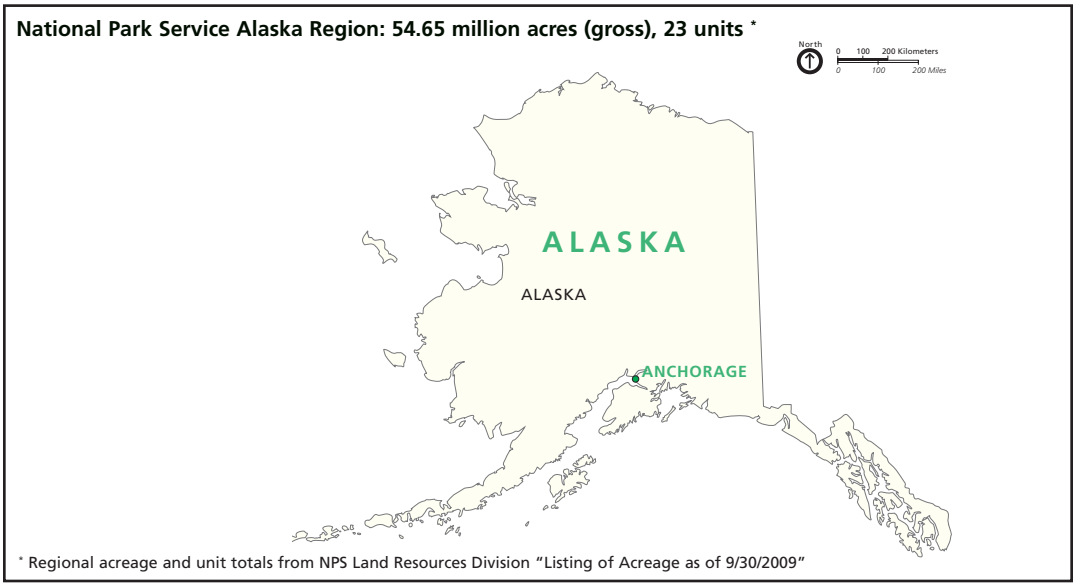
The *NPS Alaska Regional Science Strategy 2006 and Beyond* outlined five primary resource management challenges identified by NPS managers and scientists in Alaska: climate change, global and local contaminants, exotic species, increasing human use, and development within and surrounding parks. Science, resource management, and partnership building activities were underway in all of these areas in FY 2009.

Accomplishments

Bering Land Bridge National Preserve: In April 2009 two Arctic Network staff were trained in the production of podcasts and produced a short podcast highlighting the scope and objectives of the I&M Program (www.nps.gov/bela/photosmultimedia/multimedia.htm). The Arctic Network plans to work with park interpretive staff to produce one to two podcasts per year that highlight different monitoring programs. (**I&M, RLC**)

Denali National Park and Preserve: In FY 2009 Geological Society of America (GSA) GeoCorps volunteers documented 33 "new" paleo sites within the Cantwell Formation, discovering additional ornithopod, pterosaur, hadrosaur, and invertebrate trace fossils and freshwater bivalves and crayfish burrows. The information will contribute to a paleontological resource management plan for the park and can help researchers understand Cretaceous ecosystems in North America. Outreach efforts include a journal article, posters and papers presented at the annual GSA conference, and several talks for park staff and the public. (**NRPP–AK**)

Moose are a species of management concern in Denali because they are harvested by sport and subsistence users and because they may be vulnerable to habitat changes resulting from changing climate. Surveys were performed in FY 2009 in two areas of the park. Compared to 2005 surveys, moose numbers are stable or increasing. The recent survey



Sampling sockeye salmon in Telaquana Lake, Kuskokwim River watershed, Lake Clark National Park and Preserve, Alaska. NPS photo by Dan Young.

will be valuable in evaluating general and subsistence hunting opportunities in Denali National Preserve and designing appropriate regulations. (**BRM**)

Off-road vehicle (ORV) use can damage soils, vegetation, and water resources and create conflicts with other user groups. To protect park resources from this damage, Denali staff initiated a project to develop a spatial and condition baseline for all current illegal ORV use in the park and train park rangers in the use of GIS and GPS. Staff mapped 28.5 miles of illegal trails, developed GIS data layers showing these locations, and trained three park rangers in the use of equipment. The results will help law enforcement rangers prosecute illegal ORV use in the park. (**RP**)

Gates of the Arctic National Park and Preserve: Park staff continued to work with other state and federal agencies to study caribou. A project with the Alaska Department of Fish and Game included purchasing and deploying collars for some of the Western Arctic Herd. A project with the Bureau of Land Management involves habitat assessments on key winter range, as well as work with the University of Alaska–Fairbanks to look at climate change-driven changes in fire ecology. The park's wildlife biologist, a member of the technical committee for the Western Arctic Herd Working Group, developed the protocol for caribou work for the Arctic Network.

Through a cooperative agreement with the University of Alaska–Fairbanks, a graduate student was funded to analyze changes of ice volume in glaciers in Gates of the Arctic. By comparing U.S. Geological Survey maps from 1976 and 2001, the student determined 123 glaciers lost extent at a rate of roughly 50 cm/year when averaged over the glacier surface for the 15-year time period. A peer-reviewed paper will be submitted in FY 2010.

Glacier Bay National Park and Preserve: Harbor seals (*Phoca vitulina*) are an important apex predator and the most numerous marine mammal in the park; however, they have declined by up to 75 percent in the park since 1992. Working with San Jose State University and the University of Alaska, park staff examined possible reasons for this decline. Researchers collected data to quantify the vessel disturbance regime, determine behavioral response and bioenergetic consequences of this disturbance, identify habitat use and movements, and assess disease status and contaminant loads of harbor seals. Data collection and analysis are ongoing. (**NRPP–NRM**)

Park staff launched a project to protect black and brown bears, species of management concern, within Glacier Bay National Park and Preserve. Preliminary results of an interdivisional bear management and research field study in the park indicate that brown bears range farther south in the bay than was previously known and that brown bears did not appear to change their overt behavior as vessels approach until a close distance was reached (20–50 meters). Efforts to reduce bear-human conflict in the preserve included a two-day bear/people management training for resource management and protection staff, investigations of reports of bear-human conflicts, an educational outreach event for all preserve residents demonstrating tools to minimize bear problems, and repeated individual contact with residents by park rangers and biologists to discuss food/trash storage and bear activity. (**RP**)

Katmai National Park and Preserve: A globally endangered lichen, *Erioderma pedicellatum*, known from only two populations in North America, was recently discovered at a single site in the park. The other known population from western North America occurs on the south side of the Alaska Range, in Denali National Park and Preserve and Denali State Park. In addition, *Hypogymnia pulverata*, a lichen known from the southern hemisphere but rare in North America, was found in several locations in the park. (**I&M**)

Sea otters that reside along the Katmai National Park and Preserve coastline are part of the southwest Alaska stock of northern sea otters (*Enhydra lutris kenyoni*) listed as threatened by the U.S. Fish and Wildlife Service in 2005. As part of a larger, multi-year research program funded by the National Pacific Research Board and the U.S. Geological Survey, the Southwest Alaska Network's marine ecologist participated in a study to document the spatial extent of sea otter decline in southwest Alaska and to assess the potential causes of this decline. During July and August

Harbor seal fitted with head-mounted VHF tag and back-mounted time depth recorder in Glacier Bay National Park, Alaska. Photo by Jamie N. Womble.

2009, researchers collected information on body condition and health profiles from 65 individuals (30 from Katmai) along the coast. Survey results are currently being analyzed to approximate the boundary of the decline. Data on overall body condition and other health-related variables will be examined for evidence of disease and other factors potentially influencing their decline. A final report will be submitted in spring 2010. (**I&M**)

Kenai Fjords National Park: In May 2009 staff from Kenai Fjords and the Southwest Alaska Network conducted the first systematic survey of bald eagle nests along the park coastline since 2002 and the first helicopter survey since 1995. Observers detected 44 active nests with incubating adults or eggs and 36 empty nests. Information gathered during this pilot survey will be used to design a long-term, sustainable program for monitoring nest occupancy and productivity of bald eagles in the park. (**I&M**)

The Ocean Alaska Science & Learning Center at Kenai Fjords National Park collaborates with partners to present daily climate change presentations to visitors at the Alaska SeaLife Center and on tour vessels. The learning center also develops podcasts and hosts a Research Seminar Series where visiting scientists present their studies and findings on climate change and the effects of changing climate on landscapes, plants, and animals. (**RLC**)

Klondike Gold Rush National Historical Park: A 1998–1999 pilot study indicated that the Klondike Gold Rush-Skagway area exceeded lichen tissue air pollution indicator thresholds for heavy metals, sulfur, and other elements. Increasing visitation and associated transportation needs indicated a need to repeat the methodology in the original study and in all NPS areas in Southeast Alaska. Researchers used passive sensors to measure ambient concentration and deposition of various oxides of nitrogen and sulfur and collected lichen for elemental analysis. The results will be available in spring 2010. (**NRPP–SP**)

Lake Clark National Park and Preserve: Staff began a project to collar and track wolves to learn about their numbers, ecology, and distribution. Two capture operations were conducted in winter 2008–2009; eight wolves from four packs were outfitted with satellite tracking collars. Preliminary results from satellite collars show that all collared packs travel outside the park and preserve. Packs along the coast are subject to intensive management on the northeastern side, and additional intensive management is being discussed along the western edge of the preserve.

Noatak National Preserve: Results of a lake coring project highlight two important features of tundra fire regimes. First, fire-history records indicate that tundra vegetation has burned consistently over the past 6,000 years,

Sampling macroinvertebrates in the Indian River, Sitka National Historical Park, Alaska. Photo by Geoffrey Smith.

Tuxedni Glacier, Lake Clark National Park and Preserve, Alaska, 2009. NPS photo by Dan Young.

with return intervals in some cases as short as around 150 years. Analysis of tundra fires from the past 60 years indicates that tundra fires occur most often in regions with warm and/or dry climates and during summers with unusually warm August temperatures. Second, the average rate of burning at closely spaced sites has varied through time, and not necessarily in unison, as would be expected if large-scale climate variability was the only factor determining tundra fire regimes. Rather, changes in the rate of burning are linked with changes in local vegetation, suggesting that vegetation composition and/or structure is tightly linked to tundra fire regimes. These results emphasize the importance of considering changes in tundra fire regimes as both climate and vegetation in arctic and subarctic regions change in the future. (**I&M**)

Sitka National Historic Park: Rapid urban development has occurred recently in the Indian River Basin. Inexpensive, accurate, and scientifically robust protocols need to be developed to monitor water quality, detect changes over time, and provide information that would allow managers to work with other stakeholders to assure the protection of the Indian River ecosystem. Park staff tested the ability of macroinvertebrate- and algae-sampling protocols to analyze stream health through sampling, applying water quality indexes, and comparing results with established index streams in the area. The results indicate outstanding water quality. (**NRPP–SP**)

Yukon-Charley Rivers National Preserve: As of 2002 an average of 10 wolf packs lived within the preserve; nothing was known, however, about their genetic composition. A two-year project funded the development of a working wolf-genetics database that can be updated with additional samples and re-analyzed to generate updated baseline genetics information on the wolf population. Genetic information allows managers to assess and manage the "natural and healthy" levels of genetic variation present as mandated by the Alaska National Interest Lands Conservation Act of 1980 and contributes vital data toward a statewide effort to examine the genetic variability and structure of wolf populations throughout Alaska. (**NRPP–AK**)

In 2009 a high school student volunteer joined the Central Alaska Network's peregrine falcon (*Falco peregrinus*) monitoring crew during the annual survey conducted along the upper Yukon River. This outreach opportunity allowed the student to work with and learn from experts about peregrine falcon biology and survey techniques. The student volunteer spent three days in the field with scientists learning about peregrine falcon behavior and identification, data collection, and scope and binocular use. (**I&M**)

Regional Projects

Alaska Park Science: The *Alaska Park Science* journal shares what scientists learn through research and scholarship in Alaska's national parks; education can serve as the bridge between knowledge and responsibility for resource stewardship. Two issues were published in 2009. In addition, *Alaska Park Science* was recognized with three awards for publication excellence in international competitions. *Alaska Park Science* is available in print and at www.nps.gov/akso/akparkscience.html. (**NRPP–RB**)

Avian Influenza: Understanding bird migration strategies is essential in examining the role of wild birds in the spread of avian influenza. The Alaska Natural Heritage Program collected and summarized occurrence information to display seasonal distribution and potential migratory patterns for 36 avian species within and adjacent to Alaska's 16 national parks. Geospatial data were created to allow for easy viewing by number of birds observed and season for each species. Other results included species distribution maps and occurrence records within Alaska's national parks; first breeding, molting, and staging dates; and dates on spring and fall migration. These data can be used to develop predictive risk assessment models for transmission pathways of avian influenza. (**CESU**)

Climate Change Studies: The Alaska Region continued its partnership with Department of Interior bureaus and others in Alaska to document and forecast the long-term effects of climate change in northern Alaska, which will help parks plan ways to adapt to future changes in climate, soil conditions, landcover, fire, and wildlife. Several planning exercises, training, and science symposia were held dur-

ing October and November 2008, presenting more than 100 scientific studies. NPS efforts in communicating climate change science were also recognized during 2008 through three international awards for the climate change issue of *Alaska Park Science*.

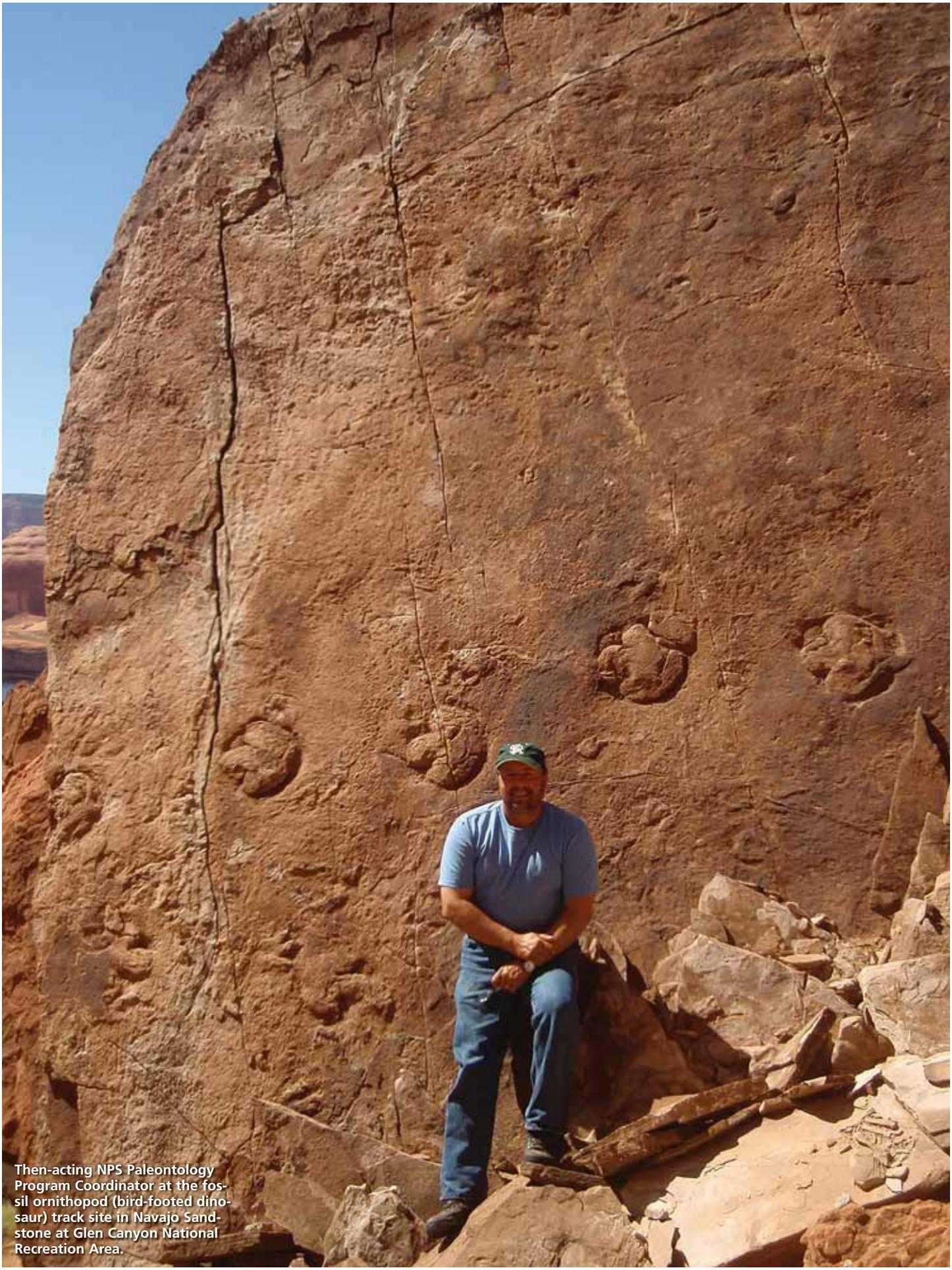
Climate Maps: The region launched a project to prepare state-of-the-science digital maps for mean monthly minimum and maximum, and mean temperature, mean dew point, and total precipitation for Alaska from 1971 to 2000. Previous maps were based on the 1961–1990 climatological period. Updating the Alaska climate maps resulted in a significant increase in spatial detail and accuracy and highly accurate estimations of point climate values from the gridded data. The final maps were completed in August 2009 and are now available as GIS layers on the Alaska Region GIS server. (**NRPP–RB**)

Invasive Plant Management: Park staff and volunteers expended 1,000 hours on invasive plant management issues in Alaska NPS units in FY 2009, an increase from 600 hours in 2008. Accomplishments include discovering and documenting several new infestations; hosting two large-scale community volunteer weed-pulls in **Klondike Gold Rush National Historical Park**, which removed more than 400 pounds of invasive weeds from the airport; and providing native and exotic plant information to visitors. The Skagway Summer Camp, a small group of 8- to 12-year-olds, learned and worked with EPMT staff in Klondike Gold Rush once a week throughout June and set up a booth at the Junior Ranger festival to show their work and educate visitors about exotics plants. (**NRPP–RB, EPMT**)

Landbird Outreach: In 2009 a pilot outreach program for junior high school students was launched in Anaktuvuk Pass, Alaska, to emphasize 12 bird species of concern occurring within the Arctic Network. During the three-day program, students learned about taxonomy, conservation status, and identification of the selected avian species of concern, including Smith's longspur, bluethroat, yellow-billed loon, harlequin duck, rusty blackbird, and others. Classroom exercises included the use of tools to study birds, such as binoculars, GPS units, and laser range-finders, and games to teach bird identification. The program is scheduled to visit additional villages in and around Arctic Network parklands next year. (**I&M**)

Science Symposium: The third Biannual Science Symposium took place in Seward, Alaska, at the Sea Life Center. Eight different presentations and 17 posters addressed the theme of "Understanding How Park Ecosystems Are Changing." More than 70 people from state and federal agencies and the surrounding community attended. The symposium was funded in part by the Ocean Alaska Science and Learning Center. (**I&M, RLC**)

Smith's Longspur (*Calcarius pictus*), one of the avian species of concern in an Arctic Network outreach program for junior high students, on tundra in the Brooks Range.



Then-acting NPS Paleontology Program Coordinator at the fossil ornithopod (bird-footed dinosaur) track site in Navajo Sandstone at Glen Canyon National Recreation Area.

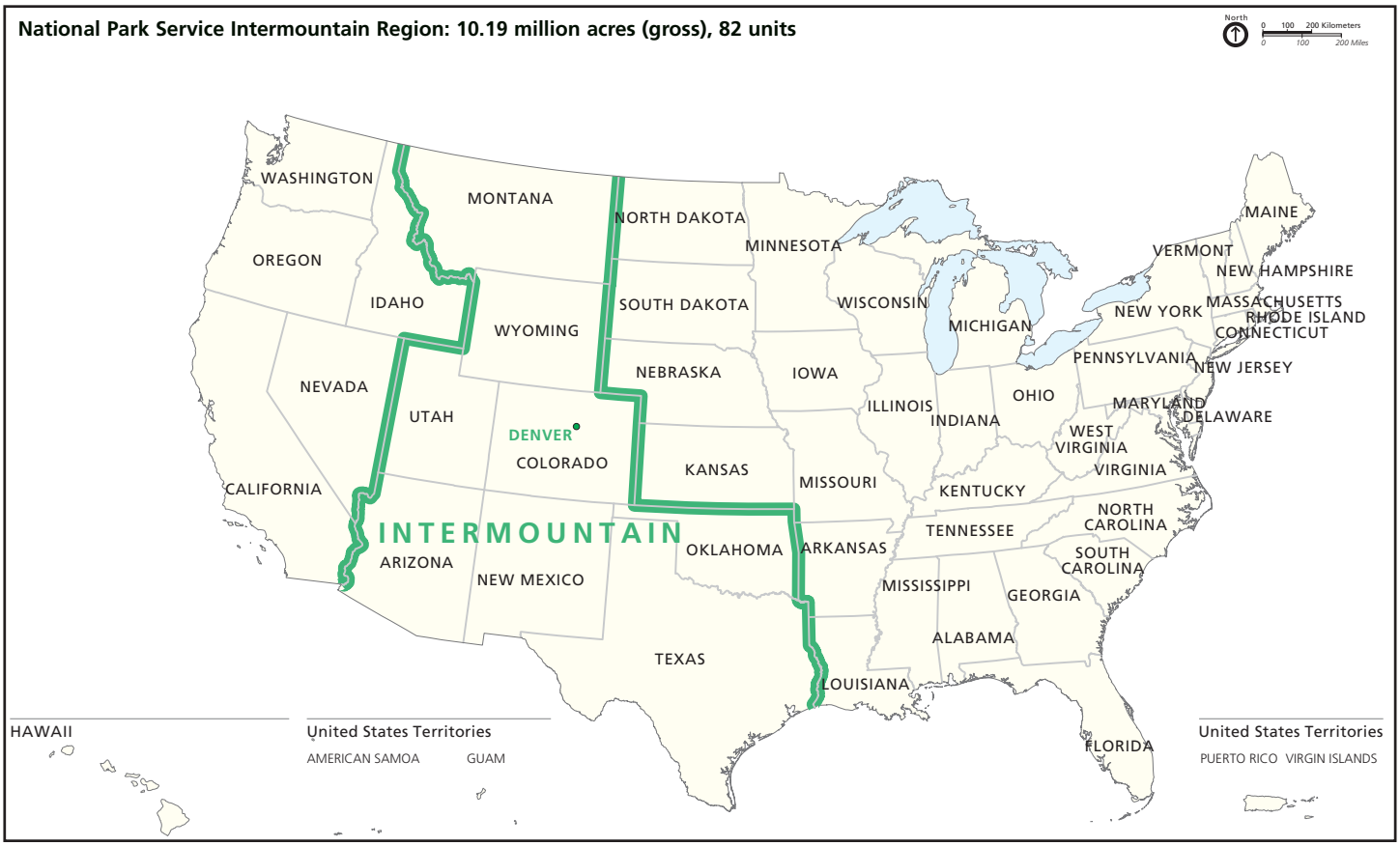
Chapter 5: Intermountain Region Accomplishments

The Intermountain Region's varied environments—from barrier islands to deserts, prairies to alpine peaks—give rise to an equally diverse collection of NPS sites. The Intermountain Region identified four major focus areas to be addressed by the regional natural resource program: climate change, invasive species, energy development, and border impacts. These focus areas represent major challenges to almost all parks throughout the region. The following accomplishments include projects that address these areas and many others.

Accomplishments

Arches National Park, Capitol Reef National Park, and Timpanogos Cave National Monument (UT): The Northern Colorado Plateau Network recently completed three multi-year, multi-partner projects to map vegetation at these sites. The projects included gathering aerial photography, collecting initial vegetation-plot data, using vegetation data to classify vegetation types and write vegetation descriptions, writing a dichotomous vegetation-type key, performing photo interpretation, conducting accuracy-assessment exercises, creating a geo-database, and publishing a final report. These maps will be a valuable resource for use in park management, natural resource monitoring, interpretive programs, park planning, and prescribed fire, and as a baseline for designing ecological studies. (**I&M**)

Aztec Ruins National Monument (NM): Geologic Resources Program staff worked closely with the superintendent regarding a company's proposal to develop its oil and gas resource in the monument and raised the option of the company accessing its oil and gas rights by directional drilling a well from a surface location outside the park. The company determined that the option made sense and moved its well location outside the park, resulting in substantial protection of the park's resources. (**GR**)



Big Bend National Park (TX): Grassland habitats within Big Bend support unique species and are significant for maintaining desert biological diversity at both local and landscape levels. Accelerated soil erosion and historic alterations to hydrology as a result of previous land management practices and the continued presence of numerous abandoned stock ponds, water diversions, and channelized streams have nearly devastated these once highly productive habitats. The potential for complete loss of these unique desert habitats within Big Bend, and from the Chihuahuan Desert ecosystem as a whole, has resulted in the development of a multi-phase restoration program to restore the historic grasslands associated with the Nine Point Draw watershed within the park. Phase three of this project mitigated erosion and restored proper hydrologic function to 353 acres of formerly healthy grassland on the former North Rosillos Ranch. (**NRPP – DLR**)

Black Canyon of the Gunnison National Park (CO): The Water Resources Program completed the settlement of a reserved water right for the park through an agreement with more than two dozen stakeholders and, working with these stakeholders through the Department of Justice, secured a final decree from the Colorado Water Court for the right on December 31, 2008. The first high-flow release through Black Canyon under the terms of the water right decree occurred in April 2009. (**WR**)

Bryce Canyon National Park, Cedar Breaks National Monument, and Zion National Park (UT): The Intergovernmental Internship Cooperative, a partnership between these parks and Southern Utah University (SUU), placed members of the Youth Conservation Corps (YCC), Utah Conservation Corps, and SUU students in internship positions at these parks. One intern worked at Cedar Breaks as a visitor experience assistant and as a result is now attending seasonal law enforcement ranger training in Santa Rosa, California. This internship program demonstrates the value of student involvement in park projects in helping to train the future NPS workforce. (**CESU**)

Coronado National Memorial (AZ): Park staff continued monitoring and protection of lesser long-nosed bats (*Leptonycteris curasoae yerbabuenae*), a federally endangered species that roosts in an on-site mine from July through September. Lesser long-nosed bat numbers decreased in FY 2009 for unknown reasons. Park staff and partners designed a temporary experimental gate for the mine; the final gate will be constructed in FY 2010.

Curecanti National Recreation Area (CO): Quagga (*Dreissena rostriformis bugensis*) and zebra mussels (*Dreissena polymorpha*) are

Intergovernmental Internship Cooperative Youth Conservation Corps crew members repairing a damaged fence at the visitor center at Cedar Breaks National Monument, Utah. NPS photo by Steven McCarthy.

Restoring the subalpine environment in Glacier National Park, Montana.

highly invasive exotic species that pose an ecological and financial threat to U.S. waters. At Curecanti, an aquatic invasive species prevention, containment, and monitoring program aimed primarily at preventing an invasion of these mussels resulted in inspections of more than 13,000 vessels and decontamination of more than 200 boats. Inspections revealed the positive identification of invasive mussels on seven vessels during the season. This intensive effort will continue in the future.

Dinosaur National Monument (CO): Extensive paleontological inventory work continued in summer 2009, resulting in the discovery of complex vertebrate burrow systems, extensive concentrations of small mammal tracks, and fossilized footprints of dinosaurs and large scorpions.

Gila Cliff Dwellings National Monument (NM): Intensive field surveys of amphibians conducted as part of the biological inventory indicate the probable loss of four species (Chiricahua leopard frog [*Rana chiricahuensis*], Mexican spadefoot toad [*Spea multiplicata*], Woodhouse's toad [*Bufo woodhousii*], and red-spotted toad [*Bufo punctatus*]) from the park; these species were commonly encountered during field surveys in the early 1970s. Many factors have likely contributed to the apparent extirpation, including the presence of aggressive non-native species, drought, and chytrid fungus; however, all of these stressors are relatively minor compared to similar areas elsewhere in the American Southwest. Increased UV radiation associated with decreased atmospheric ozone appears to be the primary culprit—a problem of great significance in the alarming recent decline of amphibians worldwide.

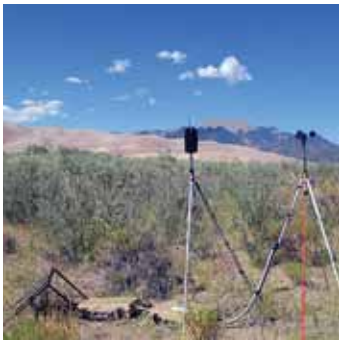
Glacier National Park (MT): Since 2002 the Rocky Mountain CESU and the park have sponsored an internship program for students at Salish Kootenai College in Pablo, Montana. In summer 2009 an intern worked in Glacier's native plant nursery, assisting in the collection of native plant seeds and cuttings for propagation in the nursery, and worked on the restoration crew in the park. The program may lead to seasonal NPS employment opportunities. (**CESU**)

Soil erosion and vegetation loss have reached critical thresholds in the heavily visited subalpine environments of Lunch Creek and Iceberg Lake in Glacier National Park. Extensive off-trail use has compromised esthetics, visitor safety, wildlife habitat, watershed values, and sensitive plant populations. Focusing on 1.5 acres of denuded and eroding high-use subalpine park lands, staff and volunteers restored soil integrity and native plant communities; defined and established a new trail route; inoculated soil with critical soil fungi; collected, grew, and planted plant materials; and blocked social trails with native shrubs and trees. The park implemented monitoring and visitor education programs in these areas to ensure success. (**NRPP–DLR**)

Glen Canyon National Recreation Area (AZ, UT): During a site visit organized by Geologic Resources Program staff through a cooperative agreement with the Utah Geological Survey, a very significant dinosaur track site was discovered in the recreation area by a team of paleontologists and volunteers. The find may move back the known existence of ornithopods (bird-footed dinosaurs) anywhere in the world by 20 to 25 million years. The group visit was organized to establish a pilot paleontological resource-monitoring program in the park to support similar monitoring efforts in other Utah parks. (**GR**)

Bonytail chubs (*Gila elegans*) are one of the most endangered vertebrate species in North America, having been extirpated from large portions of their native range, and are now facing extinction. Park staff initiated a project to establish a reproducing population of bonytails in Glen Canyon National Recreation Area. In FY 2009 staff analyzed the natural impoundment where a fish nursery would be located; results indicate that the site will be suitable for native fish introduction for many years, as long as the water level of Lake Powell does not inundate the site. The staff also addressed environmental compliance requirements. This was the first year of the three-year project. (**NRPP–T&E**)

Grand Canyon National Park (AZ): Park staff are developing alternatives for an overflights environmental impact statement using the Integrated Noise Model (INM). Currently INM models take four to five weeks to create;



Acoustic monitoring site, Great Sand Dunes National Park and Preserve, Colorado.

the Natural Sounds Program and the Volpe Center worked together to develop a spreadsheet analysis using INM outputs so the park can create and modify their own alternatives and quickly generate noise metrics and a simple map within minutes. This allows park staff to review results immediately and eliminate or modify alternatives that do not meet the purpose and need. This planning tool will speed up the alternatives development process for other parks developing air tour management plans. (**NSP**)

Grand Canyon-**Parashant National Monument (AZ):** Tassi Spring, one of the largest desert springs in the monument, provides habitat for rare endemic aquatic animals: the Grand Wash spring snail (*Pyrgulopsis bacchus*), relict leopard frog (*Rana onca*), red-spotted toad (*Bufo punctatus*), and wood-house toads (*Bufo woodhousii*). Riparian function in the area was disturbed through ranching activities from 1930 to 1988. Staff, along with the Lake Mead EPMT, Lake Mead fuels crew, and an American Conservation Experience student, restored two acres around the spring and developed an interpretive wayside exhibit to interpret the biological significance of the site. (**EPMT, NRPP–SP**)

Grand Teton National Park (WY): Because wildlife-human interactions in parks are potentially dangerous for both visitors and wildlife, a park-trained volunteer corps helps manage such interactions in the park, educating thousands of visitors about safe wildlife viewing and recreation in bear country. University of Wyoming sociologists developed a visitor survey that will be implemented in FY 2010 pending approval from the Office of Management and Budget; survey results will help park staff understand if they are successfully getting the bear safety message to the public. (**CESU, RP**)

Great Sand Dunes National Park and Preserve (CO): Inventory and monitoring was conducted for the Global Observation Research Initiative in Alpine Environments (GLORIA) program, measuring four sites in 2009 and installing monitoring instruments. The GLORIA program is designed to assess long-term impacts of climate change on alpine vegetation world-wide. (**I&M**)

At the request of park managers, the Natural Sounds Program deployed an acoustic monitoring system in the park close to the Baca National Wildlife Refuge to assess potential effects from proposed oil and gas development adjacent to the park. Equipment was utilized to characterize the current existing ambient sound levels and calculate natural ambient sound levels. This monitoring effort led to the discovery that the acoustical environment in Great Sand Dunes National Park and Preserve ranks as one of the quietest locations ever monitored by the Natural Sounds Program. In a decision that highlights the importance of scientific data and analyses in the protection of park resources and values, a U.S. District Court judge granted a preliminary injunction against drilling, ruling that Colorado's Baca National Wildlife Refuge contains wetlands, habitat for a variety of wildlife and fish, and a "large expanse of undeveloped land with a significant sense of place and quiet." (**NSP**)

Hubbell Trading Post National Historic Site (AZ): Agriculture, an important part of the cultural landscape at Hubbell Trading Post, is being used to restore once weed-infested park lands. The reintroduced agriculture is based on "green" farming practices that demonstrate the applicability of these practices to the farm community adjacent to the park. At the completion of this project, staff hope that agricultural activities can be turned over to local Navajo farmers who would continue the self-sustaining agricultural operation in partnership with the park. (**NRPP–SP**)

Montezuma Castle National Monument (AZ): In 2008 and 2009 Sonoran Desert Network landbird monitoring detected elegant trogons (*Trogons elegans*) nesting at both units of the monument, several hundred miles north of their previously documented distribution. The range of this beautiful and distinctive tropical species was thought to extend only to the borderlands of southeastern Arizona. Milder winter and spring seasons linked to climate change may have permitted an extension of this species north, leapfrogging Tucson and Phoenix to exploit the riparian environments of the Verde Valley just south of Flagstaff, Arizona. (**I&M**)

Palo Alto Battlefield National Historic Site (TX): The Water Resources Program provided

The wildland-urban interface in Saguaro National Park, Arizona.

funding to develop the final restoration design and contract specifications for the Palo Alto Resaca, a wetland on the Rio Grande delta that played a strategic role during the first major battle in the 1846 war between Mexico and the United States. The goal to restore battle-era landscape features became a high priority when the National Park Service determined that rising oil and gas prices were spurring well exploration and development at neighboring Padre Island National Seashore. Oil and gas operators must compensate for impacts on wetlands associated with these activities, but few wetland restoration opportunities exist at Padre Island; Palo Alto Battlefield, however, provides alternate restoration opportunities. (**WR, CESU**)

Rocky Mountain National Park (CO): The Air Quality Program released the final Rocky Mountain Atmospheric Nitrogen and Sulfur (RoMANS) Study to assess the source regions of nitrogen and sulfur that affect deposition and visibility in the park. Increases in nitrogen wet deposition have been linked to several documented ecosystem changes: harmful changes in soil, water, and tree chemistry; surface water nitrogen saturation; and changes in microscopic aquatic species and alpine plant species composition. The RoMANS study informs an ongoing interagency initiative to address the air quality and ecosystem issues in the park, and is part of a nationally unprecedented effort to apply sound science regarding atmospheric deposition in a real policy context, generating interest among states and other stakeholders facing similar issues. (**AQ, CESU**)

Saguaro National Park (AZ): To support the development of a terrestrial vegetation and soils monitoring protocol, staff from the Sonoran Desert Network and Saguaro National Park located and remeasured permanent vegetation plots established in 1976 in the Cactus Forest area. Designed to document potential grazing effects on native vegetation, this extensive study instead illustrated a major increase in the abundance of shallow-rooted shrubs, grasses, and other herbs at the expense of deeper-rooted trees and shrubs. Deeper-rooted species are primarily supported by cool-season precipitation, whereas shallow-rooted species take advantage of the brief, intense pulses of moisture following summer thunderstorms. These shifting vegetation patterns appear to track seasonal precipitation and freeze events measured over the last 30 years, illustrating the close linkages between ecosystems and the bimodal precipitation regime that defines the Sonoran Desert and tracking predicted regional effects of global climate change. (**I&M**)

Saguaro National Park staff worked with the Rincon Institute to develop a program to

protect and restore park resources with the help of park neighbors. Activities included distribution of a newsletter, presentations to homeowners association and at community centers, and volunteer activities for neighbors (invasive plant removal and trail brushing). Communication and relations with park neighbors have improved as evidenced in the positive response by neighbors who have assisted in protecting park resources.

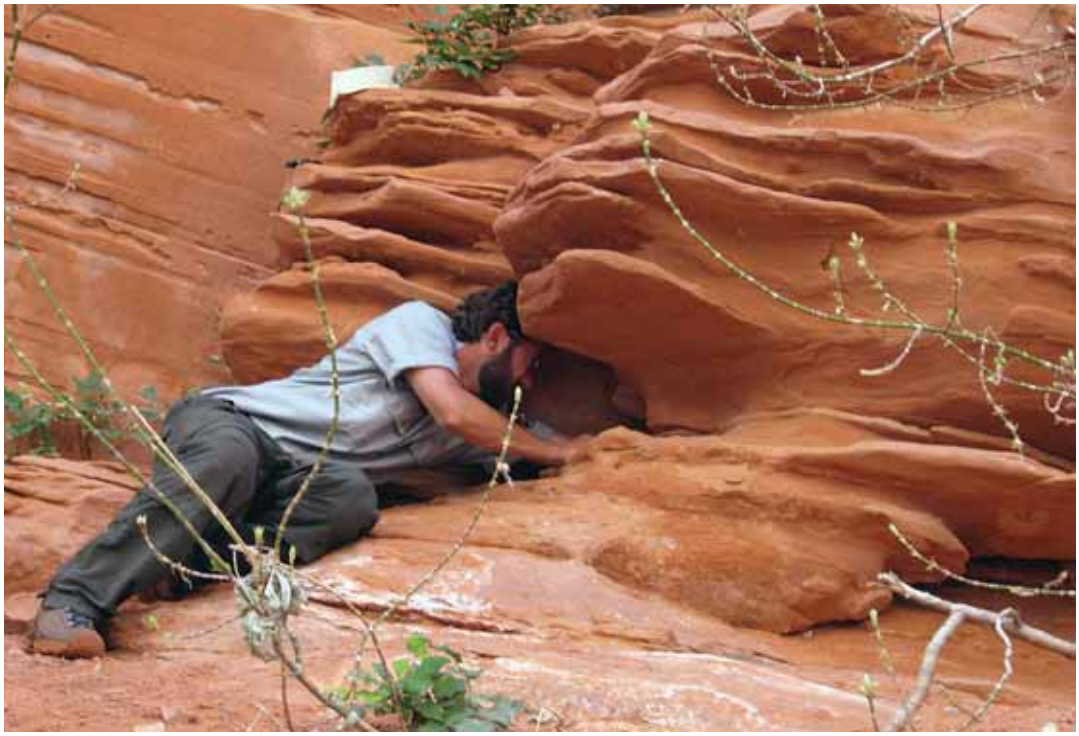
Sunset Crater Volcano, Walnut Canyon, and Wupatki National Monuments (AZ): The final *Flagstaff Area Monuments Invasive Plant Management Plan/Environmental Assessment* was completed in FY 2009, with the Finding of No Significant Impact signed in October 2009. (**EPMT**)

Timpanogos Cave National Monument (UT): Approximately 85,000 people visit the cave system every year, tracking silt, hair, litter, and lint into the caves. This foreign debris discolors cave features, dries out cave formations, provides a food source for opportunistic cave biota (algae and moss), and alters the cave ecosystem. Staff began an intensive two-year process to clean the caves. Staff surveyed and mapped areas of algal growth in the caves, identified and placed shields on feature lights that encourage algae growth, and removed all existing algae. Staff also removed mud accumulation and lint. In FY 2010 staff will finish restoration efforts, including restoring broken formations to their original locations for continued growth. (**NRPP–RB**)

Yellowstone National Park (ID, MT, WY): Managers and scientists from the Greater Yellowstone Network and the park developed the first of what is intended as an annual series of reports to summarize the overall condition of key park natural resources to aid management decisions. A review of the report shows that time, money, and effort applied toward a challenge like grizzly bear recovery can result in success. It indicates more attention and effort should be paid to issues like the decline of Yellowstone cutthroat trout and the park's resident trumpeter swan population. It also raises concerns about how air pollution from outside the park may be changing native plant habitat inside the park. (**I&M**)

Zion National Park (UT): On the Colorado Plateau, conflict is emerging between Mexican spotted owl (*Strix occidentalis lucida*) habitat protection and recreationists enjoying canyoneering activities. During the summer breeding season, federally threatened Mexican spotted owls nest in slot canyon habitats increasingly popular with canyoneers. Managers must understand if spotted owls are affected by canyoneering in order to develop public-supported recreation and resource

Placing sound recorder at Zion National Park, Utah, to monitor for Mexican spotted owls.



protection goals for slot canyons. Researchers are comparing spotted owl site selection and diurnal behavior in Zion to Capitol Reef National Park and Grand Staircase Escalante National Monument, where use of slot canyons is lower, to determine differences in responses to level of use. In 2009 data were collected from 39 sites in the three parks and Bureau of Land Management land; owls were detected in 26 of 45 territories. Zion had the highest occupancy rate of the four sites. During 1,100 minutes of behavioral observation, owls spent most of the time roosting quietly, becoming more active at dusk and dawn. The project will conclude in FY 2010. (**NRPP–NRM, CESU**)

Regional Projects

Climate Change Projects: To help address the pressing climate change issue, the Intermountain Regional Office initiated development of a regional climate change website and partnered with the University of Arizona to develop a Climate Change Needs Assessment for the region. (**CESU**)

Mussel Management Plan: The Intermountain Regional Office partnered with state and federal agencies to prepare final drafts of the *Aquatic Invasive Species Management Plan* and a more specific *Quagga and Zebra Mussels Management Plan* for the State of Colorado. Both species of mussel pose serious threats to aquatic resources as they out-compete other filter feeders for food.

Michigan Technological Research Institute researcher measuring the dimensions of a vernal pool at Pictured Rocks National Lakeshore, Michigan. Michigan Technological University/Wilf Previant photo.

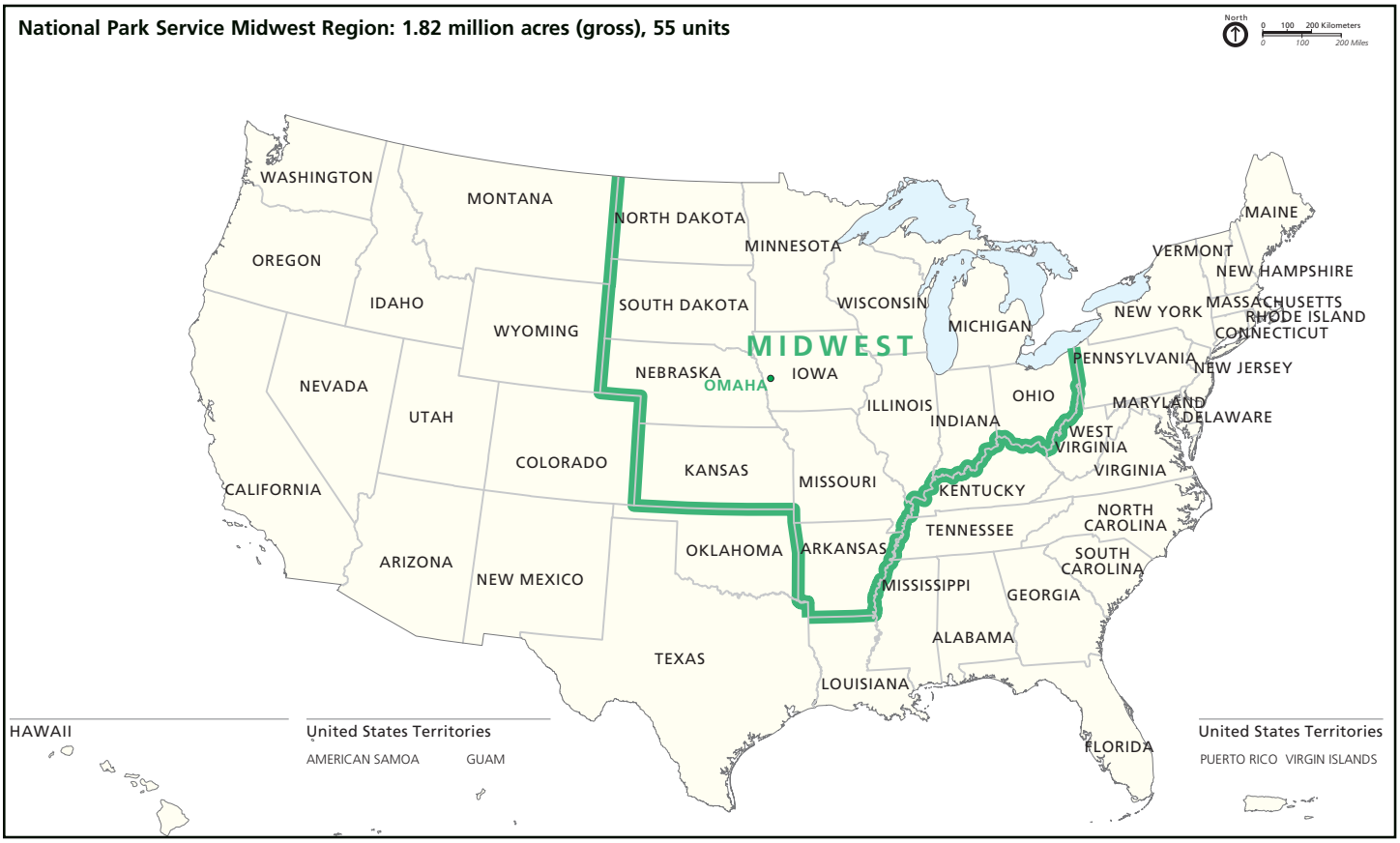
Chapter 6: Midwest Region Accomplishments

The parks in the Midwest Region encompass nearly two million acres of lands and waters in the Great Lakes, Great Plains, and Heartland regions of our nation. This region contains a rich heritage of lake and river ecosystems, forested plant communities, prairie landscapes, wetlands, and fish and wildlife habitats. Scientific and resource management staff in the region work to effectively manage these natural resources by integrating multiple disciplines with ecological sustainability, legal/policy requirements, and park community outreach efforts. In FY 2009 parks in the Midwest Region addressed such issues as exotic plants and other organisms, external threats to parks, and wildlife health and disease.

Accomplishments

Badlands and Wind Cave National Parks (SD), Devils Tower National Monument (WY), Scotts Bluff National Monument (NE), and Theodore Roosevelt National Park (ND): Plague, an infectious exotic disease that can be fatal to both humans and wildlife, had been in close proximity to but had not reached these parks. With the regional office and University of South Dakota, these parks are working to identify if background levels of the plague bacterium were already in the parks, the risk that plague could reach the parks, and management practices that could lessen plague epizootics in the parks. Preliminary information was collected in summer 2008 and 2009 and is being used in management decisions and treatment actions at the parks; a PhD candidate began the full project in fall 2009. The urgency of the project was confirmed when plague was documented at Badlands National Park in 2009. (**NRPP–NRM**)

Herbert Hoover National Historic Site (IA): More than 2.5 miles of trails had widened to



Prairie restoration project at Herbert Hoover National Historic Site, Iowa, showing hard fescue sprouting on the left where the future trail will be (area of no growth is where prairie has been restored). NPS photo by John Holding.

Portion of paleo flood map of Hell Canyon at Jewel Cave National Monument, South Dakota (red shows flood area). Map by Lee-Gray Boze.

14 to 18 feet over the years as existing invasive grasses spread from the trails into the prairie. Park staff, with the assistance of a contractor, reduced the trail width to approximately 7 feet for interior trails and 12 feet for the perimeter trail by replacing exotic invasive plants with native plants. The conversion reduces maintenance costs, fuel consumption from mowing, and treatment to control exotic plants. By reducing mowing from 28 to two times per year, the site is also reducing its carbon footprint. (**NRPP–SP**)

Homestead National Monument (NE): Staff from the Heartland Network visited the monument to complete a survey of exotic species. No new species were noted; the final report is expected in early FY 2010. (**I&M**)

Hopewell Culture National Historical Park (OH): The park's first prescribed burn was held in November 2008 to manage a six-acre plot planted with native vegetation in 2004. Three vegetation monitoring transects were established and data were taken pre-burn, immediate post-burn, and one year post-burn. A final report will be produced in FY 2010. (**NRPP–SP**)

Isle Royale National Park (MI): Researchers continued a long-term study of wolf–moose dynamics in the park. FY 2009 genetics work contributed to knowledge of the history and life stories of individual wolves, including a male wolf that immigrated from Canada in the early 1990s and produced many offspring that became pack leaders. Researchers are in the process of determining pedigrees and family relationships among the packs. (**NRPP–SW**)

Jewel Cave National Monument (SD): At more than 146 miles, Jewel Cave is the second longest cave in the world. Researchers undertook a study of the cave's paleoflood hydrology, a method of looking at geologic evidence to determine the frequency and magnitude of prehistoric floods. Twenty-eight sites were documented along 23 miles of the Hell Canyon drainage. The information will be used by the U.S. Geological Survey to refine existing flood models used in public planning efforts. (**NRPP–SP**)

Indiana Dunes National Lakeshore (IN): The Great Lakes Research and Education Center developed a project proposal with the U.S. Geological Survey, National Park Service, and Wisconsin Department of Natural Resources partners on climate change impacts to the Wisconsin Ice Age Trail; created an educational program on climate change geared toward middle school students; and provided planning assistance to the Indiana Dunes Environmental Management Team for a Midwest Region "Climate Friendly Parks" training session. The center is working on a website with the U.S. Geological Survey National Wetland Research Center for monitoring phenology of cattails across the country. (**RLC**)

Ozark National Scenic Riverways (MO): Illegal traces have been created by off-road vehicles, damaging natural resources. Staff worked with county commissioners to select and approve 54 specific traces for closure. Project elements include marking the closures; installing surveillance equipment and sensors; and creating educational products for the public. A Missouri University student was hired to conduct in-stream aquatic site assessments; the results will be compared to biological criteria indices to assess conditions. (**RP**)

Pictured Rocks National Lakeshore (MI): Monitoring of sea lamprey (*Petromyzon marinus*) in Miners River was conducted in cooperation with the U.S. Fish and Wildlife Service. Long-term monitoring and control of this invasive species will provide information on treatment efficacy and ensure integrity of the aquatic community in the river.

Vernal pools, formed each spring by high groundwater levels, provide increasingly uncommon habitat for wood frog and salamander reproduction, some wetland plants, and invertebrates adapted to temporary standing water. Researchers from the lakeshore, Michigan Technological University, and Michigan Technological Research Institute assessed the distribution and number of vernal pools throughout the lakeshore, identifying 55 vernal pools and classifying them into six categories. In 2010 researchers will assess amphibian, plant, and algal communities in and surrounding at least 30 of the vernal pools; perform the final analysis; and prepare the final report. (**NRPP–RB**)

Staff continued work with coaster brook trout (*Salvelinus fontinalis*), a migratory strain of brook trout whose abundance has declined markedly throughout their historic range. This project is being conducted in cooperation with the U.S. Fish and Wildlife Service, Northern Michigan University, Michigan Department of Natural Resources, and Trout Unlimited. Continued professional oversight was provided to study interstream movement of migratory coaster brook trout and coaster brook trout population response to removal of exotic salmonids.

Pipestone National Monument (MN): Despite its small size, the monument serves as an oasis for many native species and provides a variety of native habitats in an otherwise heavily agricultural region. Wetlands support plant species not found elsewhere within the monument, including at least four state-listed endangered plant species and one federally threatened species, the western prairie fringed orchid (*Platanthera praeclara*). Researchers completed wetland inventory work and identified current and desired conditions for seven acres of wetlands. Because invasive reed canarygrass (*Phalaris arundinacea L.*) was identified as a major problem in wetland areas, they set up monitoring plots to determine the best ways to control the species. (**NRPP–SP**)

Saint Croix National Scenic Riverway (MN, WI): Recent studies have shown that juvenile mussel density is decreasing in native mussel communities that harbor federally listed mussel species; these declines have been accompanied by increased sediment deposition. Past research indicates that sediment deposition may adversely impact native mussel communities in the St. Croix River; a study sought to assess whether water discharge has an effect on suspended sediment concentration and to determine the variability of sediment concentrations above and below the hydroelectric dam in St. Croix Falls. Analysis of suspended sediment shows that suspended organic concentration correlates with mean daily water discharge, with peaks in the early spring and late summer. Sites with higher organic material in suspension had lower mussel density, but there was insufficient evidence to arrive at any causal relationship. Future work includes dating of sediment cores to provide age classes on sedimentation rates and on the ages of large deposition events. (**BRM, NRPP–T&E**)

Theodore Roosevelt National Park (ND): Staff completed the second and final year of data collection of a three-year project designed to link elk distributions to specific vegetation attributes in the park. This project considers existing elk location data from GPS collars collected since 2003 and extensive

Non-native fish removal at mouth of Sevenmile Creek, Pictured Rocks National Lakeshore, Michigan. NPS photo by April Chiriboga.

South Dakota Geologic Survey geologist examining the Minnelusa Formation, Wind Cave National Park, South Dakota. NPS photo by Rod Horrocks.

vegetation information that was collected at various sites throughout the park these past two summers. The resulting model will help managers better understand how elk are using the landscape and thus better manage vegetation and other ungulates in the park.

Voyageurs National Park (MN): Moose and white-tailed deer are significant natural resources in the park. Anecdotal evidence suggests that moose have declined markedly over the last 30-plus years while white-tailed deer have increased. Researchers completed aerial surveys and fecal pellet counts to obtain current estimates of moose and deer abundance and distribution and to test for prevalence of brain worm and liver flukes in deer, which could account for the decline in moose abundance if those parasites are being transmitted from deer to moose. Results are expected in early 2010. Information from this study will be used to determine the status and trend of moose and deer populations in the park and to make recommendations to wildlife management agencies for deer harvest in areas adjacent to the park. (**NRPP–RB**)

Great Plains CESU and North Dakota State University researchers investigated water-level management impacts on aquatic communities within Voyageurs National Park. Observed changes in invertebrate populations likely resulted from cooler water and lower production under the new water level regulation regime, coupled with a more stable environment with respect to physical processes involving wave energy and fluctuation. Continued monitoring will show if the system may still be resettling from a recent change in water-level management. (**CESU**)

Wind Cave National Park (SD): The surficial geology of the park is a missing piece of baseline inventory data. Geologists mapped the surficial bedrock and structural geology in FY 2009. The data are being combined, digitized, and added to the geologic map of the park being produced by the South Dakota Geologic Survey; the final geologic map will be ready for publication by summer 2010. This map will satisfy the second of three critical elements of geological inventory for the Natural Resource Challenge and answer concerns related to the location of karst resources, groundwater recharge, placement of facilities and utilities, management of sensitive species in specific habitats, management of paleontological resources, and future research needs. (**NRPP–RB**)

Texas A&M University is currently using modern genotyping technologies to determine the breeding structure (pedigree analysis) of Wind Cave bison and to identify optimum management strategies for long-term conservation efforts of the genetically pure bison herd. Samples collected in 2007 and 2009 are being analyzed; a final report will be prepared in FY 2010. (**BRM**)

Regional Projects

Vital Signs Monitoring: The National Park Service's Heartland Network and Missouri State University, an Upper and Middle Mississippi CESU partner, have worked together to conduct vital signs monitoring in 15 NPS sites across eight states. Missouri State faculty and students contribute to vital signs monitoring through a variety of sponsored research projects, including biological inventories, monitoring protocol development, and data analysis. Monitoring the vital signs of ecosystem health, such as water quality and species diversity, provides early detection of emerging threats to park resources. (**CESU, I&M**)

Bird Monitoring Protocol: Heartland Network staff developed a special bird monitoring protocol and worked with well-trained citizen scientists to survey birds on approximately 243 data collection points across five different park units. By engaging citizen scientists and making special efforts to address data quality and comparability, a total of 431 sites were surveyed in FY 2009, giving the network an unprecedented opportunity to assess the status and trends in bird populations within parks and across the network. (**I&M**)

Fruiting body of a black morel mushroom (*Morchella* spp.), Catoctin Mountain Park, Maryland. Photo by Steven L. Stephenson.

Chapter 7: National Capital Region Accomplishments

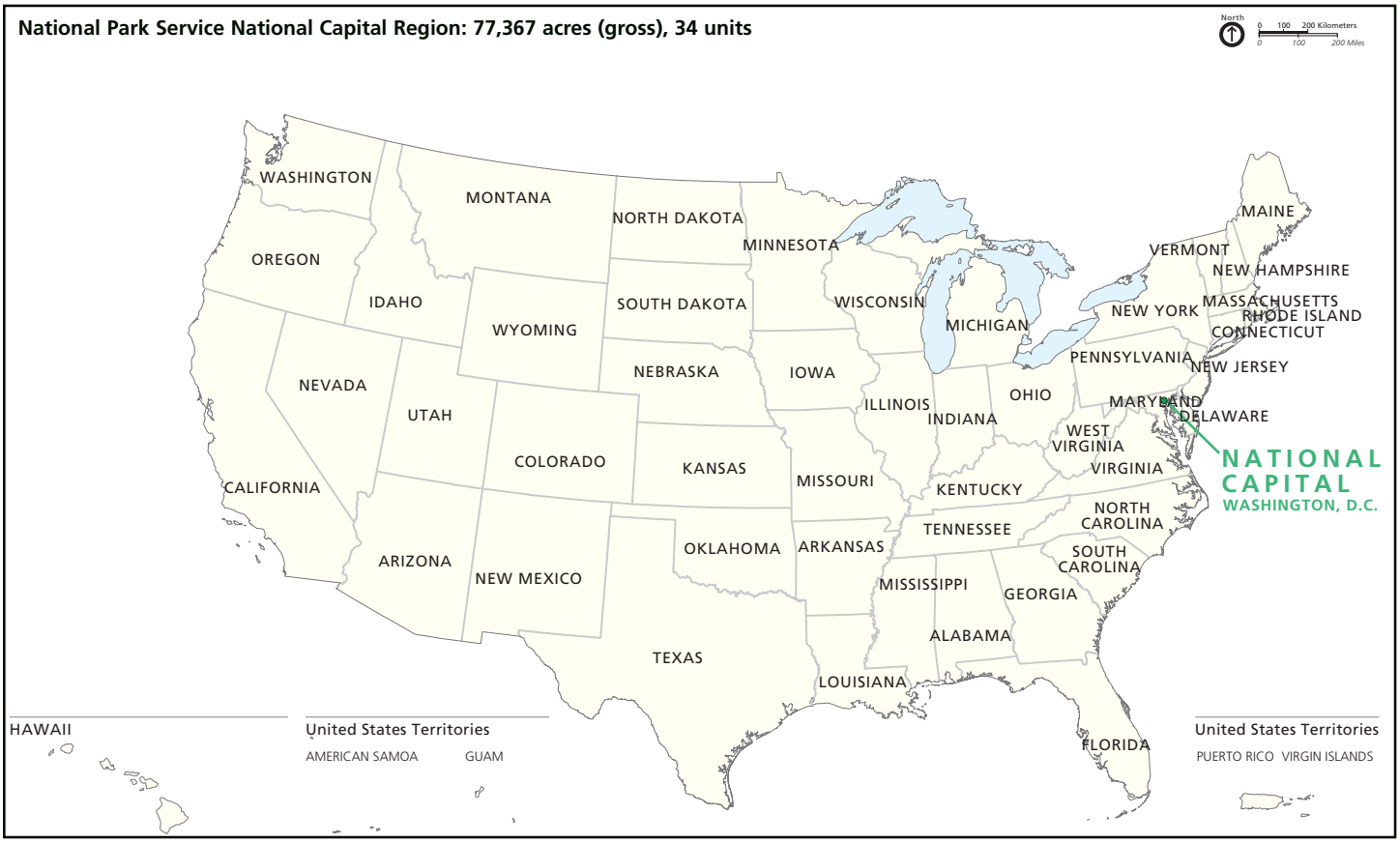
The National Capital Region contains more than 700 individual sites, ranging from community parks that serve as neighborhood gathering places to national monuments that attract visitors from around the world. Serving more than 40 million visitors annually, the parks of the National Capital Region encompass parkland and open space with thousands of historic structures and archeological sites, hundreds of miles of trails, bike paths, riverfront, scenic parkways, and historic canals.

Accomplishments

Antietam National Battlefield (MD): Park and regional monitoring programs resulted in many additions to the park's species list, including four previously undocumented reptiles and amphibians, nearly 50 insects and 20 spiders, and a state-listed rare plant. The sandbar willow (*Salix exigua*) is designated in Maryland as "highly state rare" and was not previously documented in the park.

Antietam National Battlefield (MD), Catoctin Mountain Park (MD), Chesapeake and Ohio Canal National Historical Park (DC, MD, WV), and Harpers Ferry National Historical Park (WV): Morel mushrooms (*Morchella* spp.) are the most sought-after edible macrofungi in eastern North America. Visitor-harvested resources such as morels in National Capital Region parks are under pressure from collecting, climate change, and urbanization. Researchers surveyed morel mushrooms in these parks, finding no direct link between abundance and harvesting pressure. Three of the taxa identified will be described as species new to science in a forthcoming paper.

Catoctin Mountain Park (MD): The park continued efforts to manage the population of white-tailed deer, a species of special management concern. Staff began planning for the implementation of the *White-tailed Deer Management Plan/Final Environmental Impact Statement*, signed by the regional director in



A southern pygmy clubtail (*Lanthus vernalis*) emerging from its larval stage, Catoctin Mountain Park, Maryland. Photo by Richard Orr.

NPS-owned dam that prevents passage of American eels along the Potomac River.

April 2009, and conducted vegetation monitoring in 21 pots to evaluate white-tailed deer browse impacts on forest regeneration. Results indicate very little regeneration over the past five to 10 years; monitoring will continue yearly and be used to determine the need for white-tailed deer population management action.

Damselflies and dragonflies, known collectively as odonates, are indicator species: in degraded aquatic ecosystems, the odonate population will change. Information on the presence of damselflies and dragonflies helps managers decide how best to protect the odonates and the ecosystem in which they live. Researchers performed a survey of the dragonflies and damselflies in Catoctin Mountain Park, finding 26 species—19 dragonfly and 7 damselfly species. Two state-listed rare species of dragonflies, stable clubtail (*Gomphus rogersi*) and southern pygmy clubtail (*Lanthus vernalis*), were found. Along with additional surveys in the area, this study contributed to a better understanding of current watershed health. (**NRPP–RB**)

Chesapeake and Ohio Canal National Historical Park (DC, MD, WV): Active partnerships are needed for the conservation of declining species such as the American eel (*Anguilla rostrata*). NPS and U.S. Fish and Wildlife Service staff, in cooperation with Allegheny Energy Supply Company, are completing a three-year planning process for the installation of fish ladders (eelways) on two working NPS-owned dams on the Potomac River in Washington County, Maryland. Eelways would permit the species to move back into the ocean to spawn before they die. Because there are only a few dam owners on the Potomac, the opportunity to restore upstream and downstream passage for the American eel throughout the watershed is a real possibility; the Potomac River could be the first in the nation to be completely reopened for migrating American eel.

George Washington Memorial Parkway (DC, MD, VA): The National Capitol Exotic Plant Management Team is working with the city of Arlington, Virginia; Fairfax County; and park staff to control *Phragmites* (common reed) along the Potomac River. This ongoing partnership has led to the removal of this highly invasive species along several miles of river banks and the restoration of riparian vegetation. (**EPMT**)

Harpers Ferry National Historical Park (WV): The vegetation inventory taxonomy was used to identify plant communities that contain ash trees as a dominant or co-dominant species in the park. The vegetation inventory data and the associated map allow park staff to target survey locations for the emerald ash borer beetle (*Agrilus planipennis* Fairmaire), an invasive species that has killed millions of ash trees since its discovery in the United States in 2002. (**BRM**)

Monocacy National Battlefield (MD): Park staff helped develop the final draft of the region's pilot Resource Stewardship Strategy document. The park has already begun using it to guide research and technical assistance requests, funding opportunities, and strategic planning for FY 2010.

The Biological Resources Management Program provided science-based guidance and technical support for development of chronic wasting disease detection and initial response plans for **Monocacy and Antietam national battlefields** and **Shenandoah National Park (VA)**. The plans will be used as a template for other NPS units. (**BRM**)

National Mall and Memorial Parks (DC): Urban forests are an important natural resource to the parks in Washington, D.C. The data collected from a tree inventory on Hains Point within the boundaries of East Potomac Golf Course fill a data gap and provide the park with a comprehensive tree inventory. Data on more than 2,000 trees were added to the tree inventory, providing a baseline for a sustainable urban forest management plan that will guide a more effective urban forest that provides suitable wildlife habitat, improved air and water quality, and increased visitor safety. (**NRPP–RB**)

Prince William Forest Park (VA): In 2007 the I&M water resources staff observed a freshwater sponge (*Porifera*) in a stream in the park. These organisms are not common in the mid-Atlantic region and this discovery may be unique; preliminary investigation does not show any literature that cites the occurrence of freshwater sponges in NPS parks in the

A limestone red cedar glade, one of the plant communities identified in the vegetation inventory taxonomy in Harpers Ferry National Historical Park.

National Capital Region. They can be an important component of stream ecosystem processes, and they are intolerant of high levels of pollutants. As of October 2009 they appeared to be spreading to other parts of the stream. Monitoring will continue. (**I&M**)

The Urban Ecology Research Learning Alliance created a summer internship position under the Urban Ecology Internship program to support Prince William Forest Park with preparation of the park's application to the "Climate Friendly Parks" program, which provides parks with the tools and resources to address climate change. The intern was successful at completing the application. (**RLC**)

Rock Creek Park (DC): Volunteers donated approximately 850 hours to managing invasive plants in the park, including removal of the highly invasive mile-a-minute weed (*Polygonum perfoliatum*) and garlic mustard (*Alliaria petiolata*). Park staff assisted with the planning and implementation of a large volunteer project, held in partnership with Bank of America, in which 250 young adults performed invasive plant work along park roads and wood edges.

Regional Projects

Climate Change Models: The Urban Ecology Research Learning Alliance ran global climate change models for temperature and precipitation for all National Capital Region parks under three carbon emission scenarios and downscaled them using weather data from 1950 to 2009. These data are available for all adaptation and mitigation projects requiring climate change projections for the next 100 years. (**RLC**)

Forest Monitoring: The most comprehensive study of the structure and composition of National Capital Region Network forests ever undertaken is underway with the establishment of 400 permanent forest vegetation monitoring plots throughout the 11 I&M parks in region. The network is now monitoring 11,184 individual trees representing 82 species, 2,114 shrubs representing 25 species, and 23 exotic herbaceous species. In 2010 the network will begin to re-measure all plots. Long-term findings will help managers understand the dynamics of network forests and shed light on the impacts of climate change and other stressors. (**I&M**)

Freshwater Mussel Prediction Model: The dwarf wedge mussel (*Alasmidonta heterodon*) is the only federally endangered freshwater mussel within the Atlantic Slope fauna. Researchers developed a landscape model and associated stream-segment database to predict occurrences for this species in the National Capital and Northeast regions. The model was tested in 50 freshwater streams in the two regions. No dwarf wedge mussels were found during the surveys. The model can narrow the focus in identifying streams in which to locate surveys. (**NRPP–T&E**)

Graduate Degrees: Three students received graduate degrees (two MS degrees and one PhD) because of their work on National Capital Region Network monitoring projects. Projects include natural resource report cards, bird monitoring, and amphibian monitoring in the network. (**I&M**)

Forest monitoring crew with the I&M Program setting up a forest plot in Morristown National Historical Park, New Jersey. NPS photo by K. Miller.

Chapter 8: Northeast Region Accomplishments

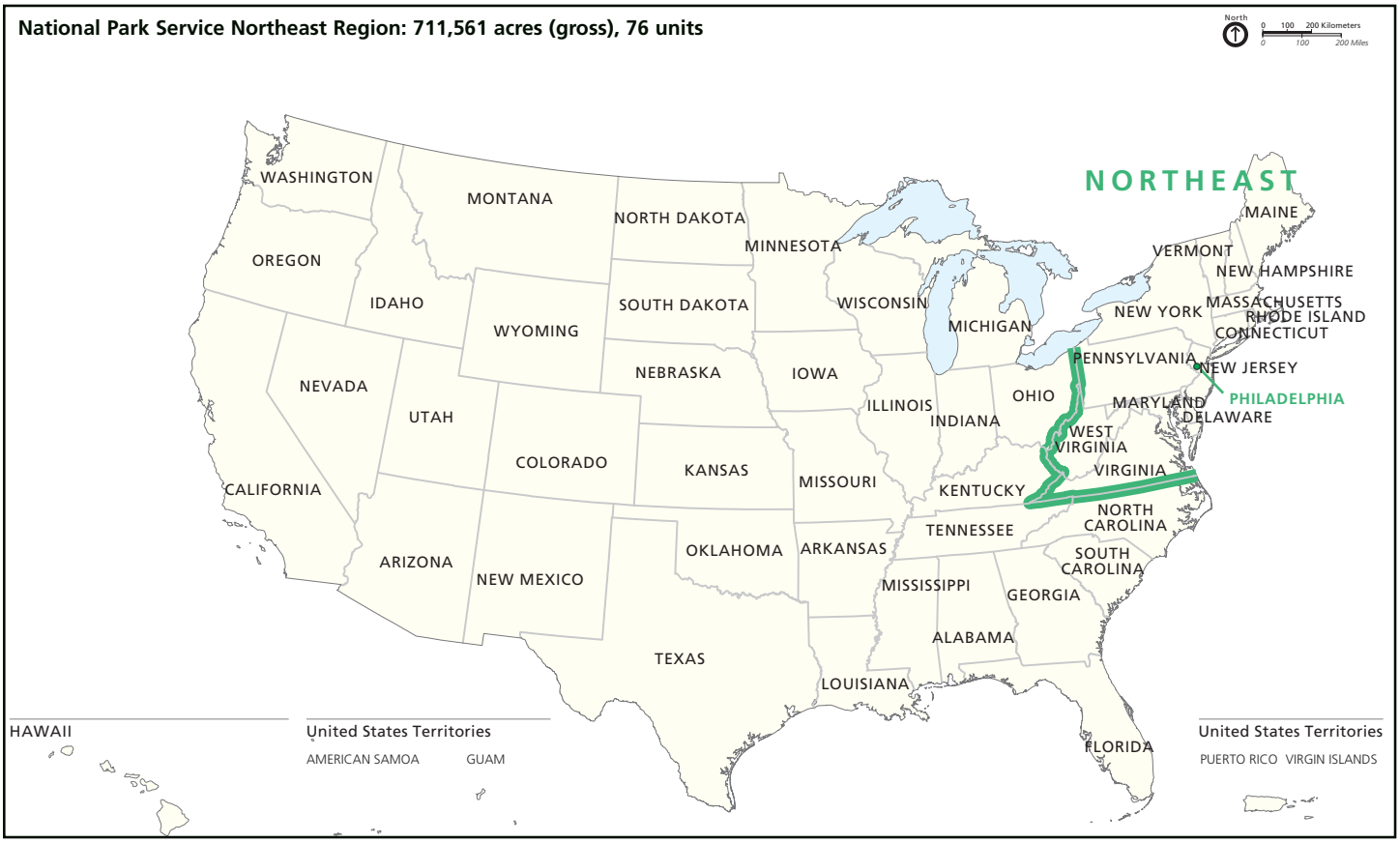
The NPS units of the Northeast Region preserve not only the story of our nation's beginnings but also outstanding natural resources from salt marshes and seashores to rolling hills and granite mountain peaks. In FY 2009 Northeast Region parks addressed issues common throughout the National Park Service, in particular those surrounding energy development and ocean protection.

Accomplishments

Acadia National Park (ME): The Schoodic Education and Research Center's Acadia Research Fellowship program funded a pilot study of tidal saline wetlands to determine the long-term carbon storage potential of the different marsh zones. Once rates of carbon accumulation are known for the different marsh zones, researchers and park managers will better understand the effects of sea level rise and marsh transgression on the long-term carbon storage potential of these wetlands. (**RLC**)

Appalachian National Scenic Trail (ME to GA): "A Trail to Every Classroom," a sustainable service-learning program developed by NPS and Appalachian Trail Conservancy staff, continued to engage youth and preserve the volunteer tradition through a multidisciplinary professional development program for K–12 teachers. In 2009 staff integrated natural resource information and technology into its training sessions.

Boston Harbor Islands National Recreation Area (MA): A major, long-term endeavor to restore the natural diversity of the Boston Harbor Islands is underway. The first step is the identification of all taxa beginning with invertebrate fauna. Efforts in FY 2009 included the collection, processing, identification, and cataloguing of invertebrate specimens by a wide range of individuals (students from high school through graduate school, volunteers, and professional taxonomists). More than 150,000 specimens were collected; about



American oystercatchers (*Haematopus palliatus*) and willets (*Catoptrophorus semipalmatus*) on Snake Island, Boston Harbor Islands National Recreation Area, Massachusetts. NPS photo by Brian Mitchell.

45,000 were identified. Results are communicated through the project website (http://insectdatabases.oeb.harvard.edu/boston_islands/index.htm) and student honors/thesis projects. (**NRPP–RB**)

Cape Cod National Seashore (MA), Fire Island National Seashore (NY), Gateway National Recreation Area (NJ, NY), Assateague Island National Seashore (MD, VA): The Northeast Coastal and Barrier Network is working with University of Rhode Island and U.S. Geological Survey cooperators to produce historical topographic models for these NPS units. These historical topographic models are based on 1869, 1951, and 1976 photography, respectively, and will be incorporated into models that help managers understand potential impacts of sea-level rise on these coastal parks. (**I&M**)

A parking lot and beach facilities at Herring Cove in Provincetown, Massachusetts, are threatened by severe erosion. The Northeast Coastal and Barrier Network and Atlantic Research Center supported research on shoreline dynamics and sediment budgets that helped provided projections of continued erosion and recommendations for an appropriate response given the need to provide public facilities. (**I&M, RLC**)

Delaware Water Gap National Recreation Area (PA, NJ): The Delaware River Sustainability Project will strengthen the capacity of natural resource organizations in the upper Delaware River Basin to more effectively address increasing development pressures while sustaining ecological, economic, and cultural values critical to environmental quality within the region. In FY 2009 the Natural Lands Trust developed the "SmartConservation" tool to identify and assess ecological sites for protection. An intern developed GIS layers and assessed quality control for products used in the Common Waters Atlas, conference exhibits, and the SmartConservation model. (**NRPP–RB**)

Fire Island National Seashore (NY): A systematic study of beach scraping and artificial dune formation, used to protect homes and community infrastructure from storms, seeks to determine short- and long-term impacts on park resources. In winter 2009 several communities within the seashore began an emergency beach nourishment project, the largest such effort undertaken since topographic surveys of dunes began in 2006. The project provided an opportunity to capture the immediate impacts of nourishment on beach/dune morphology and to provide baseline data. The survey was successfully conducted in early April 2009. The data are being analyzed and will be assessed relative to the regular surveys

that were conducted in March and September 2009. (**NRPP–RB**)

Gateway National Recreation Area (NJ, NY): The Sandy Hook Unit of Gateway National Recreation Area is embarking upon a unique transfer of sand through a buried pipeline from areas of beach accumulation updrift to areas of beach erosion. This is the first application of sand back-passing technology in the United States to create a balanced sediment budget in the beach. The Northeast Coastal and Barrier Network's coastal topography protocol is being used to establish quantities of sand lost in the erosional area and sand gained in the depositional area as a basis for determining the duration and magnitude of the pipeline operation. (**I&M**)

Morristown National Historical Park (NJ): The State of New Jersey formed the Central Jersey Invasive Species Strike Team, the state's first cooperative effort to perform early detection and rapid response for invasive species on a regional basis. The Northeast Exotic Plant Management Team is joining efforts with the strike team to begin control of exotic Kiwi vine in and around the park. (**EPMT**)

Richmond National Battlefield Park (VA): The park acquired approximately 600 acres of new park land, and little is known about the species present in that area. Cooperators at the University of Maryland have undertaken a suite of baseline inventories using previously established protocols for birds, reptiles and amphibians, and mammals. FY 2009 highlights include new county records for the yellow-bellied slider turtle (*Trachemys scripta scripta*) and eastern lesser siren salamander (*Siren intermedia*). The project will continue in FY 2010. (**NRPP–SP**)

Saugus Iron Works National Historic Site (MA): The effort to restore the Saugus River turning basin, a rare freshwater intertidal marsh community, and dock continued in FY 2009. All construction and the first round of planting for the freshwater tidal marsh restoration were completed. The park also began coordination of a multi-resource monitoring program for the turning basin and adjacent river and marsh areas and hosted the first annual stakeholder meeting to present monitoring results and seek feedback on continuing management issues. The park biologist received the NPS Trish Patterson Student Conservation Association Award for Natural Resource Management in a Small Park for work on this project.

Valley Forge National Historical Park (PA): The park was selected as a pilot park for development of a Resource Stewardship Strategy (RSS) through the Northeast Regional RSS Program in FY 2008. The park contains significant natural resources, including both living and non-living components of an ecosystem that continues to increase in value over time as suburban sprawl occurs. The comprehensive strategies developed to achieve park-specific desired future resource conditions will be used to develop detailed program and project needs and to determine the park's long-term needs for changes in budget allocations, funding outside of park base, and staffing. FY 2009 activities include completion of the project agreement, a development meeting, completion of introductory information for the document, and identification of key attributes and indicators of condition. (**NRPP–SP**)

Regional Projects

Bat Inventory: Bats play essential ecological roles in most ecosystems, yet many parks lack basic knowledge of what species may be present and of the habitat necessary to support them. This two-year project seeks to conduct inventories of bat community composition, including rare, threatened, and endangered species, at six small parks in the region: **Boston Harbor Islands National Recreation Area (MA), Morristown National Historical Park (NJ), Roosevelt-Vanderbilt National Historic Sites (NY), Saint-Gaudens National Historic Site (NH), Saratoga National Historical Park (NY),** and **Weir Farm National Historic Site (CT)**. All the parks have habitat likely to support at least a portion of the 11 species known to be present in the Northeast, which includes the federally endangered Indiana myotis (*Myotis sodalis*). In FY 2009 activities included acquisition of GIS data, site visits, and preparation of a preliminary assessment and projection of the bat inventory effort. (**NRPP–SP**)

Invasive Species Monitoring Field Guide: In FY 2009 the Eastern Rivers and Mountains Network (ERMN) collaborated with the

Northeast Temperate Network and a Penn State University research associate to publish the *ERMN Surveillance Monitoring Field Guide*. The field guide assists NPS employees, contractors, and citizen scientists in detecting populations of targeted invasive species before they become widely established. The ERMN vegetation monitoring field crew has been implementing this program for two years with great success, reporting 13 early detections of six species during summer FY 2009 with three already eradicated by park staff. The field guide, an associated U.S. Forest Service guide, reporting forms, and more information are available on the ERMN website at http://science.nature.nps.gov/im/units/ermn/monitoring/EarlyDetection.cfm. (**I&M**)

Marcellus Shale Report: Geologic Resources Program staff assisted parks in addressing the development of the Marcellus Shale, a vast natural gas resource that extends from southern New York across Pennsylvania, and into western Maryland, West Virginia, Virginia, and eastern Ohio. In the decades to come, Marcellus development will likely affect at least 35 units of the National Park System and a number of special status areas (e.g., National Natural Landmarks). Program staff produced a report entitled *Development of the Natural Gas Resources in the Marcellus Shale*, which educates park and regional staff and management on the technological, environmental, and policy aspects of exploration and development of this significant natural gas resource and ways to mitigate those effects. (**GR**)

Ocean Shoreline Protocol: The Northeast Coastal and Barrier Network's ocean shoreline position monitoring protocol is being tested by the Southhampton Council of southern England as a means to monitor shoreline changes. The ease and efficiency of this protocol, along with the wide availability of GPS technology, were the key points in the consideration of its use. (**I&M**)

Ocean Stewardship: The North Atlantic Coast CESU continues to serve a major role in the implementation of the *Northeast Region Ocean Park Strategic Plan*. In FY 2009 the CESU sponsored a workshop on marine habitat mapping of shallow waters and embraced the concept of a seamless network of marine parks, refuges, reserves, and sanctuaries. The workshop informed NPS, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration natural resource

Salt marsh on Tom's Cove in Assateague Island National Seashore, one of the ocean and coastal parks in the Northeast Region.

Sampling regeneration in a grey birch woodland, Acadia National Park, Maine. NPS photo by K. Miller.

managers of the range of methods available for submerged habitat mapping. The North Atlantic Coast CESU academic and federal partners also participated in an "Ocean Messaging Workshop," providing technical scientific guidance on issues of climate change, nutrient enrichment, and habitat alteration. (**CESU**)

Northeast Park Science Blog: The Northeast Temperate Network collaborated with Acadia Partners for Science and Learning and the Schoodic Education and Research Center in **Acadia National Park (ME)** to create a blog called "Field Notes: Observations on nature and science in northeastern national parks" (http://northeastparkscience.wordpress.com/). Established as part of a science communication internship program, the blog seeks to build an online community where researchers, NPS staff, and writers in northeastern national parks can present observations on science and nature to a diverse readership, with the hope of providing them with a more personal connection to research and science projects. (**I&M, RLC**)

Village volunteers restoring eroded slopes in the National Park of American Samoa.

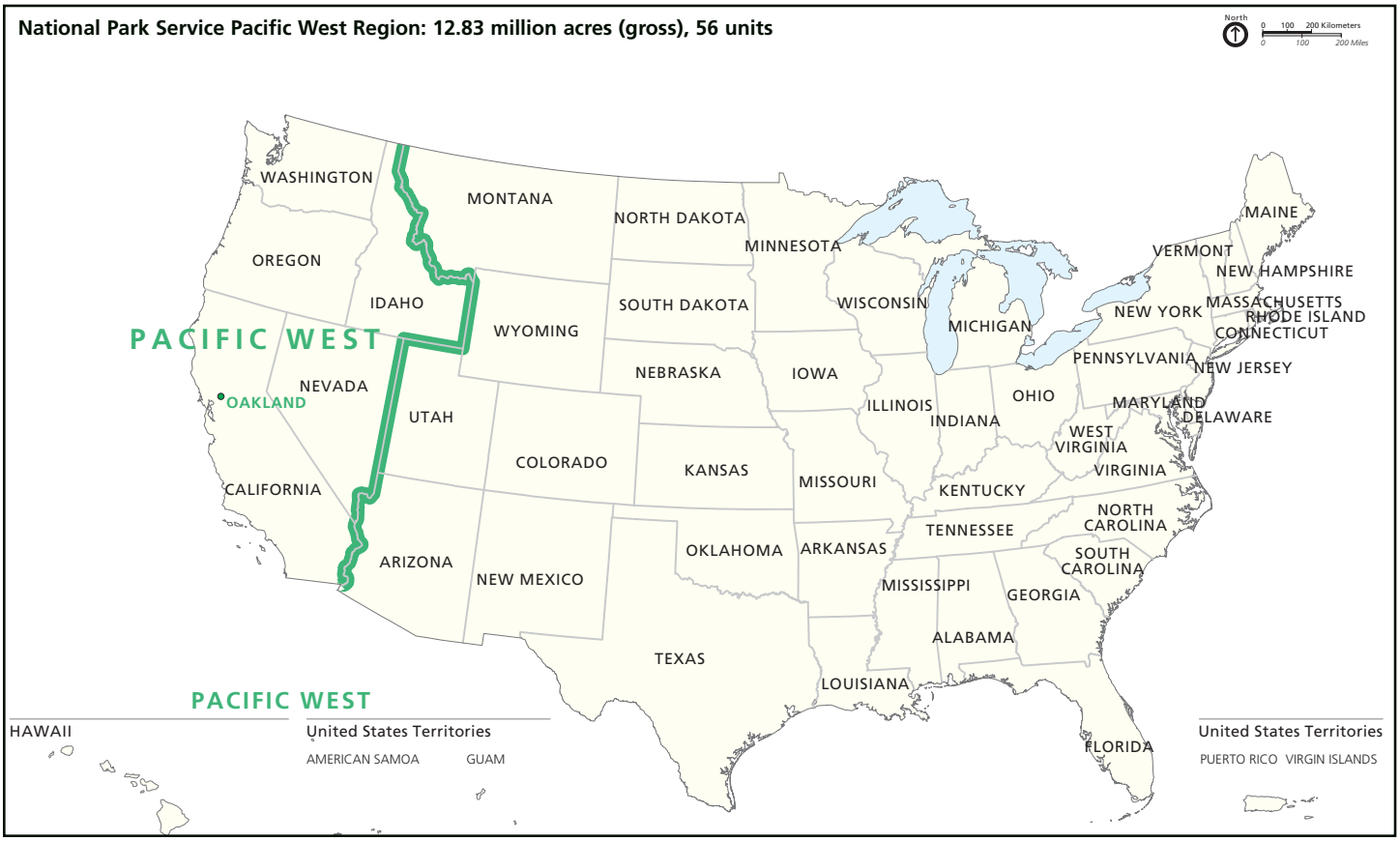
Chapter 9: Pacific West Region Accomplishments

Rich in cultural and natural diversity, the Pacific West Region extends across more than 100 degrees longitude, encompassing a network of NPS units from eastern Nevada to Guam and Saipan on the other side of the International Dateline. Issues of concern to the Pacific West Region include fragmentation of ecosystems, invasive exotic species, preservation of rare and endangered species, increasing demand for energy development and water use, ocean stewardship, climate change, and relevancy of parks to the public. The region's strategy to address these difficult resource issues includes building partnerships with stakeholders and seeking funds for research, monitoring, and management programs designed to maximize natural resource protection and ecosystem resilience.

Accomplishments

Channel Islands National Park (CA): The Stewardship of New Marine Protected Areas initiative was fully funded for the first time in FY 2009, allowing the park to continue kelp forest monitoring at 32 sites in an effort to help evaluate the performance of the marine reserve. The park continued its outreach and education efforts through the "Live Dive" program, which transmits underwater broadcasts into classrooms and the park visitor center.

Crater Lake National Park (OR): Thanks to ongoing efforts to conserve bull trout (*Salvelinus confluentus*), a federally endangered species and the only native fish in the park, the Sun Creek population is the cornerstone of the species' recovery effort in the Klamath Basin. Individuals now number approximately 2,000, up from a low of 150 in the late 1980s, and they are beginning to expand downstream to colonize historic habitats outside the park. Park scientists are cooperating with neighbor-



Fruit of *Clermontia lindseyanna* from one of the few remaining wild trees within Hawaii Volcanoes National Park, Hawaii. NPS photo by Sierra McDaniel.

Federally endangered bull trout (*Salvelinus confluentus*) from Sun Creek, Crater Lake National Park, Oregon.

ing landowners and other state and federal agencies to apply lessons learned in Sun Creek to bull trout restoration elsewhere in the basin.

Craters of the Moon National Monument and Preserve (ID): The American pika (*Ochotona princeps*) has emerged as another potential casualty of accelerated climate change in the western United States. Localized extirpations have been documented in the Great Basin, and the average elevation of occupied sites has increased in the Great Basin and Sierra Nevada. A unique and poorly described subspecies of the pika occurs in the extensive lava flows of Craters of the Moon. Elevation data and the monument's new vegetation map developed through the NPS Vegetation Inventory Program were used to model pika distribution throughout the entire 175 square-kilometer area. The findings have important implications for the long-term persistence of the species in the park. (**I&M**)

Golden Gate National Recreation Area and Point Reyes National Seashore (CA): The "Weed Watchers" volunteer program by the San Francisco Bay Area Network continued its third year of monitoring at Golden Gate and second year at Point Reyes. The volunteer program was designed to find and eradicate invasive plant species before they get established. In FY 2009 the Golden Gate program covered more than 60 miles along roads and trails, mapped more than 185 infestations of priority species, and removed at least 25 of these infestations. The Point Reyes program covered more than 160 miles along roads and trails, mapped more than 77 priority invasive species, and removed 10 infestations. Of the remaining priority patches in both units, park staff later treated more than 40 infestations. (**I&M**)

The federally endangered mission blue butterfly (*Icaricia icarioides missionensis*)—now restricted to a few locations in the San Francisco Bay Area due to intensive urbanization—occurs in coastal prairie grassland areas within Golden Gate. Because the species relies on three native perennial lupine species for reproduction and survival, management has focused on habitat restoration through removal of invasive plant species and outplanting of lupine host plants. Researchers initiated a project to introduce a variety of disturbance treatments to mission blue habitat areas to test mechanisms for expanding the distribution of lupine host plants and populations, increasing their health and vigor, and thereby improving and expanding available habitat for the mission blue. Activities in FY 2009 included locating and mapping suitable experimental study plots; completing lupine host plant mapping and site characterization, compliance requirements, pre-treatment of vegetation, and photo monitoring of the plots; and developing and implementing an outreach plan. (**NRPP–T&E**)

Great Basin National Park (NV): The park held its first BioBlitz, focusing on beetles, in September 2009. Scientists and students from four universities and a state agency volunteered more than 600 hours. A total of 716 beetles in at least 30 families were found and are currently being identified.

Hawaii Volcanoes National Park (HI): Spring 2005 field surveys identified 40 rare and endangered plant species, including six federally listed species, within the Kahuku addition of the park. To preserve genetic source material of two federally endangered, one candidate, one threatened, and 14 rare plant species, a project was initiated to collect seeds or cuttings, propagate them in the park nursery, and establish plants within ungulate-proof exclosures. This is a short-term measure to protect these species until long-term management is in place to restore the landscape. In FY 2009, 14 species were successfully propagated and three species were established within exclosures. The remaining species under propagation will be planted in FY 2010. (**CESU**)

Koa-manele forests are among the most unique and rarest forest communities in the world. The Mauna Loa Strip section of Hawaii Volcanoes National Park is one of the few places in Hawaii where these forests are protected from cattle grazing, logging, and feral ungulates. The park had previously established two Special Ecological Areas (SEAs) in these forests; staff enlarged these SEAs and created three more. The project saved 395 additional acres of ecologically rich forestland, preserved rare native plant species not found in the existing SEAs, helped stabilize two federally listed endangered plant species, and created a more defen-

sible set of SEAs not constantly threatened by encroachment of weeds. A podcast documenting the project is being developed for the park website. (**NRPP–NRM**)

Kalaupapa National Historic Park (HI): As part of a historical ecology study of the park, researchers acquired scans of 80 letters and other correspondence regarding land use and land transfer; documented 935 published and unpublished references, maps, etc.; and purchased 296 historic photographs/aerial photos from the Bishop Museum in Honolulu.

Lava Beds National Monument (CA): The monument is rapidly losing perennial ice within its caves: 20 years of both photographic and quantitative monitoring have confirmed rapid ice loss in 80 percent of monitored caves, which creates a risk of potentially losing 3,300 years of recorded natural history. Several important pieces of information, such as age, climate, volcanic history, and past vegetative regimes, can be obtained in preserved ice cores. Two cores, one each from Skull Cave and Crystal Ice Cave, were taken and are being preserved and analyzed at Oregon State University's Ice Core and Quaternary Chemistry Lab. (**NRPP–SP**)

Caldwell and Crescent volcanic cinder cones within Lava Beds are significant resources that play a major role in the landscape appeal of the monument. The scars from two 1962 borrow pits located on these cones were growing annually, posing safety risks to employees and visitors and creating an eyesore. Restoration of the borrow pits, totaling 7.9 acres, was completed in FY 2009. Park staff initiated monitoring efforts, including taking repeat photographs at fixed locations, establishing and reading four new weed control monitoring transects, and determining the survival of salvaged bunchgrass seedlings from previous plantings. (**NRPP–DLR**)

Mojave National Preserve (CA): The preserve provides critical habitat for the federally threatened desert tortoise (*Gopherus agassizii*). To protect tortoises from mortality on paved roads due to direct vehicle impact, FY 2009 tasks included traffic data collection and road surveys. Surveys of motorist response to tortoise on paved roads in the presence of warning signs determined that warning signs have no effect on motorist behavior. The project will be extended into 2010 to allow comparison of motorist behavior with no signs, with signs, and with signs equipped with flashing lights. (**RP**)

In FY 2009, 43 parcels incorporating 2,828 acres of private land were purchased and donated to Mojave National Preserve. Of this land, 570 acres are located in designated critical habitat for desert tortoise; much of the remainder is in high-quality desert tortoise habitat.

Federally endangered desert tortoise along the roadway in Mojave National Preserve, California, where it is susceptible to being hit by cars.

North Cascades National Park (Washington) superintendent talking to high school students about the natural resources of the park. Photo by Benj Drummond.

Photo collage of restored dune plants at Point Reyes National Seashore, California.

National Park of American Samoa: Park staff, with the assistance of 20 village volunteers, restored three acres of steep, eroding slopes along Alava Ridge that had caused continual sedimentation into streams and nearby coral reefs. They removed non-native species and planted 2,000 native rainforest trees, with 100 percent survival due to continued clearing of invasive species. Several hundred native trees were given to the community, and six presentations were made at the local school about the goals and needs for this project. This work has given park staff the skills and experience needed to continue restoration work as a regular part of the park's terrestrial ecosystem management program.

North Cascades National Park (WA): Scientists with the North Coast and Cascades Network participated in the Parks Climate Challenge in July 2009, an innovative program designed to inspire urban youth who demonstrate leadership potential to serve as climate change ambassadors for the national parks. The students progress from studying climate change in the field to developing ideas on how to engage other youth in climate change awareness to designing a service project in their own communities that allowed them to turn their concern for the future of the environment into action. (**I&M**)

Marbled murrelets (*Brachyramphus marmoratus*) are small, federally threatened diving seabirds that breed along the Pacific Coast. Murrelets forage almost exclusively in near-shore marine environments and fly inland to nest in the canopy of mature and old-growth conifer forests. Researchers sought to determine the likelihood of presence and/or probable absence of the species through audio-visual surveys and to document the numbers, flight patterns, and behaviors of any marbled murrelets detected in the study area. They conducted 66 audio-visual surveys at 14 stations in 2009; four possible murrelet detections were identified. Three of these were identified using night vision equipment, which will be used for future surveys. (**NRPP–RB**)

Olympic, Mount Rainier, and North Cascades National Parks (WA): In partnership with the EPA, the National Park Service held "Climate Friendly Parks" workshops in these parks in FY 2009. The goals of the "Climate Friendly Parks" initiative are to understand climate change impacts in parks; assess and reduce greenhouse gas (GHG) emissions that contribute to climate change; help park managers prepare adaptation strategies; and educate the public about climate change impacts, park adaptation strategies, and ways to mitigate their own GHG emissions. (**AQ**)

Point Reyes National Seashore (CA): The physical integrity of unique coastal dune features near the lighthouse at Point Reyes is threatened by the spread of nonnative, highly invasive iceplant (*Mesembryanthemum crystallinum L.*). Iceplant stabilizes once-dynamic sand dunes, prevents natural erosion, alters soil properties, and eliminates natural sand sources for aeolian dune maintenance. Through the control of invasive iceplant and European beachgrass (*Ammophila arenaria*), the seashore protected 80 acres of climbing and ancient dunes that provide habitat for 14 special-status plant species. Five rare plant species already have been found growing in the restored areas. More than 1,200 volunteer hours were dedicated to this project. (**NRPP–DLR**)

Santa Monica Mountains National Recreation Area (CA): Lyon's Pentachaeta (*Pentachaeta lyonii*) is a federally endangered plant endemic to the Santa Monica Mountains, Channel Islands, and the nearby Simi Hills. It is in decline throughout its limited range; in particular, the single population on NPS property at Rocky Oaks declined from hundreds of thousands of individuals in the 1980s to 800 in 2004. Researchers examined the pollination biology of the endangered plant to ensure that a critical part of its life cycle is not being overlooked in its conservation and management. Experimental results indicate that plants receive sufficient pollinator service regardless of population size or isolation. This may be because of, in part, reliance on generalist pollinators and to timing of pollination to overlap with other yellow-flowered plants. Field work was conducted by a California State University–Northridge graduate student with assistance from NPS interns and volunteers. (**NRPP–T&E**)

Sequoia and Kings Canyon National Parks (CA): In FY 2009 the exotic plant management program had its biggest control year

since the program was established in FY 2002, treating 29 canopy acres and reaching control status on 44.7 acres. Part of this effort involved the start of a three-year project to control the remainder of the reed canarygrass populations in the park, including those on a private inholding. Twenty private landowners signed cooperative agreements to allow the park to treat the species on their land.

Whitman Mission National Historic Site (WA): The non-native "Tree of Heaven" (*Ailanthus altissima*), planted more than 50 years ago to screen the maintenance facility from visitor use areas, is overgrowing other vegetation and spreading into adjacent, restored native grasses. Park staff removed the Trees of Heaven near the Great Grave, cutting, chipping, and removing trees from the park. Stumps were cut flush with the ground and will be allowed to rot in place, eliminating any ground disturbance in the sensitive area beside the Great Grave and Pioneer Cemetery. Native grasses and small, native shrubs will be planted to provide more vegetative screening between the Great Grave and the park maintenance area. (**NRPP–SP**)

Yosemite National Park (CA): A collaboration among park staff, the U.S. Geological Survey, and Oregon State University examined projected changes in park vegetation due to climate change. Researchers used existing vegetation, soils, fuels, fire history data, and projected future climate data to make projections of vegetation change in Yosemite based on predicted climate scenarios in California over the next 100 years. Park resources and management staff will use the project's final report and data to plan for and potentially mitigate expected changes. Already, park scientific staff are using the projected changes to vegetation and climatic variables to draw attention to issues such as invasive plant species spread, fire regime changes, and drops in snowpack and spring/summer water runoff. (**CESU**)

Regional Projects

NPS-University Partnerships: The Californian CESU (CA-CESU) assembled a pilot outreach team to explore opportunities for enhancing and invigorating NPS-university partnerships. Team members contacted staff at 14 NPS units in the state to document research needs and opportunities that could be shared with CA-CESU universities. They developed communication products— including a brochure, poster, and PowerPoint presentation—to address these opportunities and scheduled on-campus meetings and seminars at universities. The response to the pilot outreach effort was overwhelmingly positive and pointed to great potential in enhancing the NPS-university partnership. Results of the outreach effort and recommendations for future action are presented in the *Report on National Park Service Pilot Outreach–Californian CESU–June 2009*. (**CESU**)

Climate Change Partnership: The North Coast and Cascades Research Learning Network entered into a new cooperative agreement with the University of Washington Climate Impacts Group (CIG). Through research and interaction with regional stakeholders, the CIG works to increase the resilience of the Pacific Northwest to fluctuations in climate. The CIG is unique in its focus on the intersection of climate science and public policy. They perform fundamental research on climate impacts and work with planners and policy makers to apply this information to the regional decision-making processes. (**RLC**)

In addition, the Pacific West Region has a carbon neutral vision for park operations, which includes implementing conservation and sustainable practices and educating the public regarding what they can do to help reduce their carbon footprint and mitigate national park resource impacts caused by climate change.

Gulf Islands National Seashore.
NPS photo by Bob Woodman.

Chapter 10: Southeast Region Accomplishments

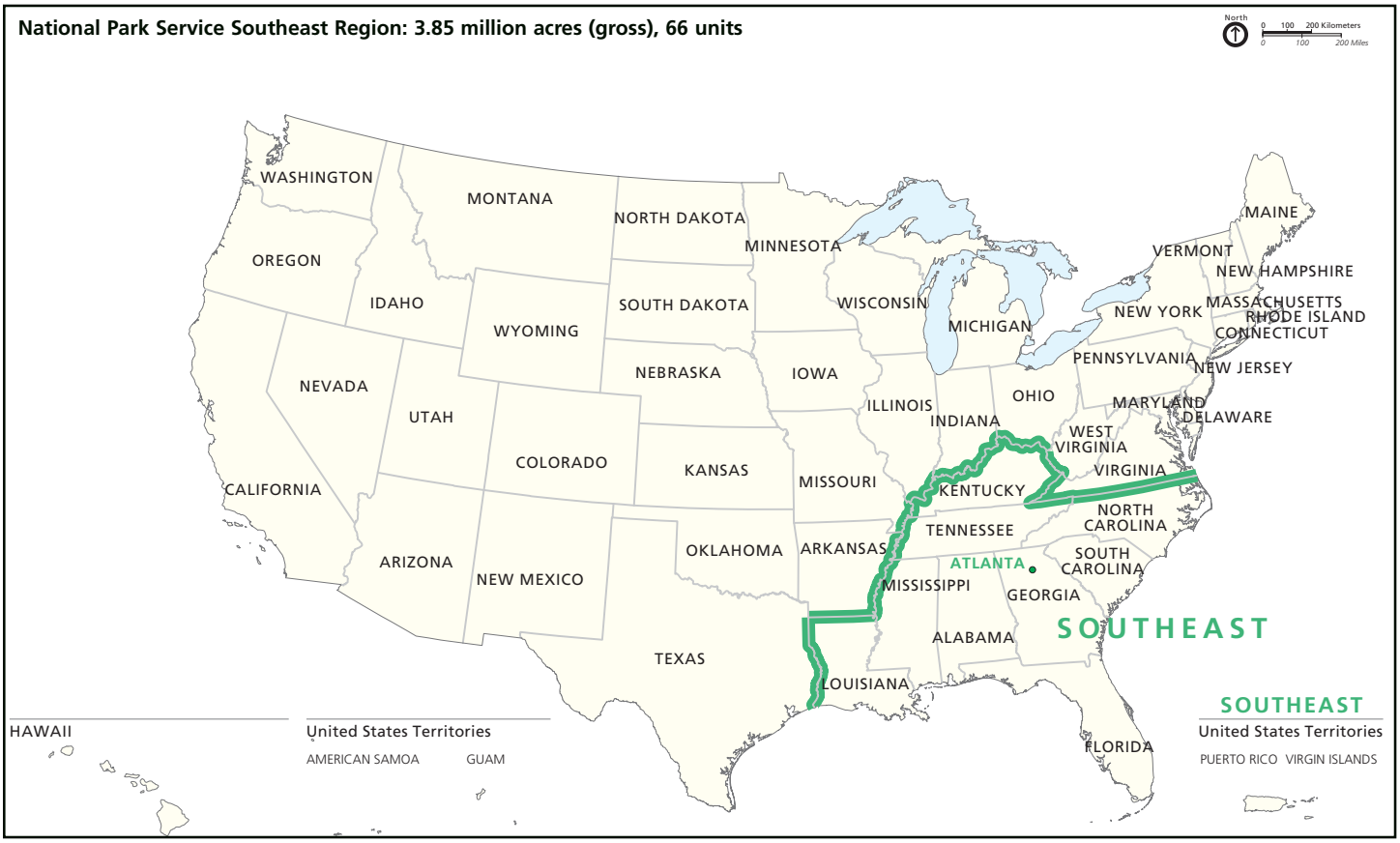
While two-thirds of the NPS units in the Southeast Region feature history as their primary theme, the region also includes natural treasures, including biodiversity hotspots in the Great Smoky Mountains and Everglades and five of 10 national seashores.

Accomplishments

Big Cypress National Preserve (FL): The Big Cypress exotic vegetation control program performed three major exotic plant control projects. One control project involved equipment and techniques, including precision delivery of herbicide by helicopter (spot spray), not previously used in eastern NPS units.

Big South Fork National River and Recreation Area (KY, TN): Approximately 75 of the more than 300 oil and gas wells in the recreation area are abandoned and unplugged, posing environmental risks and public safety threats, including personal injury and property damage from pressurized and flammable fluids, groundwater contamination, and surface disturbances. A FY 2009 project plugged eight abandoned wells, reclaimed the associated surface disturbances, and removed the environmental and human safety hazards of each site, reducing the total number of abandoned wells by approximately 10 percent. (**NRPP–DLR**)

Biscayne National Park (FL), Dry Tortugas National Park (FL), and Buck Island Reef National Monument (Virgin Islands): The Water Resources Program provided funding to support rapid assessment surveys, protocols, and public outreach to detect and respond to invasions of lionfish (*Pterois volitans* and *Pterois miles*), a voracious predator introduced in the early 1990s. Lionfish feed on commercially, recreationally, and ecologically important reef fish and pose a threat of stings to divers, snorkelers, and fishermen. The South Florida/Caribbean Network found no lionfish in surveys at 166 sites in Biscayne and Dry Tortugas; however, a lionfish was seen at Biscayne by a park ranger in 2009. In Buck Island Reef, park staff began preparations for



Setting up acoustic monitoring equipment at Fort Jefferson in Dry Tortugas National Park, Florida, where the fort's masonry walls can be impacted by sonic booms from military aircraft.

a project that includes public education and outreach. To date no lionfish have been observed there, but they are present around the main island of St. Croix. (**BRM, WR, I&M**)

Blue Ridge Parkway (NC, VA): Staff from the Appalachian Highlands Network continue to document heavy poaching of commercially valuable plant species along the parkway. Using predictive habitat models and recently completed detailed vegetation maps, field crews are locating and establishing long-term monitoring plots for key species targeted by poachers—ginseng, trillium, bloodroot, black cohosh, and galax. In the past two years, 200 sites predicted to be ginseng habitat have been monitored, with only 42 ginseng populations being found. Virtually all of these have shown signs of heavy poaching, and only one of the 42 populations contained more than 30 plants (the minimum number needed for long-term survival). The vast majority of the ginseng populations monitored in the last two years had less than a dozen plants remaining. (**I&M**)

Canaveral National Seashore (FL): Mosquito Lagoon, included in the National Estuary Program, is part of the most diverse estuary in the United States. It is home to nine federally protected species and supports a multimillion dollar recreational fishery. Because the lagoon flushes very slowly, it is sensitive to influxes of pollutants. Water quality sampling and biological evidence (increased tumors on sea turtles and lesions on dolphins) demonstrate an increase in contaminants. Continued nutrient loading could shift the entire lagoon from a seagrass-based to an algal-based system, with profound ecological results. To understand the relationship between lagoon hydrology and water quality, a project was launched to track and quantify pollutants and provide definitive cause/effect data on the role of septic tanks as nutrient and bacterial sources. In FY 2009 water sampling continued, and both the hydrodynamic and water quality portions of the Mosquito Lagoon model were calibrated and validated. Model production runs have begun; in FY 2010 sampling results will be integrated into the model. (**NRPP–NRM**)

Cape Lookout National Seashore (NC): Texas A&M University and Geologic Resources Program staff worked with Atlantic and Gulf Coast parks to better prepare for significant storm events. As part of this effort, a storm hazard recovery plan was drafted for the seashore. The plan outlines protocols for short-, medium-, and long-range management actions for resource recovery. The plan and its components potentially can be adapted and utilized by other coastal parks, other management agencies, and local communities to enhance the recovery and preservation of natural and cultural resources. (**CESU, GR**)

Chattahoochee River National Recreation Area (GA), Congaree National Park (SC), Horseshoe Bend National Military Park (AL), and Keenesaw Mountain National Battlefield Park (GA): In FY 2009 the Southeast Coast Network concluded its inventory of the presence of the amphibian fungal pathogen *Batrachochytrium dendrobatidis* (Bd), which is linked to global amphibian population declines. The fungus was detected in four species (three frogs and one salamander). The finding of Bd in the salamander was significant as it was the first recorded occurrence of Bd in this species and the State of Alabama. The results of the multiyear effort were presented at the 2009 George Wright Society meeting. Future efforts will expand knowledge on the population-level impacts of the fungus and other species in which the fungus occurs. (**I&M**)

Cumberland Gap National Historical Park (KY, TN, VA): In cooperation with Kentucky State Nature Preserves Commission, the Cumberland/Piedmont Network updated the status of state-listed and special concern plants on more than 10,000 acres of the park in Kentucky. A total of 18 listed plants were determined to be extant within the park, many of which had not been verified in more than 15 years. (**I&M**)

Dry Tortugas National Park (FL): Large sonic booms generated by military aircraft training in the Key West Range Complex cause damage to Fort Jefferson, a mid-19th–century military fortress. After staff observed an increase in sonic booms in 2008 and early 2009, they contacted the Natural Sounds Program, which arranged for acoustical monitoring in the park and discussions between U.S. Navy and park staff. The Navy voluntarily expanded the airspace restriction for sonic boom generation from 12 to 30 nautical miles to minimize

Volunteers searching for lichens among bald cypress, Everglades National Park, Florida. NPS photo by Jean Seavey.

the number of sonic booms reaching the fort and incorporated flight avoidance awareness briefings into pre-flight planning guidance. Park staff also met with U.S. Air Force units in Florida to raise awareness of the impacts of sonic booms and increase compliance with avoidance measures. These measures resulted in a 94-percent reduction in sonic booms experienced at Fort Jefferson from May to October 2009. (**NSP**)

Everglades National Park (FL): Two cooperative agreements were executed to establish fellowship programs at Florida International University and Florida Atlantic University. These projects facilitate research and technical assistance projects in Everglades National Park and adjacent areas to strengthen education and provide new scientific information for the Everglades restoration effort, or alternatively, provide syntheses and broad dissemination of existing research on Everglades science topics linked to NPS and DOI natural resources. (**CESU**)

Great Smoky Mountains National Park (NC, TN): During the FY 2009 field season, 613 introduced wild hogs (*Sus scrofa*) were removed from the park, the third highest annual number of hogs removed in the 50-year history of the program. The hogs' rooting and wallowing, in addition to their willingness to eat most things, damage park ecosystems. Park staff continued a cooperative disease monitoring program and documented more hogs seropositive for pseudorabies, including one from the northeastern portion of the park, which suggests that the disease is spreading.

The Appalachian Highlands Science Learning Center prepared a research proposal with a researcher from Duke University to downscale climate predictor models to Great Smoky Mountains and develop predictive models for rainfall, solar radiation, soil moisture, and extreme events, such as blowdowns, landslides, and flooding, and the impacts of these changes on ecological communities of concern. (**RLC**)

Gulf Islands National Seashore (FL, MS): NPS regional and seashore staff continued collaboration with the U.S. Army Corps of Engineers on the Mississippi Coastal Improvement Project. Barrier island restoration within the seashore will not only help restore East and West Ship islands but also help restore a more natural process to the barrier island

ecosystem. The restoration strategy includes specific actions to mitigate erosion and land loss on the barrier islands caused by frequent intense storms, sea level rise, and a deficit in the sediment budget attributed to the dredging of sand from navigation channels. This partnership effort also involved NPS personnel from the Geologic Resources Program and Denver Service Center; the State of Mississippi; the U.S. Geological Survey; the U.S. Fish and Wildlife Service; and others. (**GR**)

Mammoth Cave National Park (KY): Monitoring has shown that the number of hibernating federally endangered Indiana bats (*Myotis sodalis*) at a cave in the park has dropped from a high of around 17,000 in the mid-1980s to around 2,000 in 2009 for unknown reasons. The cave entrance has been closed with a bat-friendly gate since 1995 and access has been limited to a few researchers. Using cave meteorology monitoring data, Cumberland Piedmont Network scientists were able to eliminate one hypothesis, as there were no changes detected in temperature or relative humidity in the cave. (**I&M**)

Obed Wild and Scenic River (TN): Cobble bars are a very rare type of riverine tallgrass prairie habitat that exists only on the Cumberland Plateau of Tennessee and Kentucky. Fewer than 500 acres of cobble bar habitat are believed to remain, and the best remaining examples are within this site and **Big South Fork National River and Recreation Area (KY, TN)**. The Appalachian Highlands Network mapped 42 river miles at Obed and surveyed 86 percent of the 71 river miles at Big South Fork. Teams discovered multiple previously unknown populations of the federally listed threatened species Cumberland rosemary (*Conradina verticillata*), indicating that Obed Wild and Scenic River is probably the most significant refuge remaining for this rare species. In addition, they found two new populations of the globally imperiled Cumberland sand reed (*Calamovilfa arcuata*), an extremely rare species that is currently under consideration for federal listing as endangered. (**I&M**)

Russell Cave National Monument (AL): A preliminary field report indicates the presence of the federally endangered gray bat (*Myotis grisescens*). Documented during a mammal inventory through a cooperative agreement with University of Memphis, this becomes the first federally listed species recorded for the monument. The adult female was captured in late August outside a cave entrance. This occurrence could indicate a gray bat roost exists somewhere in a park cave or that this species of bat roosts off-park and uses cave entrances in the monument for fall "swarming" (i.e., socializing) activity. Gray bats are restricted to caves or cave-like habitats, and few caves meet their specific roost requirements, which make them highly vulnerable to disturbance. (**I&M**)

Virgin Islands Coral Reef National Monument (Virgin Islands): While anchoring is prohibited in the monument, the Hurricane Hole area has traditionally been used by boaters seeking refuge from storms. Traditionally boaters have secured their boats by anchoring and tying lines to mangrove trees along the shores. Abrasion to the trees has caused significant damage to this vital resource that provides nursery habitat to juvenile coral reef fish and reduces sediment input to coastal waters. Hurricane Hole may provide the source of reef fish for most of the reef systems along the east and south coasts of St. John. FY 2009 funding permitted the completion of a project to install a hurricane mooring system that accommodates 102 boats while protecting the mangroves. (**NRPP–SP**)

Regional Projects

Coastal Water Assessment: Estuaries are partially enclosed coastal bodies of water connected with the open sea, containing a mixture of sea water and fresh water. Estuaries contain critical habitat for a variety of fish and wildlife species and are therefore vulnerable to impacts from development and use. University of Georgia and Southeast Coast Network researchers, through the Piedmont-South Atlantic CESU, measured water quality at six coastal parks as part of the I&M effort. (**CESU, I&M**)

Forest Pest Monitoring Protocol: The Cumberland Piedmont Network drafted a protocol that will compile existing forest pest data available from federal, state, and private agency websites. These data include distribution maps and models, recent outbreaks, species profiles and watch lists, funding availability, and treatment options. The protocol includes an early detection and rapid response frame-

Advanced master gardener land care stewards at the 2008 Virginia State Fair, where they reached out to friends and neighbors in an effort to help people become true partners in fire protection.

work and should reduce confusion regarding the roles of state and federal cooperators when a forest pest is detected, increase communication among participants, and aid in planning responses. Rapid response is critical to stopping forest pests' spread and minimizing their impact. (**I&M**)

Reef Fish Monitoring Protocol: The South Florida/Caribbean Network, in partnership with the State of Florida Fish and Wildlife Research Institute, National Oceanic and Atmospheric Administration, and the University of Miami, published a reef fish monitoring protocol titled *A Cooperative Multi-Agency Reef Fish Monitoring Protocol for the Florida Keys Coral Reef Ecosystem*. As a result of the interagency collaboration on the development of this protocol, a single, consistent method is now used to count fish in the Florida Keys from Miami to the Dry Tortugas. This collaborative approach improves efficiency and provides a highly robust regional data set for the reef fish community, which supports a multi-million dollar fishing industry in South Florida. (**I&M**)

White-Nose Syndrome in Bats: White-nose syndrome is a newly identified disease causing unprecedented mortality in bats. Bat mortality has exceeded 90 percent in many affected caves and mines. Since first documented in 2006, the disease has spread rapidly, including toward Cumberland Piedmont Network parks with significant populations of bats that use caves or mines (e.g., **Chickamauga and Chattanooga National Military Park [GA, TN], Cumberland Gap National Historical Park [KY, TN, VA],** and **Mammoth Cave National Park [KY]**). A network ecologist provided technical assistance to several network parks with bats as they decide how to address this unprecedented threat. Assistance included bat monitoring, meetings with park managers, newspaper interviews, development of park-specific guidance/response documents, presentations to park staff, bat research, submission of bats for testing, and development of a web announcement and poster/signs. (**I&M**)

Yard Waste Disposal Education: The Virginia Land Care Stewards program sends master gardeners to work with neighbors and offer information to help them protect what they value in environmentally sound ways. To confront the dangers of debris burning, a major source of wildfires and a threat to parks located in the wildand-urban interface, the National Park Service worked with master gardeners to produce a resource book and to develop public training sessions about recycling yard waste and considering alternatives to burning. (**CESU**)

Chapter 11: Servicewide Accomplishments

By focusing efforts on the broad issues, such as climate change, ocean stewardship, biodiversity, and energy development, that affect NPS natural resources, Servicewide natural resource programs reach across state boundaries to provide benefits for multiple parks.

Climate Change Communication: The Climate Change Response Program created numerous products in FY 2009 focused on communicating and sharing work efforts. A monthly newsletter distributed to park staff and external partners reported on what is happening in the program, advertised upcoming climate change workshops, and highlighted what regions and parks have been doing in regards to climate change. A monthly webinar series, initiated in 2008, continued to host speakers from outside the National Park Service to share their expertise on climate change adaptation, mitigation, or communication with NPS employees. Eleven webinars had more than 1,000 participants in FY 2009. In partnership with the U.S. Fish and Wildlife Service, the program is creating a series of 11 bioregional reports that summarize the current state of knowledge about climate change and impacts to protected areas in those bioregions, with a focus on national parks and refuges. These allow federal land managers to focus on concerns and solutions pertinent to their respective areas. (**CCRP**)

Climate Change Scenario Planning: Parks are exploring the use of climate change scenario planning as a long-range planning tool for incorporating climate change into a range of park management processes and documents, including general management plans and Resource Stewardship Strategies. Benefits of this approach are 1) increased understanding of key uncertainties, 2) incorporation of alternative perspectives into conservation planning, and 3) improved capacity for adaptive management to promote resource sustainability. In spring 2009 a prototype workshop was conducted using case studies from four parks: **Joshua Tree National Park (CA), Wind Cave National Park (SD), Kaloko-Honokohau National Historical Park (HI),** and **Assateague Island National Seashore (MD, VA)**. (CCRP)

Dark Night Skies: The NPS Night Sky Team continued its effort to measure and improve night sky quality in parks. Advancements were made to restore the night sky at several parks. Lighting retrofits are underway at **Joshua Tree National Park (CA)** and **Arches and Canyonlands national parks (UT),** and **Acadia National Park (ME)** partnered with the community to establish a Starry Night Festival to bring attention to the outstanding skies found in coastal Maine. The team also documented degradation of night sky quality; repeat measurements at **Death Valley National Park (CA)** showed a 61-percent increase over six years in the brightness of light pollution from Las Vegas, Nevada, illustrating the rapid pace that many night skies are being lost to light pollution. The team continued development of engineering guidelines for dark-sky friendly lighting, a computer model to aid compliance and planning efforts, and a simplified index of night sky condition. (**AQ**)

Ecological Integrity: Biological Resource Management staff released decision support tools on ecological integrity and desired future conditions to parks to incorporate into foundation documents, Natural Resource Condition Assessments, and plans and other analyses. These documents provide guidance to park staff to clearly articulate management objectives as the core of condition-based management and public accountability. (**BRM**)

Forest Health: The U.S. Forest Service and the NPS Integrated Pest Management Program staff continued an effective cooperative relationship in the detection and management of forest pests. In FY 2009 the U.S. Forest Service Forest Health Program provided technical support and funding for 14 forest health projects in 14 parks. These projects included monitoring and suppression of nonnative invasive pests (e.g., gypsy moth, oak wilt, sudden oak death, hemlock woolly adelgid, Dutch elm disease, and white pine blister rust) and native pests (e.g., Douglas fir beetle, southern pine

Delicate Arch, Arches National Park, Utah, by Dan Duriscoe and Cindy Duriscoe. The NPS Night Sky Program has assessed night sky quality in Arches National Park and 79 other NPS units.

beetle, and mountain pine beetle). These pests threaten the viability of forests both inside and outside national parks. (**BRM**)

Fossil Resources: Currently, 221 parks are known to contain documented fossil resources. In March President Obama signed the Omnibus Public Land Management Act of 2009, which directs the Secretary of the Interior to manage and protect park fossil resources and to develop plans for inventory and monitoring and scientific and educational uses of fossil resources. With other federal agencies, Geologic Resources Program policy staff began to jointly develop regulations supporting this act. Program staff worked with partners and contractors to complete five new paleontological resource I&M Network reports encompassing 63 parks. Twenty-seven such reports now exist to inform and guide decision making for 232 parks. (**GR**)

Geologic Monitoring Manual: Geologic Resource Program staff edited the book *Geological Monitoring*, which was prepared in cooperation with a team of technical experts and published by the Geological Society of America. The book synthesizes methods covering the spectrum of geologic resources and will assist resource managers in selecting the most appropriate and cost-effective methods for monitoring short- and long-term changes in geologic features and landscapes. (**GR**)

Geoscientists-in-the-Parks: The Geoscientists-in-the-Parks program helps parks and central offices address specific unmet geologic resource management, research, public safety, and education projects with advanced students, professors, professionals, and/or retired professionals. In FY 2009, 56 participants worked in 30 parks and two central offices covering all NPS regions. Participants directly reached tens of thousands of park visitors through geologic outreach and education programs, and many more benefited through improvements to park websites. Through partnerships and the use of inexpensive but professional volunteers, the program leveraged federal dollars at a rate of five to one, with the NPS receiving more than $1.38 million in project work at a cost of about $283,000. (**GR**)

NOAA Partnership: The Water Resources Program finalized an agreement between the National Oceanic and Atmospheric Ad-

Geoscientists-in-the-Parks intern at Lake Clark National Park and Preserve, Alaska, mapping Quaternary (recent) sediments. NPS photo by Patrick Gregerson.

Biologically diverse coral reefs at Halape, Hawaii Volcanoes National Park, Hawaii.

ministration (NOAA) and the National Park Service to increase scientific and educational partnerships to support resource protection and to improve relations, communication, and information exchange between the two agencies. (**WR**)

Ocean and Coastal Workshop: The Water Resources and Geologic Resources programs conducted an Ocean and Coastal Workshop for more than 50 park, regional, and central office resource managers. The workshop provided a forum to distill lessons learned and best practices, forge effective Servicewide approaches, and draft guidance to strengthen the National Park Service's ability to address resource protection issues in ocean and coastal parks. Participants discussed high-priority resource management issues, including climate change, fisheries, invasive species, water quality and watershed management, sediment management and coastal infrastructure, and habitat and ecosystem restoration. A workshop report will be published in FY 2010. (**GR, WR**)

Ocean Park Protection: The Water Resources Program nominated 10 ocean and coastal parks to the National System of Marine Protected Areas maintained by the NOAA Marine Protected Areas Center. Parks will benefit by sharing science, information, and technologies with state and federal partners. (**WR**)

Ocean Webinar: The Water Resources Program developed a webinar series to increase Servicewide communication on important ocean and coastal resource issues. Topics included water quality, ocean acidification, fishery management, and marine invasive species. More than 40 to 60 individuals viewed each webinar. (**WR**)

Oil and Gas Leases: Geologic Resources Program staff represented the National Park Service on a Bureau of Land Management review team that conducted an on-the-ground evaluation of the merits of leasing parcels for federal oil and gas in Utah. The parcels had been the subject of significant controversy. More than a dozen of the parcels were in proximity to **Canyonlands and Arches national parks (UT)** and **Dinosaur National Monument (CO)**. The review team delivered a report, which contained a number of recommendations for improving the bureau's oil and gas leasing process, to the Department of the Interior early in October 2009. (**GR**)

Park Flight: The Park Flight Migratory Bird Program became a partner in a three-year National Science Foundation-funded project, "Engaging Latino Audiences in Informal Science Education," in collaboration with Environment for the Americas. The goals of this project are to identify and reduce the barriers to Latino participation in informal science education, provide effective tools to assist educators in connecting Latino families with science education, and broadly disseminate these tools to agencies and organizations challenged with engaging this audience in informal science education. Park Flight international volunteers at six NPS units were involved in the first stage of the project, working with nearby Latino communities to conduct surveys and establish connections with local Latino organizations and leaders. (**BRM**)

Portable Ozone Monitoring: Ground-level ozone can create unhealthy conditions, especially for the young, old, active, and sick, as well as cause significant vegetation damage. Because national parks are not immune to its effects, the NPS Air Quality Program worked with parks across the country to provide portable ozone monitoring stations, in addition to the ongoing monitoring, that monitor levels of ozone during the summer months. Additional portable monitors in parks with complex terrain help understand the spatial distribution of air pollutants within a park. The portable systems are intended for summer season characterization of ozone over a one- to five-year period. Results from the program are useful for survey monitoring, addition to ozone spatial monitoring, and special purpose measurements. (**AQ**)

Resource Advisor (READ) Training: The Environmental Quality Program, Geologic Resources Program, and Museum Emergency Response Team cosponsored a two-day READ training session for 50 participants in June 2009 at **Point Reyes National Seashore (CA)**. The READ program provides natural and cultural resource professionals with an understanding of the needs of Incident Management Teams so that together they respond proactively to major incidents. Resource advi-

Dredging relief channel to return Kautz Creek to its original streambed after flooding in Mount Rainier National Park, Washington. NPS photo by Scott Beason.

sors from this training course were deployed with the Incident Management Teams that responded to the earthquakes and tsunami that affected **National Park of American Samoa** in September 2009. (**EQ, GR**)

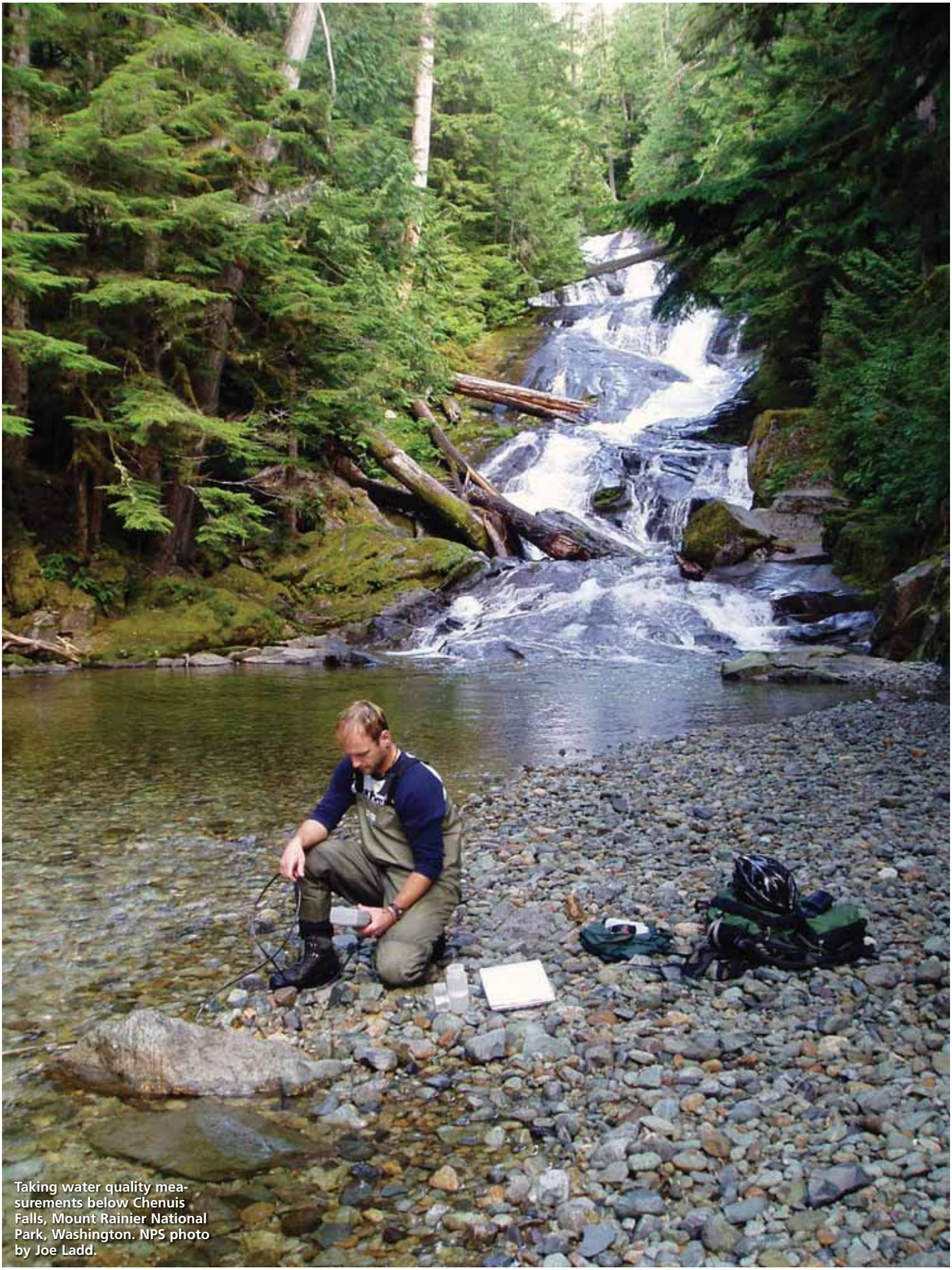
Renewable Energy: Servicewide natural resource programs collaborated to respond to increased activity in renewable energy development by assisting parks in evaluating site-specific and programmatic proposals near park boundaries. The programs are looking at ways to meet the Secretary of the Interior's renewable energy objectives and also protect parks. For example, in FY 2009 staff from the Water Resources Program assumed a leadership role for the National Park Service on the Bureau of Land Management's Solar Energy Programmatic Environmental Impact Statement. The Geologic Resources Program is coordinating efforts with affected parks and regions and identifying ways that the bureau can increase renewable energy generation on public lands while also safeguarding nearby parks. (**AQ, BRM, GR, NSP, WR**)

Threatened and Endangered Species Collection: The National Park Service signed a partnership agreement with the American Museum of Natural History's Ambrose Monell Collection for Molecular and Microbial Research to establish an NPS Special Collection. The collection will consist of blood and tissue samples of threatened and endangered species from NPS units and will be available to researchers through third-party loan. The collection will enable parks to measure long-term genetic changes of rare species. (**BRM**)

Water Resource Assistance: Aquatic resource professionals worked with parks Servicewide to provide technical assistance and guidance for water resource projects. FY 2009 highlights include identifying and mitigating current flood hazards and developing recommendations to minimize future flood damage at **Mount Rainier National Park (WA)**; providing written review and organizing the NPS response to a Delaware River branch water extraction request for gas production from shale; with U.S. Geological Survey partners, conducting historical data analysis to evaluate potential causes for avian botulism outbreaks since 1960 in Lake Michigan at **Sleeping Bear Dunes National Lakeshore (MI)** and drafting a related manuscript for submission to the *Journal of Great Lakes Research*; and beginning development of an interactive geodatabase for observing large-scale lake drying and thermokarst events in Arctic Network parks, which will help demonstrate to the public the large-scale impacts of global warming on Alaska's parklands. (**WR**)

WebRanger Modules: The Natural Resource Program Center Office of Outreach and Education (OEO) worked cooperatively with the NPS Partnership and Visitor Experience Directorate to continue the development of a series of WebRanger modules on key natural resource topics. Three new natural resource modules were added to the WebRanger program, which now hosts more than 50,000 unique users. (**OEO**)

Wetland Protection: Water Resources Program staff authored and obtained final approval for the NPS Alaska Region Wetland Mitigation Banking Program: Umbrella Mitigation Bank Instrument. The purpose is to allow Alaska parks to use various individual wetland mitigation banks to compensate for unavoidable adverse impacts on wetlands, as required under NPS Director's Order #77-1: Wetland Protection. (**WR**)



Taking water quality measurements below Chenuis Falls, Mount Rainier National Park, Washington. NPS photo by Joe Ladd.

Appendix A: Natural Resource Challenge Funding in Parks

Table A-1. Natural resource funding of National Park Service units receiving Natural Resource Challenge increases in FY 2001 or FY 2002

NPS unit	Amount of Challenge increase ($)	Natural resource total ($)							
		FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Acadia NP [1]	345,000	849,827	794,395	755,087	752,395	695,273	726,254	722,433	795,278
Antietam NB	150,000	319,965	316,723	314,900	353,000	350,000	420,000	421,360	425,000
Appalachian NST	142,000	263,638	256,603	258,337	298,642	299,453	310,919	316,667	273,351
Big Cypress NPr [2]	399,000	1,033,640	1,010,000	1,108,140	1,108,140	1,085,907	1,104,663	1,050,220	841,536
Buck Island Reef NM [3]	100,000	270,000	216,450	216,000	216,000	216,000	216,000	216,000	216,000
Catoctin Mountain Park [4]	89,000	254,400	231,900	232,200	272,414	174,867	200,594	204,976	370,829
Channel Islands NP [5]	498,000	1,406,622	1,406,622	1,440,607	1,891,222	1,891,222	1,891,222	2,255,648	2,487,208
Coronado N Mem	60,000	94,993	105,231	95,236	108,000	60,000	60,000	60,000	60,000
Curecanti NRA	141,000	657,500	690,600	719,300	724,000	731,700	741,900	859,100	894,800
Dinosaur NM	189,000	501,800	559,375	568,874	571,152	524,200	627,280	772,738	667,000
Gates of the Arctic NP and Pr	148,000	362,401	363,039	349,164	377,345	357,517	342,014	534,945	553,000
Great Basin NP	126,000	331,450	315,756	375,939	367,080	382,600	454,600	483,157	498,319
Great Sand Dunes NP and Pr	180,000	291,700	287,500	281,300	281,300	323,400	332,000	325,300	344,900
Great Smoky Mountains NP	402,000	1,245,100	1,152,700	1,003,200	1,231,700	476,000	353,200	2,258,200	2,540,700
Haleakala NP	480,000	1,561,660	1,372,200	1,196,400	1,196,400	1,404,882	1,458,403	1,492,557	1,533,262
Homestead NM of America	82,000	104,500	104,500	81,198	82,460	82,353	87,731	77,244	114,793
Hopewell Culture NHP [4]	105,000	95,000	79,322	103,047	99,953	109,519	106,024	106,332	122,874
Jewel Cave NM	50,000	168,500	168,500	167,140	159,203	153,330	161,422	170,571	170,000
John Day Fossil Beds NM	95,000	129,000	130,000	115,000	127,101	119,000	129,000	129,000	143,000
Kalaupapa NHP [6]	211,000	549,000	549,000	549,000	499,000	534,000	549,000	787,000	549,000
Lake Clark NP and Pr	147,000	321,500	319,810	250,000	262,600	245,800	261,032	259,900	310,000
Little River Canyon NPr [7]	85,000	182,426	174,027	112,900	171,275	95,898	96,371	111,941	116,000
Mojave NPr [4]	470,000	1,264,000	1,219,073	1,177,488	1,178,297	1,165,193	1,160,397	1,147,303	1,213,592
Monocacy NB [4]	118,000	120,000	116,000	116,000	116,000	116,000	116,000	116,000	116,000
Obed Wild and Scenic River	195,000	245,000	193,318	188,775	188,775	188,775	195,000	182,751	195,000
Padre Island NS	95,000	408,000	403,825	543,000	471,896	600,200	589,492	547,307	809,185
Pictured Rocks NL	55,000	194,650	207,000	211,000	237,000	238,832	243,664	266,547	244,725
Rock Creek Park [4]	163,000	436,522	393,168	359,104	299,000	376,300	307,977	305,881	392,876
San Juan Island NHP	95,000	124,600	125,050	124,600	124,600	116,837	101,200	123,230	106,264
Saugus Iron Works NHS	58,000	58,000	58,000	69,900	58,000	58,000	58,000	58,000	58,000
Sequoia & Kings Canyon NPs [4] [8]	112,000	1,446,000	1,424,400	1,424,400	1,457,400	1,563,600	1,590,600	1,885,200	1,966,927
Stones River NB [9]	132,000	132,000	137,100	127,924	132,000	208,277	188,182	267,954	476,049
Sunset Crater, Walnut Canyon, & Wupatki NMs	100,000	166,762	171,227	186,341	191,683	196,426	208,661	204,024	206,917
Theodore Roosevelt NP	133,000	302,500	292,500	282,500	281,500	264,660	301,400	332,600	383,727
Virgin Islands NP [10]	399,000	1,077,234	1,002,726	941,500	877,234	877,234	399,000	399,000	399,000
Zion NP [11]	246,000	536,300	515,872	518,774	485,274	518,774	467,101	492,344	555,828
TOTAL [12]	6,595,000	17,506,190	16,863,512	16,564,275	17,249,041	16,802,029	16,556,303	19,943,430	21,150,940

[1] Figure shown for FY 2008 reflects a correction to that reported in FY 2008 report.
[2] Part of increase to another program for contract support; part of balance of change from pre-Challenge increase due to realigned position.
[3] Park also received $65,000 Coral Reef Initiative increase in FY 2001.
[4] 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.
[5] Park received NRC funding in FY 2002 ($498,000 for Santa Cruz Island restoration) and in FY 2005 ($477,000 for island fox recovery).
[6] FY 2008 funding includes $238,000 from Coral Reef Initiative.
[7] Figures shown for FY 2001 and 2002 reflect a correction to those reported in the FY 2002 report.
[8] Park also received a non-Challenge $367,000 base increase in FY 2001.
[9] Park also received one-time flexible park base funding of $333,000 to address scorecard issues, which is not reflected in total for FY 2008.
[10] Park also received a Coral Reef Initiative base increase ($300,000) and Prototype Monitoring increase ($230,000) in FY 2001.
[11] FY 2008 does not include natural resource projects funded through the SCC ($213,702).
[12] Totals show corrected totals from FY 2005 and FY 2008 (corrected from $19,162,997).

Appendix B: Natural Resource Program Funding–Servicewide Programs, FY 2009

Table B-1. FY 2009 funding for NPS natural resource programs

Office/program	Total available in FY 2008 ($)	Classified pay increase ($)	FY 2009 decrease ($) [1]	Adjustments ($)	Total available in FY 2009 ($)	Change from FY 2008 ($)
Air Quality Program	8,673,000	123,000	-12,000		8,784,000	111,000
Biological Resource Management Program [2]	9,765,000	83,000	-15,000		9,833,000	68,000
Cooperative Ecosystem Studies Units [3]	125,000				125,000	0
Geologic Resources Program [4]	3,224,000	133,000	-16,000		3,341,000	117,000
Inventory and Monitoring Program [5]	43,836,000	803,000		400,000	45,039,000	1,203,000
Natural Resource Data and Information Program	1,871,000	51,000	-11,000		1,911,000	40,000
Natural Resource Preservation Program	8,100,000		-1,000		8,099,000	-1,000
Natural Sounds Program [6]	3,527,000	22,000	-4,000	-413,000	3,132,000	-395,000
Resource Damage Assessment and Restoration Program (incl. Oil Spill Pollution Act)	1,373,000	52,000			1,425,000	52,000
Resource Protection Fund	283,000				283,000	0
Social Science Program [7]	1,749,000	12,000			1,761,000	12,000
Water Resources Program	12,316,000	173,000	-17,000		12,472,000	156,000

[1] Decrease reflects travel reduction.
[2] Total includes avian flu funding ($332,000).
[3] CESU funding listed here is for national network support; see Table B-4 for individual CESU funding.
[4] Total includes transfer to base funds from National Cave and Karst Research Institute ($323,000).
[5] Adjustment includes funding transferred from Olympic and North Cascades national park prototype programs to North Coast and Cascades I&M Network.
[6] Adjustment includes transfer of $372,000 to Servicewide Comprehensive Call projects and $41,000 to Hawaii Volcanoes National Park.
[7] Total includes Park Use Statistics funding ($277,000).

Table B-2. Air Quality Program funding by category, FY 2009

Category	FY 2009 funding ($)
Program management and implementation	1,300,000
Air quality monitoring, projects, and analysis	5,134,000
Collaboration and outreach	250,000
Technical assistance	2,100,000
TOTAL	8,784,000

Table B-3. Biological Resource Management Program funding by category, FY 2009

Category	FY 2009 funding ($)
Biological Resource Management competitive projects in parks	625,000
Ecological restoration	275,000
Endangered species	425,000
Emergency park requests	5,000
Exotic plant management	5,604,000
Highly pathogenic avian influenza	332,000
Integrated pest management	280,000
Invasive animals	280,000
Invasive plants	280,000
Migratory birds	175,000
Operations	377,000
Vegetation mapping	250,000
Wildlife management and health	925,000
TOTAL	9,833,000

Table B-4. Allocation of funding among Cooperative Ecosystem Studies Units, FY 2009

Unit	Fiscal year first funded	FY 2009 funding ($)
Californian [1]		
Chesapeake Watershed	2001	155,000
Colorado Plateau	2001	155,000
Desert Southwest	2001	155,000
Great Basin	2001	155,000
Great Lakes-Northern Forest	2003	155,000
Great Plains	2001	155,000
Great Rivers [1]		
Gulf Coast	2003	155,000
Hawaii-Pacific Islands [1]		
North and West Alaska [1]		
North Atlantic Coast	2001	155,000
Pacific Northwest	2001	155,000
Piedmont-South Atlantic Coast [1]		
Rocky Mountains	2001	155,000
South Florida-Caribbean	2001	155,000
Southern Appalachian Mountains	2001	155,000
TOTAL		1,860,000

[1] These five CESUs do not receive NPS funding.

Table B-5. Geologic Resources Program funding by category, FY 2009

Category	FY 2009 funding ($)
Cave and karst	99,000
Cave and Karst Research Institute	323,000
Coastal geology	438,000
Disturbed lands/AML	241,000
Geologic hazards	91,000
Geologic resource evaluation	640,000
Minerals management	966,000
Paleontology	332,000
Soil resources	211,000
TOTAL	3,341,000

Table B-6. Inventory and Monitoring Program funding by category, FY 2009

Category	FY 2009 funding ($)
Natural resource inventories	10,782,068
Vital signs monitoring	29,581,120
Information management	2,012,703
Regional coordinators	965,500
Program administration	1,697,609
TOTAL	45,039,000

Table B-7. Allocation of funding among basic natural resource inventories, FY 2009

Category	FY 2009 funding ($)
Air quality related values	160,000
Geologic resources inventories	1,850,000
Soil resources inventories	2,595,000
Alaska vegetation and soil inventories	1,000,000
Paleontology inventories	50,000
Vegetation inventories	4,200,000
Water resources inventories	90,000
Submerged resources inventories	250,000
Species inventories	103,778
Other natural resource inventories	483,290
TOTAL	10,782,068

Table B-8. Allocation of monitoring funding among Inventory and Monitoring Networks, FY 2009

Network [1]	Fiscal year first funded	Number of parks in network	Water quality monitoring ($)	Vital signs monitoring ($)
Alaska Region				
Arctic	2005	5	144,100	1,609,200
Central Alaska	2002	3	94,200	1,278,400
Southeast Alaska	2006	3	40,400	446,700
Southwest Alaska	2002	5	133,600	1,490,000
Intermountain Region				
Chihuahuan Desert	2007	6	70,200	793,200
Greater Yellowstone	2002	3	68,200	765,400
Northern Colorado Plateau	2002	16	103,700	1,037,300
Rocky Mountain	2004	6	58,600	665,000
Sonoran Desert	2001	11	61,500	712,600
Southern Colorado Plateau	2003	19	119,100	1,261,200
Southern Plains	2006	10	27,900	410,000
Midwest Region				
Great Lakes	2003	9	118,200	1,373,400
Heartland	2001	15	78,800	755,600
Northern Great Plains	2007	13	77,900	802,000
National Capital Region				
National Capital	2002	11	68,200	796,900
Northeast Region				
Eastern Rivers and Mountains	2004	9	60,600	671,800
Northeast Coastal and Barrier	2001	8	86,500	792,100
Northeast Temperate	2003	11	57,700	814,000
Pacific West Region				
Klamath	2004	6	73,000	837,700
Mediterranean Coast	2002	3	73,000	332,300
Mojave Desert	2006	6	76,900	908,000
North Coast and Cascades	2001	7	78,800	1,201,400
Pacific Island	2003	9	145,100	1,608,700
San Francisco Bay Area	2002	6	67,200	803,500
Sierra Nevada	2004	3	60,600	685,000
Upper Columbia Basin	2006	8	48,000	554,900
Southeast Region				
Gulf Coast	2004	8	85,500	962,200
Mid-Atlantic	2006	10	42,300	315,500
Appalachian Highlands	2002	4	67,200	446,100
Cumberland/Piedmont	2001	14	56,700	994,600
South Florida/Caribbean	2006	6	141,300	1,580,000
Southeast Coast	2005	17	116,300	1,321,100
Servicewide Data Management			*136,600*	
TOTAL [2]		270	2,737,900	29,025,800

[1] Networks are listed by the region that includes the majority of the network area, even though the network may extend into other regions.
[2] Vital signs monitoring funding in this table does not include national program costs; the total, therefore, differs from Table B-6.

Table B-9. Water Resources Program funding by categories, FY 2009

Category	FY 2009 funding ($)
Water resource projects	832,000
Water quality vital signs monitoring	2,737,900
Natural Resource Condition Assessment program	2,202,700
Water resource protection - aquatic resource professionals	1,290,000
Legacy high-priority projects	67,700
Water resource technical assistance	5,341,700
TOTAL	12,472,000

Collecting seeds of the endangered *Clermontia lindseyanna* in the Kahuku Unit of Hawaii Volcanoes National Park, Hawaii. NPS photo by Sierra McDaniel.

Appendix C: Biological Resource Management Competitive Projects, FY 2009

Table C-1. Biological resource projects, FY 2009

Region	State	Park	Project title	FY 2009 funding ($)
AKR	AK	Denali National Park and Preserve	Census Sensitive Moose Populations in the Cantwell and Yentna Areas	36,700
	AK	Katmai National Park and Preserve	Assess the Status of the Harvested Brown Bear Population	38,750
IMR	AZ	Grand Canyon National Park	Supplemental Feeding Station for Improving Wild Condor Reproduction and Reducing Lead Poisoning	15,000
	MT	Glacier National Park	Control Backcountry Invasive Weeds	11,500
	MT	Glacier National Park	Conservation of Clark's Nutcrackers (A Species Critical to Whitebark Pine Restoration)	50,000
	SD	Wind Cave National Park	Develop Long Term Management Strategy to Protect Genetically Pure Bison Herd	25,000
	UT	Bryce Canyon National Park	Utah Prairie Dog Population and Habitat Conservation Plan	25,000
	WY	Yellowstone National Park	Develop Techniques to Evaluate Effectiveness of Grizzly Bear Management Areas	16,700
MWR	IN	Indiana Dunes National Lakeshore	Restore Endangered Karner Blue Butterfly to East Unit	10,660
	MN, WI	Saint Croix National Scenic Riverway	Converting Hydropower Dam Operation to Run-of-the-River: The Effect on Endangered Mussels	17,666
	WI	Apostle Islands National Lakeshore	Determine Population Dynamics of Archipelagic Black Bear Population Needed for Harvest Management	49,700
	VA	Shenandoah National Park	Control the Highly Invasive Mile-A-Minute Vine	24,723
PWR	American Samoa	National Park of American Samoa	Rehabilitate Disturbed Lands on Alava Ridge	24,800
	CA	Golden Gate National Recreation Area, Point Reyes National Seashore	Inventory Non-Native Invasive Aquatic species	50,000
	HI	Haleakala National Park	Remove Feral Animals To Protect Rare Koa-Ohia Forest Community	25,000
	HI	Haleakala National Park	Initiate Bog Restoration	49,700
	HI	Hawaii Volcanoes National Park	Assess Habitat Use and Investigate Causes of Adult Nene Mortality	18,500
	HI	Hawaii Volcanoes National Park	Protect Biodiversity of Rare Plants in New Kahuku Addition	49,100
	Saipan	American Memorial Park	Assess and Plan to Exclude Brown Tree Snakes	49,900
	WA	Mount Rainier National Park	Mortality Risk of Western Toads from Roads/Trails at Tipsoo Lake	11,146
SER	SC	Congaree National Park	Conduct Acoustic Sampling to Detect Endangered Bird Species	25,000
TOTAL				624,545

Appendix D: Water Resource Program Projects, FY 2009

Table D-1. Water resource protection projects, FY 2009

Region	State	Park	Project title	FY 2009 funding ($)
IMR	AZ	Montezuma Castle National Monument	Hydrologic Data Collection for the Verde River Adjudication	43,900
	CO	Great Sand Dunes National Park and Preserve	Hydrogeologic Data Analysis	134,400
	OK	Chickasaw National Recreation Area	Hydrologic Data Collection	2,200
	WY	Grand Teton National Park	Investigation of Hydrology of the Gros Ventre River	11,600
MWR	NE	Niobrara National Scenic River	Investigation of Water Dependent Resources	42,200
PWR	NV	Great Basin National Park	Investigation of Hydrogeology and Hydrologic Data Collection	207,900
	HI	Kaloko-Honokohau National Historical Park	Investigation of Hydrology and Water Dependent Values	141,100
	AZ, NV	Lake Mead National Recreation Area	Hydrologic Data Collection and Groundwater Modeling	5,000
	CA	Point Reyes National Seashore	Protection of Instream Flows	4,300
Service-wide	ALL	Servicewide	Support to the Office of the Solicitor	195,000
	ALL	Servicewide	Technical Support to All Projects and Technical Assistance	30,100
TOTAL				817,700

Table D-2. High-priority water resource project funding, FY 2009

Region	State	Park	Project title	FY 2009 funding ($)
IMR	CO	Great Sand Dunes National Park and Preserve	Court-Ordered Installation of Ten Ground Water Monitoring Wells at Great Sand Dunes National Park and Preserve	55,200
	TX	Palo Alto Battlefield National Historical Park	Develop Final Restoration Design and Contract Specifications for the Palo Alto Resaca, Palo Alto Battlefield NHP, Texas	47,500
PWR	NV	Great Basin National Park	Development of Hydrogeologic and Numerical Groundwater-Flow Model Analyses to Determine Potential Groundwater Withdrawal Impacts to Great Basin NP Resources	73,400
SER	FL, Virgin Islands	Biscayne National Park, Dry Tortugas National Park, Buck Island Reef National Seashore	Rapid Assessment Surveys and Protocols for Potential Lionfish Invasions in Select National Parks	50,000
Service-wide	Multiple	Multiple	Watershed Attributes and Their Influences on Impaired Waters in the National Park System	40,000
TOTAL				266,100

Table D-3. National Park Service sites with natural resource condition assessment projects in FY 2009 and organization performing the assessments

Region	State	Parks	Agency, cooperator/ partner, or contractor	FY 2009 funding ($)
AKR	AK	Denali National Park and Preserve, Klondike Gold Rush National Historical Park	Pacific Northwest CESU/ Saint Mary's University of Minnesota	148,000
IMR	AZ, NM	Montezuma Castle National Monument, Tuzigoot National Monument, Tumacacori National Historical Park, Gila Cliff Dwellings National Monument, Tonto National Memorial	Desert Southwest CESU/Aquatic Sciences Program, Sonoran Institute	102,000
	CO	Great Sand Dunes National Park and Preserve	Rocky Mountain CESU/ Colorado Natural Heritage Program, Colorado State University	70,000
	Multiple	Multiple	Rocky Mountain CESU/ Colorado State University (geospatial products for use in multiple Intermountain Region projects)	203,000
MWR	IA, MO	Effigy Mounds National Monument, Ozark National Scenic Riverways (ongoing project)	NPS Heartland I& M Network	15,000
	NE, SD, WY	Jewel Cave National Monument, Missouri National Recreational River, Wind Cave National Park, Devils Tower National Monument [1]	Great Rivers CESU/Saint Mary's University of Missouri	312,000
NCR	MD, VA	Monocacy National Battlefield, Manassas National Battlefield Park, Antietam National Battlefield	Chesapeake Watershed CESU/ University of Maryland	74,000
NER	VA	Appomattox Court House National Historical Park, Booker T. Washington National Monument, Petersburg National Battlefield, Richmond National Battlefield Park (ongoing)	Southern Appalachian CESU/Virginia Tech	44,000
	VA	Colonial National Historical Park	Chesapeake Watershed CESU/ University of Maryland	51,000
	NJ, NY	Morristown National Historical Park, Roosevelt-Vanderbilt National Historic Sites, Saratoga National Historical Park	Chesapeake Watershed CESU/Pennsylvania State University	127,000
PWR	CA	Sequoia and Kings Canyon National Parks (ongoing project)	Californian CESU/ University of California, Berkeley	166,000
	CA	Santa Monica Mountains National Recreation Area, Pinnacles National Monument, John Muir National Historic Site (ongoing)	Californian CESU/ University of California, Santa Barbara	43,000
	CA	Yosemite National Park, Devils Postpile National Monument	Yosemite National Park	90,000
	ID, MT	Craters of the Moon National Monument and Preserve, City of Rocks National Reserve, Hagerman Fossil Beds National Monument, Big Hole National Battlefield (ongoing)	Northwest Management, Inc.	108,000
SER	AL, FL, GA, NC, SC	Chattahoochee River National Recreation Area, Congaree National Park, Kennesaw Mountain National Battlefield Park, Moores Creek National Battlefield, Ocmulgee National Monument, Horseshoe Bend National Military Park, Cape Hatteras National Seashore, Cape Lookout National Seashore, Cumberland Island National Seashore, Timucuan Ecological and Historic Preserve	Piedmont – South Atlantic Coast CESU/ North Carolina State Univ.	25,000
	FL, LA, MS, TN	Gulf Islands National Seashore, Jean Lafitte National Historical Park and Preserve, Natchez Trace Parkway, Shiloh National Military Park, Vicksburg National Military Park	Piedmont – South Atlantic Coast CESU/ University of Georgia	271,000
TOTAL				1,849,000

[1] Devils Tower National Monument is in the Intermountain Region.

Appendix E: Resource Protection (RP) Projects, FY 2009

Table E-1. Resource Protection fully funded projects, FY 2009

Region	State	Park	Project title	Total funding ($)	FY 2009 funding ($)
AKR	AK	Denali National Park and Preserve	Protect Park Resources from Illegal Off Road Vehicle (ORV) Use	49,500	12,000
IMR	AZ	Saguaro National Park	Resource Protection and Restoration in an Urban Interface	114,700	50,000
	UT	Timpanogos Cave National Monument	Protecting Cave Resources through Enhanced Cave Security	60,000	60,000
PWR	CA	Mojave National Preserve	Protect Threatened Desert Tortoise from Road Mortality	43,000	14,000
TOTAL				267,200	136,000

Table E-2. Resource Protection new and ongoing projects, FY 2009

Region	State	Park	Project title	Total funding ($)	FY 2009 funding ($)
AKR	AK	Glacier Bay National Park and Preserve	Protect Bears from Human-Caused Mortalities, Disturbance, and Displacement	69,000	27,000
IMR	WY	Grand Teton National Park	Protect Bears and Other Wildlife With New VIP Corps, Other Partnerships, Protocols and Media	72,000	33,000
MWR	MO	Ozark National Scenic Riverways	Protect Natural and Cultural Resources from Illegal Off-Road Vehicle Impacts	138,000	62,000
SER	KY	Mammoth Cave National Park	Protecting and Preserving Poached Plant Communities	75,000	25,000
TOTAL				354,000	147,000

Appendix F: Natural Resource Preservation Program Projects (NRPP), FY 2009

Table F-1. NRPP–Alaska Special Projects, FY 2009

Park	Project title	Total funding ($)	FY 2009 funding ($)
Denali National Park and Preserve	Inventory the Bryophyte and Lichen Flora of Denali, Yukon-Charley, and Wrangell-St. Elias	90,920	35,231
Denali National Park and Preserve	Inventory and Protection of Paleontological Sites (Dinosaurs) in Denali NP	77,975	23,069
Denali National Park and Preserve	Modeling Caribou Habitat at a Landscape Scale to Determine the Potential Impacts of Climate Change	65,737	31,333
Denali National Park and Preserve	Monitor Subsistence Fisheries throughout the Northwest Portion of Denali National Park	39,760	15,252
Klondike Gold Rush National Historical Park	Create a Regional Soundscape/Acoustic Data Collection Equipment Cache	28,174	10,242
Lake Clark National Park and Preserve	Assess Wolf Population Status and Predation Rate in Lake Clark National Park and Preserve	177,728	81,637
Wrangell-St. Elias National Park and Preserve	Evaluating the Genetic Structure of Dall's Sheep in Wrangell St. Elias National Park and Preserve	147,359	71,266
Wrangell-St. Elias National Park and Preserve	Paired-Catchment Study of ATV Impacts on Water Quality in Wrangell-St. Elias	50,000	23,831
Wrangell-St. Elias National Park and Preserve	Improve Subsistence Management with Up-to-Date Information on Resource Use in Yakutat	90,944	74,354
Yukon-Charley Rivers National Preserve	Using Radiotelemetry to Assess Genetic Variation in Wolves of Yukon-Charley Rivers National Preserve	53,971	26,453
Yukon-Charley Rivers National Preserve	Understanding Lake Disappearance through Time in Northern Alaskan Parks	79,286	40,207
Yukon-Charley Rivers National Preserve	Cretaceous Alaska: Paleontological Inventory of Yukon-Charley Rivers National Preserve	113,800	29,455
Alaska Regional Office	Regional Assessment	4,670	4,670
TOTAL		1,020,324	467,000

Table F-2. NRPP–Disturbed Lands Restoration fully funded projects, FY 2009

Region	State	Park	Project title	Total funding ($)	FY 2009 funding ($)
IMR	AZ	Wupatki National Monument	Restore Abandoned NPS Housing/Maintenance Area at Heiser Springs	76,000	26,000
	CO	Rocky Mountain National Park	Restore 600 Acres of Native Wetland to Enhance Visitor Photo Opportunities	124,000	14,000
	MT	Glacier National Park	Restore Severely Denuded, Eroding Park Lands in Lunch Creek and Iceberg Lake High Visitor Use Areas	75,000	20,000
	TX	Big Bend National Park	Restoring Grasslands in Big Bend National Park	248,000	90,000
PWR	CA	Point Reyes National Seashore	Restore Paleodune and Climbing Dune Dynamics at Point Reyes Headlands	249,000	36,000
	CA	Lava Beds National Monument	Restore Two Prominent Volcanic Buttes at Lava Beds National Monument	106,000	36,000
SER	KY, TN	Big South Fork National River and Recreation Area	Plug 8 Abandoned Wells and Perform Associated Surface Reclamation in Big South Fork NRRA	249,000	21,000
TOTAL				1,127,000	243,000

Table F-3. NRPP–Disturbed Lands Restoration new and ongoing projects, FY 2009

Region	State	Park	Project title	Total funding ($)	FY 2009 funding ($)
IMR	MT	Glacier National Park	Restoration of Soils and Vegetation at Running Eagle Falls in Glacier National Park	65,000	15,000
	MT	Glacier National Park	Stabilization of Eroding Soils and Restoration of Vegetation to the Big Bend Area, Glacier National	50,000	20,000
	TX	Lyndon B. Johnson National Historical Park	Restore Prairie at 5 National Park Units in 3 States	249,000	97,000
PWR	CA	Point Reyes National Seashore	Restoring Historic Rock Quarries	98,000	85,000
	VA	Prince William Forest Park	Disturbed Land Restoration of the Headwaters of Quantico Creek	98,000	90,000
SER	GA	Chattahoochee River National Recreation Area	Support Corporate Wetland Restoration Partnership Initiative in Johnson Ferry Unit	73,000	25,000
	KY, TN	Big South Fork National River and Recreation Area	Plug and Reclaim Eight Wells at Big South Fork National Recreation Area	250,000	215,000
TOTAL				883,000	547,000

Table F-4. NRPP–Natural Resource Management fully funded projects FY 2009

Region	State	Park	Project title	Total funding ($)	FY 2009 funding ($)
AKR	AK	Glacier Bay National Park and Preserve	Investigate Causal Factors of Harbor Seal Decline in Glacier Bay National Park and Preserve	326,000	22,000
IMR	UT	Zion National Park	Determine Recreational Impacts on Threatened Mexican Spotted Owls on the N. Colorado Plateau	198,000	61,000
NCR	DC	National Capital Regional Office	To Weed or Not to Weed? An Economic Decision Support Tool for National Capital Region Parks	310,000	160,000
NER	MA	Cape Cod National Seashore	Evaluating the Status of Spawning Horseshoe Crabs, *Limulus polyphemus*, within Cape Cod NS	172,000	78,000
PWR	CA	Point Reyes National Seashore	Control Exotic Deer	749,000	123,000
	HI	Hawaii Volcanoes National Park	Control Disruptive Alien Weeds and Restore Rare and Endangered Plants in Mesic Koa and Koa-Manele Forest	222,000	110,000
	HI	Kalaupapa National Historical Park	Exclude Ungulates from the Northern Unit of Puu Alii Plateau	445,000	109,000
SER	FL	Canaveral National Seashore	Create Hydrologic Model of Mosquito Lagoon at Canaveral National Seashore	280,000	90,000
	KY	Mammoth Cave National Park	Optimal Lighting in National Park System Caves	239,000	53,000
TOTAL				2,941,000	806,000

Table F-5. NRPP–Natural Resource Management new and ongoing projects, FY 2009

Region	State	Park	Project title	Total funding ($)	FY 2009 funding ($)
AKR	AK	Glacier Bay National Park and Preserve	Determine Impacts of Increased Cruise Ship Traffic on Endangered Humpback Whales	159,000	89,000
IMR	AZ	Canyon de Chelly National Monument	Implement Restoration Prescriptions: Native Seed Collection, Propagation and Revegetation	363,500	140,000
	AZ	Organ Pipe Cactus National Monument	Illegal Migration in AZ Border Parks: Assessment, Protection and Restoration of Resources	238,000	67,000
	CO	Rocky Mountain National Park	Reduce Elk Numbers to Restore a Healthy Ecosystem that Supports Diverse Wildlife	308,000	145,000
	ID, MT, WY	Yellowstone National Park	Management of Introduced Mountain Goats in Yellowstone National Park	197,000	74,000
	NM	Bandelier National Monument	Restore Degraded Pinon-Juniper Landscape: Phase I (of 3)	388,000	132,000
MWR	IN	Indiana Dunes National Lakeshore	Restore the Biological Resources of the Cowles Bog Wetland Complex: Phase II-Fen Recovery	251,000	81,000
	MI	Sleeping Bear Dunes National Lakeshore	Identify the Sources, Species and Pathways In Recent Type E Botulism Waterfowl Dieoffs	175,000	96,000
	MI	Voyageurs National Park	Assessing the Effects of the Namakan Reservoir Operations on Lake Sturgeon Ecological Habitats	307,000	103,000
	SD	Badlands National Park	Assess Long-term Viability of Restored Swift Fox in Badlands NP and South Dakota	341,000	115,000
		Midwest Regional Office	Determine Invasion Status and Ecological Impacts of an Exotic Zooplankter in Great Lakes Parks	190,000	75,000
		Midwest Regional Office	Risk of Plague to Prairie Dog Populations in Five Great Plains' Parks	93,000	46,000
NER	MA	Boston Harbor Islands National Recreation Area	Sediment Transport and Salt Marsh Development in Boston Harbor Islands NRA	271,000	88,000
	MA	Cape Cod National Seashore	Cape Cod Shoreline Change and Resource Protection II	112,000	58,000
PWR	CA	Channel Islands National Park	Eradicate Dense Fennel and Facilitate Eradication of Feral Pigs	455,000	151,000
	CA	Pinnacles National Monument	Protect Recently Acquired Sensitive New Lands from Exotic Pigs	272,000	83,000
	CA	Pinnacles National Monument	Restore Rare Bottomlands of Newly Acquired Ranch	184,000	69,000
	CA	Point Reyes National Seashore	Marine Resource Assessment for Marine Protected Areas	180,000	59,000
	CA	Santa Monica Mountains National Recreation Area	Sources, Prevalence, and Impacts of Anticoagulant Poisons on Wildlife in an Urban NP	258,000	67,000
	WA	North Cascades National Park	Eradicate Non-native Trout from Seven Lakes in North Cascades NPS Complex, Washington	383,000	151,000
SER	FL	Dry Tortugas National Park	Dry Tortugas Research Natural Area Implementation	282,000	94,000
	NC, TN	Great Smoky Mountains National Park	Preserving Smoky Mountain Hemlock Forests from Destruction by an Invasive Insect	350,000	117,000
Servicewide		Assoc. Director, NRSS	National Academy of Public Administration (NAPA) Review		222,000
		Assoc. Director, NRSS	Improve Communications Equipment		10,000
			Other		1,000
TOTAL				5,757,500	2,333,000

Table F-6. NRPP–Regional Program Block projects, FY 2009

Region	State	Park	Project title	Total funding ($)	FY 2009 funding ($)
AKR	AK	Alaska Regional Office	Natural Resource Employees Professionalization and Technical Competency Enhancement	197,000	25,635
	AK	Alaska Regional Office	Alaska Park Cooperative and Technical Assistance Projects (Regional Block Grant)	155,000	15,150
	AK	Alaska Regional Office	Produce Alaska Park Science Journal	435,000	38,885
	AK	Alaska Regional Office	Alaska Scientific and Technical Reports	66,000	7,000
	AK	Alaska Regional Office	PLC - Volunteer Crew for Invasive Plant Removal in Katmai, Kenai Fjords, and Wrangell-St. Elias	113,000	20,413
	AK	Denali National Park and Preserve	Implement Regional Integrated Pest Management (IPM) Program to Insure Health of Natural Resources	49,000	4,775
	AK	Denali National Park and Preserve	Develop High Resolution Climate Maps for the Alaska Region	43,000	10,600
	AK	Denali National Park and Preserve	Documenting Traplines and Trapping Activities in Two Alaska Parks	64,000	20,378
	AK	Klondike Gold Rush National Historical Park	Create a Regional Soundscape / Acoustic Data Collection Equipment Cache	28,000	10,242
	AK	Klondike Gold Rush National Historical Park	Publish an Annotated Checklist of Alaskan Lichens	6,000	5,893
	AK	Yukon-Charley Rivers National Preserve	Cretaceous Alaska: Paleontological Inventory of Yukon-Charley Rivers National Preserve	113,800	27,701
IMR	AZ	Petrified Forest National Park	Inventory Paleontological Resources On Newly Acquired Park Lands For General Management Plan	37,308	19,100
	AZ, UT	Glen Canyon National Recreation Area	Develop Resource Assessment Protocols for Grazing Allotments in Glen Canyon National Recreation Area	39,000	19,200
	CO	Mesa Verde National Park	Sources of Mercury Deposition to Mesa Verde National Park	25,000	15,560
	CO	Rocky Mountain National Park	Provide Access to a Bighorn Sheep Mineral Lick	40,000	22,080
	MT	Glacier National Park	Assess and Restore Native Habitat	144,000	20,000
	NM	Carlsbad Caverns National Park	Monitor Bats at Carlsbad Caverns National Park Using Long-term Echolocation Stations	19,000	18,500
	UT	Bryce Canyon National Park	Implement Exotic Plant Control to Areas Identified through Inventories	40,000	20,000
	UT	Timpanogos Cave National Monument	Restore Cave Resources	39,692	19,700
	WY	Devils Tower National Monument	Restore a 50-Acre Shortgrass Meadow and Control Exotic Invasive Plant Species	40,000	30,000
MWR	IN	Indiana Dunes National Lakeshore	Prevent Invasive Plant Expansion through Early Detection and Rapid Response	18,000	17,390
	KS	Tallgrass Prairie National Preserve	Prairie Butterfly Inventory and Assessment of the Effects of Fire and Grazing Management	14,688	15,040

Table F-6 (cont). NRPP–Regional Program Block projects, FY 2009

Region	State	Park	Project title	Total funding ($)	FY 2009 funding ($)
	MI	Isle Royale National Park	Beaver Population Monitoring at Isle Royale National Park: A Long-Standing Program in need of Update	17,000	16,920
	MI	Pictured Rocks National Lakeshore	Assess Vernal Pools of PIRO by Determining Distribution, Abundance, and Ecological Significance	18,000	17,860
	MN	Voyageurs National Park	Assess Threat to Moose Population from Sympatric White-tailed Deer	17,485	24,610
	MO	Wilson's Creek National Battlefield	Preserving Prairie Restoration in Crisis	14,800	14,570
	SD	Badlands National Park	Expand Park Paleontological Database to Cover all of the Saddle Pass Area	20,000	19,790
	SD	Wind Cave National Park	Complete Wind Cave and Pringle Geologic Quadrangle Maps at Wind Cave National Park	17,200	16,920
		Midwest Regional Office	Locate Native, Exotic, and Hybrid Cattail Populations in CUVA, PIRO, and SLBE	15,000	15,510
NCR	DC	National Mall and Memorial Parks	Conduct urban forest inventory at East Potomac Park, NAMA	18,000	18,300
	DC, MD, VA	George Washington Memorial Parkway	Collembolan Survey of George Washington Memorial Parkway	10,000	9,500
	MD	Antietam National Battlefield	Evaluate Impacts of White-Tailed Deer on Forest Vegetation at ANTI, MONO, and CHOH	20,000	20,000
	MD	Catoctin Mountain Park	Survey of the Dragonflies and Damselflies of Catoctin Mountain Park	9,000	8,200
	VA	Prince William Forest Park	Identify Orchid-Fungi Relationships for *Isotria medeoloides*	30,000	10,000
		National Capital Regional Office	Photo-interpretation and Accuracy Assessment for Vegetation Classification in NCR	96,000	25,000
		National Capital Regional Office	Providing Opportunities for Profession Development for NCR Natural Resource	79,000	25,000
		National Capital Regional Office	Integrating Science with Resource Management through Collaborative Approaches	71,000	20,900
NER	MA	Boston Harbor Islands National Recreation Area	Restore Natural Biodiversity to Boston Harbor Islands	238,000	20,000
	MA	Cape Cod National Seashore	Prepare Environmental Impact Statement for the Estuarine Restoration of Herring River	760,000	30,000
	ME	Acadia National Park	Develop Restoration Prescriptions for Impaired Streams in Acadia National Park, Maine	20,000	10,000
	NY	Fire Island National Seashore	Impacts of Beach Scraping and Artificial Dune Creation on the Natural Resources	86,000	4,833
	NY	Fire Island National Seashore	Development of a Vegetation Management Plan	25,000	25,000
	NY, PA	Upper Delaware Scenic and Recreational River	Determine Age Structure of American Shad in the Upper Delaware River	17,065	4,863

Table F-6 (cont). NRPP–Regional Program Block projects, FY 2009

Region	State	Park	Project title	Total funding ($)	FY 2009 funding ($)
	NY, PA	Upper Delaware Scenic and Recreational River	Determine Status of State-Endangered Bridle Shiner in Delaware River and Selected Tributaries	40,000	20,195
	PA, NJ	Delaware Water Gap National Recreation Area	Delaware River Highlands Sustainability Project	21,000	11,200
	PA, NJ	Delaware Water Gap National Recreation Area	Delaware River Highlands Sustainability Project	21,200	10,000
	VA	Manassas National Battlefield Park	Post Clear Cut Plant and Aquatic Community Monitoring	12,000	3,700
	VA	Manassas National Battlefield Park	Establish Native Warm Season Grassland	5,000	4,800
	VA	Shenandoah National Park	Characterize Threatened and Impaired Headwater Streams and Springs	336,723	4,587
	VA	Shenandoah National Park	Eradicate Wavyleaf Basketgrass	47,506	15,425
PWR	CA	Sequoia and Kings Canyon National Parks	Restore Reed Canarygrass-Invaded Meadows in Grant Grove	99,878	33,052
	CA	Sequoia and Kings Canyon National Parks	Restoration of Mountain Yellow-legged Frogs and High Mountain Lakes and Streams in SEKI	99,924	27,661
	HI	Haleakala National Park	Remove Feral Animals To Protect Rare High Elevation Koa-Ohia Forest Community	140,000	43,607
	HI	Hawaii Volcanoes National Park	East Rift Rain Forest Rare Plant Project	79,000	13,440
	OR	Crater Lake National Park	Determine and Compare Pika Microdistribution and Habitat Use in Four Park Units	87,000	30,000
	WA	North Cascades National Park	Status and Distribution of the Marbled Murrelet in NOCA	65,000	26,800
	WA	Olympic National Park	Improve Razor Clam Management at Olympic National Park by Predicting Pathogen Outbreaks	70,557	11,440
SER	AR	Buffalo National River	Revise River Use Management Plan	18,000	16,230
	FL	Canaveral National Seashore	Mapping Impacts of Recreational Boating Versus Restoration on Oyster Reefs at CANA	25,000	24,700
	GA	Chattahoochee River National Recreation Area	Biological Monitoring Using Aquatic Invertebrate Communities in the Chattahoochee River	107,000	12,400
	GA	Cumberland Island National Seashore	Feral Hog Population Control on Cumberland Island NS	25,000	24,700
	GA	Kennesaw Mountain National Battlefield Park	Eradicate Garlic Mustard on Kennesaw Mountain	25,000	11,900
	KY, TN	Big South Fork National River and Recreation Area	River Habitat Mapping (bathymetric) for Pools, Riffles and Endangered Species Mussel Habitat	50,000	12,500
	MD, VA	Assateague Island National Seashore	Minimize Resource Impacts of Recreational Driving on Over Sand Vehicle Zone	25,000	25,800
	NC	Carl Sandburg Home National Historic Site	Treat Japanese Stiltgrass Throughout Park	12,214	12,214
	SC	Congaree National Park	Assess the Long-Term Flood History of the Congaree River and its Relation to Channel Geomorphology	25,000	24,700

Table F-6 (cont). NRPP–Regional Program Block projects, FY 2009

Region	State	Park	Project title	Total funding ($)	FY 2009 funding ($)
	TN	Obed Wild and Scenic River	Clear Creek Oil Spill: An Assessment of Effects by USGS	20,000	19,800
	TN	Stones River National Battlefield	Restoration of Three Highly Disturbed Sites at Stones River National Battlefield	24,008	23,700
	WV	Harpers Ferry National Historical Park	Identify and Create a Protocol for Vegetation Analysis	20,000	20,000
	WV	Harpers Ferry National Historical Park	Developing a GIS Database and Assessment of Available Hydrogeologic Data for Three Parks with Karst	20,000	20,000
Servicewide		All Regions	Regional Assessments	37,431	37,431
TOTAL				4,883,479	1,303,000

Table F-7. NRPP–Small Park Block projects, FY 2009

Region	State	Park	Project title	Total funding ($)	FY 2009 funding ($)
AKR	AK	Klondike Gold Rush National Historical Park	Monitoring Air Quality in the Southeast Alaska Network: Linking Pollutants with Ecological Effects	85,753	9,405
	AK	Sitka National Historical Park	Conduct Benthic Invertebrate and Algae Investigations to Determine Biological Water Quality Indexes	48,500	9,405
IMR	AZ	Canyon de Chelly National Monument	Determine Distribution and Abundance of Threatened Mexican Spotted Owls on North Rim	37,900	19,900
	AZ	Flagstaff Area Parks	Acoustic Monitoring in Walnut Canyon National Monument	29,700	9,800
	AZ	Grand Canyon-Parashant National Monument	Restore Tassi Spring Native Vegetation and Rare Aquatic Animal Habitat	26,700	26,700
	AZ	Hubbell Trading Post National Historic Site	Integrate Newly Introduced Agricultural Activity with Natural Resource Management at HUTR	40,586	5,330
	CO	Bent's Old Fort National Historic Site	Restore Eight Acres of Short-grass Prairie Adjacent to the Fort	92,638	22,500
	CO	Bent's Old Fort National Historic Site	Repair Eroding Irrigation Return Ditch and River Outlet	15,015	15,000
	CO	Colorado National Monument	Restore Native Vegetation After Resurfacing Historic Rim Rock Drive	18,540	12,700
	OK	Chickasaw National Recreation Area	Monitor Wastewater Discharges to Rock Creek	19,650	19,700
	TX	Fort Davis National Historic Site	Develop A Flood Mitigation Plan To Lower Threat To Life And Property	30,000	20,000
	UT	Arches National Park	Assessing Ecological Impacts of Tamarisk Leaf Beetle on Treated Tamarisk Stands: Arches NP	40,000	20,000
	UT	Cedar Breaks National Monument	Prevent Degradation of Native Mountain Meadows	39,850	19,900
	UT	Natural Bridges National Monument	Evaluate Status and Trends of Sensitive Plant Species in Seeps and Springs in NABR	39,950	20,000
	UT	Timpanogos Cave National Monument	Establish Bat Species Baseline through Echolocation Monitoring Stations	38,950	19,000

Table F-7 (cont). NRPP–Small Park Block projects, FY 2009

Region	State	Park	Project title	Total funding ($)	FY 2009 funding ($)
MWR	IA	Herbert Hoover National Historic Site	Remove Exotic Plants from 2.6 Miles of Pathways in Prairie	11,210	13,810
	KS	Fort Larned National Historic Site	Reintroduce Native Grasses and Forbs	5,000	6,110
	MN	Grand Portage National Monument	Research Ecology, Propagation, Ethnobotany and Management of Ethnographically Significant Plants	14,988	15,040
	MN	Pipestone National Monument	Develop Strategies for Wetlands Management and Implement Disturbed Lands Restoration	14,970	15,040
	ND	Knife River Indian Villages National Historic Site	Development of a Comprehensive Forest Management Plan	30,000	15,510
	NE	Scotts Bluff National Monument	Treat Exotic Plants at Scotts Bluff National Monument Using an Integrated Approach	29,878	11,280
	OH	Hopewell Culture National Historical Park	Establish Native Grassland at Hopeton Earthworks Unit	12,480	12,220
	SD	Jewel Cave National Monument	Reduce Human Introduction of Lint and Debris into Cave Ecosystem	2,070	2,820
	SD	Jewel Cave National Monument	Trace Hydrologic Path of Point Source Contamination	4,400	4,700
	SD	Jewel Cave National Monument	Research Paleoflood History of the Jewel Cave Area	4,899	4,888
NCR	DC	National Capital Parks-East	Map Identified Rare, Threatened and Endangered Plant Species within National Capital Parks-East	9,600	9,000
	DC, MD, VA	George Washington Memorial Parkway	Inventory Insects in Turkey Run and Great Falls Parks	30,000	10,000
NER	MA	Boston Harbor Islands National Recreation Area	Determine Bat Community Composition of Six Northeast Parks	90,000	45,000
	MA	Boston Harbor Islands National Recreation Area	Effects of Nonnative European Rabbits and Norway Rats on the Plant Species Composition of Lovells Is	5,120	5,120
	MA	Minute Man National Historical Park	Assess Beaver Management Options to Restore Cultural Landscapes	10,600	600
	NY	Sagamore Hill National Historic Site	Implement Invasive Species Control Program	30,000	10,000
	PA	Johnstown Flood National Memorial	Delineate Wetlands at JOFL Historic Lakebed	15,000	12,560
	VA	Colonial National Historical Park	Control Phragmites through Aerial and Ground Spraying	19,056	10,000
	VA	Richmond National Battlefield Park	Conduct Biological Inventories at Newly Acquired Park Sites	72,414	13,920
	VA	Valley Forge National Historical Park	Resource Stewardship Strategy	30,000	2,440
	VT	Marsh-Billings-Rockefeller National Historical Park	Evaluate Vernal Pool Use by Amphibians	20,950	6,700
PWR	CA	Lava Beds National Monument	Replace Old Trail/Cave Counters with TRAFx Advanced Counting Systems	6,710	1,867
	CA	Lava Beds National Monument	Analyze Perennial Ice Resources within Lava Tubes: This is the Last Chance.	9,000	3,900

Table F-7 (cont). NRPP–Small Park Block projects, FY 2009

Region	State	Park	Project title	Total funding ($)	FY 2009 funding ($)
	CA	Muir Woods National Monument	Develop Methods and Control *Ehrharta erecta* in Muir Woods	30,000	14,965
	ID	Craters of the Moon National Preserve	Complete Exotic Plant Management Plan and Environmental Compliance for 5 Small Park Units	50,000	23,300
	OR	Crater Lake National Park	Determine and Compare Pika Microdistribution and Habitat Use in Four Park Units	87,160	57,160
	Amer. Samoa	National Park of American Samoa	Reduce and Control the Most Destructive Invasive Tree in NPSA: *Falcataria moluccana*	79,824	26,608
	WA	Whitman Mission National Historic Site	Remove Non-Native Trees	6,800	6,500
SER	AR	Arkansas Post National Memorial	Implement Exotic Plant Management	12,507	12,220
	AR	Pea Ridge National Military Park	Pea Ridge NMP Resource Stewardship Plan	17,000	12,980
	FL	De Soto National Memorial	Mapping of Floral Communities	5,875	5,900
	FL	Timucuan Ecological and Historic Preserve	Update GIS Coverages and Train Resources Staff in Usage	24,400	23,700
	FL, MS	Gulf Islands National Seashore	Partnering with SCA and Escambia County for Sea Turtle Conservation at GUIS	17,800	17,800
	GA	Ocmulgee National Monument	Manage Feral Hog Invasion	19,500	18,800
	GA, TN	Chickamauga and Chattanooga National Military Park	Control Exotic Plants on Missionary Ridge Battlefield	25,000	24,700
	KY	Abraham Lincoln Birthplace National Historical Park	Reduce Wildfire Hazards	50,000	19,800
	MS	Vicksburg National Military Park	Control Exotic Chinaberry Tree Species	27,500	14,800
	SC	Kings Mountain National Military Park	Conduct Survey of Macroinvertebrates	25,000	24,330
	TN	Obed Wild and Scenic River	Assessment of a Hydrilla Infestation in the Emory River Watershed	24,984	25,000
	Virgin Islands	Virgin Islands Coral Reef National Monument	Habitat Protection and Resource Access in VICR	24,800	24,700
Servicewide		All Regions	Regional Assessments	1,834	1,834
		Intermountain Regional Office	Create Exotic Vegetation Management Plans Fossil Butte NM and Golden Spike NHS	20,000	15,750
		Intermountain Regional Office	Create Exotic Vegetation Management Plans For Two Small Parks – Grant Kohrs Ranch and Little Bighorn	20,000	20,000
		Midwest Regional Office	Development of Park Natural Resource Programs	188,600	33,182
		Northeast Regional Director's Staff	Develop a Volunteer-Based Bird Monitoring Protocol for Small Parks	24,500	8,500
		Southeast Regional Office	Southeast Region Parks Natural Resources/CESU Workshop	22,500	18,606
TOTAL				1,887,661	933,000

Table F-8. NRPP–Servicewide projects, FY 2009

Park	Project title	Total funding ($)	FY 2009 funding ($)
Air Quality - Washington Office	Sustain Night Sky Programmatic Tasks	40,000	40,000
Air Quality - Washington Office	Assess Effects of Nitrogen Deposition and Climate Change in Rocky Mountain Alpine Ecosystems	20,000	20,000
Assoc. Director, Natural Resource Stewardship and Science	Director's Annual Natural Resource Awards	205,000	50,000
Assoc. Director, Natural Resource Stewardship and Science	Serving as NPS Senior Scientist for ADNRSS and Director	175,000	50,000
Assoc. Director, Natural Resource Stewardship and Science	Research Learning Centers - National Coordination	25,000	25,000
Assoc. Director, Natural Resource Stewardship and Science	Best Practices for Shellfish Mariculture and a Scientific Review of Ecological Effects at Point Reyes NS	84,200	24,200
Environmental Quality Division - Washington Office	Continued Implementation of the Emergency Response Program	140,000	30,000
Environmental Quality Division - Washington Office	Resource Advisor (READ) Program to Support All Hazards Incidents	130,000	30,000
Geologic Resources Division - Washington Office	Address Critical Geoscience Needs in the NPS	40,000	40,000
Geologic Resources Division - Washington Office	Develop Renewable Energy Fact Sheets for Use by Parks	15,000	15,000
Geologic Resources Division - Washington Office	Geoscientists in the Park		15,000
Natural Resource Program Center OCD, WASO	Web Design Services to Support NRPC and NRSS needs	40,000	40,000
Natural Resource Program Center OCD, WASO	Supporting the Use of Climate Change Scenarios for Park General Management and Resource Stewardship	40,000	40,000
Natural Resource Program Center OCD, WASO	*Park Science* Bulletin (FY 2009)	30,000	30,000
Natural Resource Program Center OCD, WASO	"Views of the National Parks" - FY09 Enhancements	30,000	30,000
Natural Resource Program Center OCD, WASO	Evaluating the Carbon Storage Potential of NPS Ecosystems	20,000	20,000
Natural Resource Program Center OCD, WASO	Partnership Evaluation		14,000
Natural Resource Program Center OCD, WASO	The Administration of Scientific Research in the Parks and the RPRS	2,700	2,700
NRSS Biological Resource Management Division	Isle Royal Long Term Research Study-Wolves and Moose	50,000	50,000
NRSS Biological Resource Management Division	Get the Lead Out!	40,000	40,000
NRSS Biological Resource Management Division	Initiate and Implement Critical Migratory Species Data Compilation and Program Development	53,800	18,800
NRSS Biological Resource Management Division	Workshop to Identify Best Practices for Addressing Plague to Protect Wildlife and Human Health	16,000	16,000
Water Resources Division - Washington Office	Hold Service-wide Ocean/Coastal Park Workshop	25,000	25,000
	Other		98,000
TOTAL		1,221,700	763,700

Table F-9. NRPP–Threatened and Endangered Species fully funded projects, FY 2009

Region	State	Park	Project title	Total funding ($)	FY 2009 funding ($)
IMR	AZ	Coronado National Memorial	Protect Mine Roosts of Endangered Lesser Long-nosed Bats	77,544	55,000
PWR	CA	Santa Monica Mountains National Recreation Area	Investigation and Mitigation of Pollen Limitation in the Endangered Plant, *Pentachaeta lyonii*	65,200	26,000
TOTAL				142,744	81,000

Table F-10. NRPP–Threatened and Endangered Species new and ongoing projects, FY 2009

Region	State	Park	Project title	Total funding ($)	FY 2009 funding ($)
IMR	AZ, UT	Glen Canyon National Recreation Area	Create a Protected Nursery to Expand Populations of Endangered Colorado River Native Fish	49,965	29,000
	CO	Rocky Mountain National Park	Determine the Distribution of Greenback Cutthroat Trout in Rocky Mountain National Park	148,150	51,000
	TX	Padre Island National Seashore	Establish New Techniques to Protect Increasing Numbers of Endangered Kemp's Ridley Sea Turtle Eggs	150,000	52,000
MWR	MN, WI	Saint Croix National Scenic Riverway	Modeling Sediment Dynamics in the St. Croix River and the Impact on Federally Endangered Mussels	149,174	53,000
PWR	CA	Golden Gate National Recreation Area	Enhance Habitat for GGNRA Mission Blue Butterfly through Habitat Disturbance Actions	129,000	43,000
	CA	Pinnacles National Monument	Restoring California Condors at Pinnacles NM: Use of Isotopes to Identify Sources of Lead Poisoning	150,000	91,000
SER	TN, NC	Great Smoky Mountains National Park	Recovery and Evaluation of Introduced Endangered fished Through Interdivisional Outreach and Monitoring	91,107	67,000
TOTAL				867,396	386,000

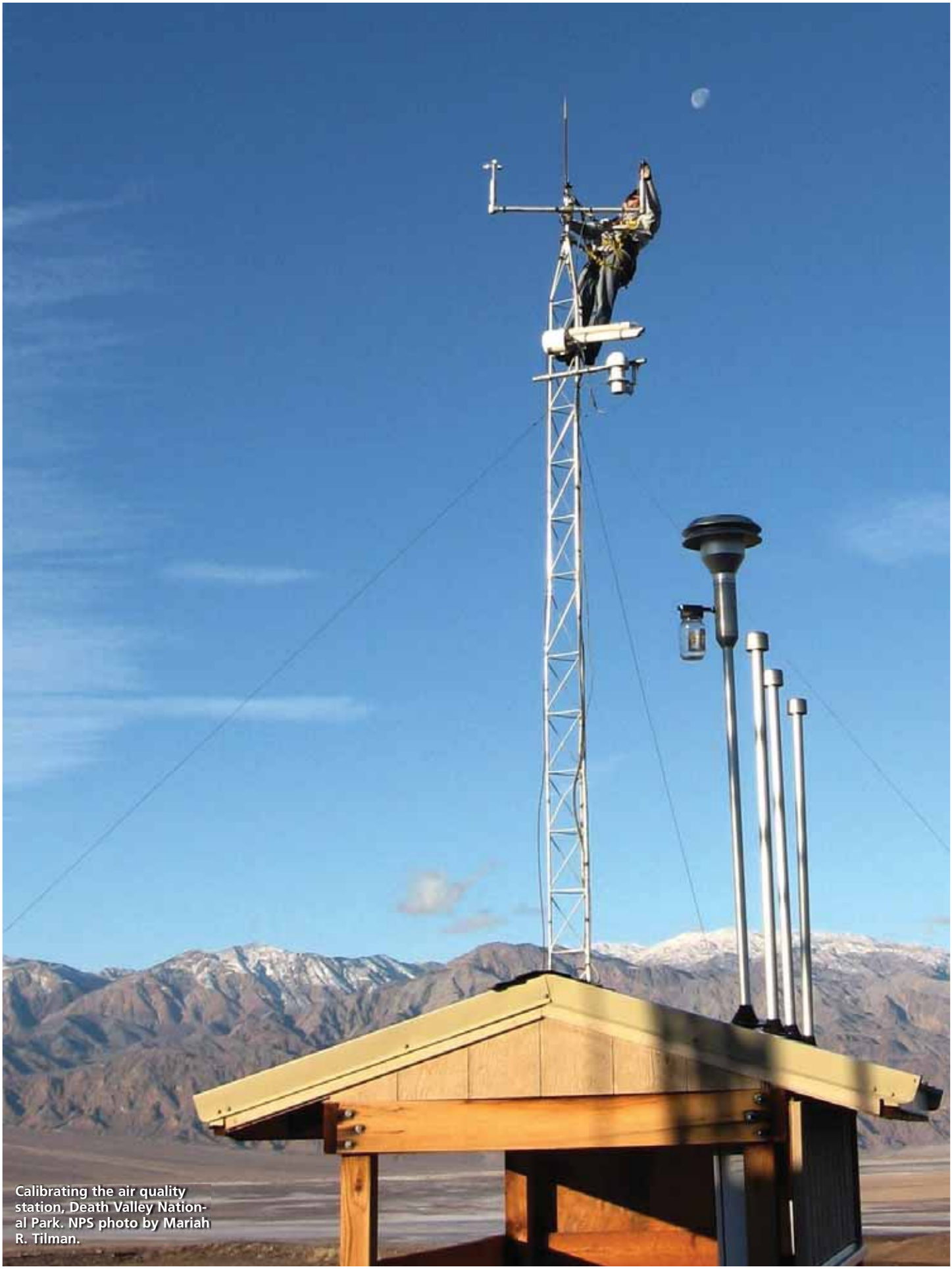
Appendix G: Park-Oriented Biological Support (POBS) Projects, FY 2009

Table G-1. Park-Oriented Biological Support (POBS) projects, FY 2009

Region	State	Park	Project title
AKR	AK		Monitoring the Body Condition of Caribou in Late Winter: Developing and Evaluating a 'Hands Off' Approach
IMR	CO	Rocky Mountain National Park	Developing a Non-Invasive Technique for Bighorn Sheep Population Estimation Using Fecal DNA, Rocky Mountain National Park, Colorado
	CO, WY	Grand Teton National Park, Rocky Mountain National Park	Identifying Factors Driving the Divergent Effects of Disease on Amphibians in Two National Park Ecosystems in the Rocky Mountains
	ID, MT, WY	Yellowstone National Park	Use of Molecular Techniques in Surveying Infectious Diseases of Gray Wolves in Yellowstone National Park
	MT	Glacier National Park	Black Bear Population Size and Distribution in Glacier National Park
MWR	MN, WI	Saint Croix National Scenic Riverway	Determine the Effects of Food Quality on Juvenile Unionid Mussel Survival and Growth in the St. Croix National Scenic Riverway
	OH	Cuyahoga Valley National Park	Implementation of Models for Predicting Exceedances of *E. coli* Standards in the Cuyahoga River, Cuyahoga Valley National Park, Ohio
NER	MA, MD, ME, NY, VA	Acadia National Park, Assateague Island National Seashore, Cape Cod National Seashore, Fire Island National Seashore	Seagrass Condition Assessment within the NPS North Atlantic Coastal Parks: Site Selection, Training, and Integration with National Programs
	ME	Acadia National Park	Does Acadia National Park Need a Sea Run Brook Trout Management Plan? Detecting Marine Habitat Use by Stream-Dwelling Trout in a Coastal Stream
PWR	CA	Channel Islands National Park	Technical Assistance in Determining Population Abundance And Composition Of Non-Native Deer and Elk During Phased Population Reductions at Santa Rosa Island, Channel Islands National Park
	CA	Channel Islands National Park	Channel Islands Loggerhead Shrike Population Size and Territory Locations
	HI	Haleakala National Park	Population Dynamics and Pollination Ecology of the Threatened Haleakala Silversword
	HI	Hawaii Volcanoes National Park	Tracking Nene Movements across Park Boundaries
	WA	Olympic National Park	Predicting Spread of Invasive Exotic Plants into De-watered Reservoirs following Dam Removal on the Elwha River, Olympic National Park, WA
SER	FL	Dry Tortugas National Park	Human Fecal Microflora as a Source of Coral Pathogens in the Dry Tortugas National Park: Are Coral Pathogens Invasives or Endemic
	FL	Everglades National Park	Soil Chemistry Changes Affected by Pine Trees and Exotic Plants in Native and Disturbed Pine Rockland, Everglades NP
	FL	Everglades National Park	Habitat Characterization of Juvenile Snook and Other Gamefish in Tarpon Bay, Everglades National Park, FL
	LA	Jean Lafitte National Historical Park and Preserve	Effects of Dredge Spoil Applications on Subsiding Coastal Baldcypress Swamps in Jean Lafitte National Historical Park and Preserve, Louisiana
	Virgin Islands	Buck Island Reef National Monument	Demography of Sea Turtle Nesting Populations in the Caribbean

Park Index

State and Territory Index



Calibrating the air quality station, Death Valley National Park. NPS photo by Mariah R. Tilman.

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.

June 2010

National Park Service
U.S. Department of the Interior

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