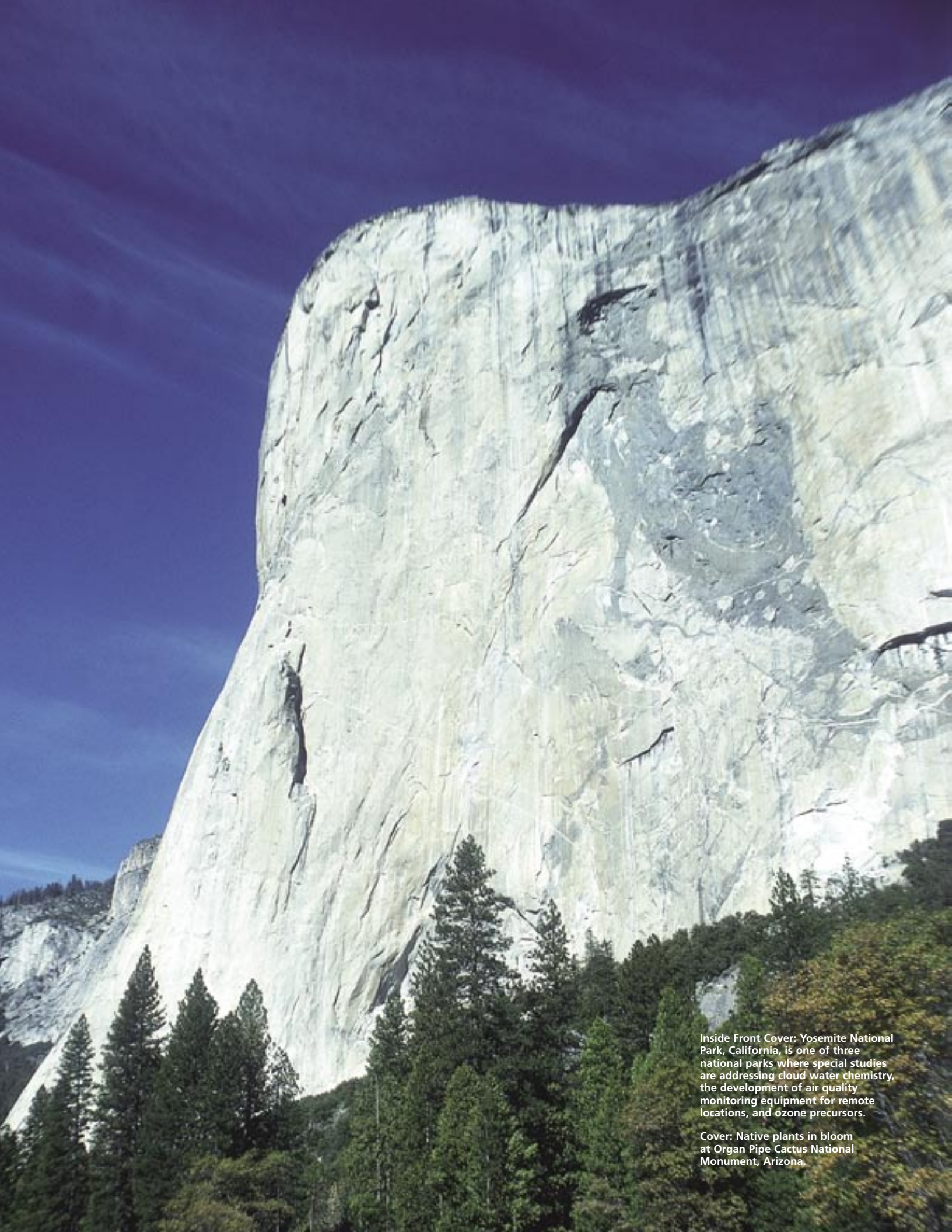
National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Funding the Natural Resource Challenge

Report to Congress, Fiscal Year 2004



Inside Front Cover: Yosemite National Park, California, is one of three national parks where special studies are addressing cloud water chemistry, the development of air quality monitoring equipment for remote locations, and ozone precursors.

Cover: Native plants in bloom at Organ Pipe Cactus National Monument, Arizona.

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Washington, DC

U.S. Department of the Interior
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The service thus established shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations hereinafter specified by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is 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.

16 U.S.C. § 1

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Executive Summary

National Park Service Natural Resource Challenge Program (the Challenge) funding increases beginning in FY 2000 have led to significant gains in core mission capability through careful design and to efficiencies through cross-program interactions, partnerships, and accountability. Natural Resource Challenge increases (2000–2004) are making a difference now and providing the framework to do even more in the future.

As a result of FY 2004 funding increases for monitoring, 22 of 32 monitoring networks of parks are funded to initiate long-term park vital signs for monitoring. Together these 22 networks represent 76 % of parks with significant natural resources. By the end of FY 2004:

- 17 of the 22 funded networks, representing 153 parks, had identified vital signs—the key to a low cost, management-oriented monitoring program.
- 12 of the 17 networks, representing 101 parks, had completed their monitoring program designs and are poised to initiate monitoring upon plan approval.
- The 5 remaining funded networks, representing 32 parks, had completed Phase I reports, synthesizing available data and information needed to begin vital signs identification.
- All 32 networks, representing 270 parks, had received funding for water quality monitoring.

Through the Inventory and Monitoring Program, 1,637 inventory data sets have been completed since 2000; including documentation of 264,948 species listings. Numerous species newly discovered to be present in parks and numerous range extensions have been documented, as well as discoveries of several species new to science. Information developed through the monitoring design process and from inventories and ongoing park monitoring efforts being integrated into vital signs programs is providing important planning and compliance information into park resource conditions and trends:

- New and historic photography at **Lake Clark National Park and Preserve** documents retreating glaciers, rising tree line, shrub invasion into tundra, and receding lake levels.
- Photography comparisons at **Canyon de Chelly National Monument** show upland invasion of piñon and juniper and spread of both native and exotic species into the riparian zone.
- Comparisons of new data with older data show an increase in numbers of fish species at **Big South Fork National Recreation Area**, and increases and decreases in different bird species at **Haleakala** and **Hawaii Volcanoes National Parks** and **Cape Cod National Seashore**.

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

- Through an agreement with the U.S. Geological Survey, protocols are being developed for the Northeast Coastal and Barriers network to allow network parks to be part of a larger regional salt marsh monitoring effort that also includes several National Wildlife Refuges.
- National Park Service Exotic Plant Management Teams (EPMTs) assisted the U.S. Fish and Wildlife Service (USFWS) in establishing mobile strike teams for fighting invasive plants, similar to NPS EPMTs. The National Park Service detailed EPMT personnel to the Fish and Wildlife Service to provide technical assistance to help implement the USFWS program at Charles M. Russell National Wildlife Refuge.
- The Northern Colorado Plateau network is developing an umbrella protocol with the Bureau of Land Management and the U.S.D.A. Forest Service for joint use in monitoring threatened and endangered plant species.
- The Inventory and Monitoring program partnered with the NPS Fire Program to complete 21 vegetation maps in FY 2004; these maps provide information on fuels, including modeling vegetation flammability, as well as information for natural resource management uses. In another fire-related project, a joint effort between the Exotic Plant Management Team-funded Student Conservation Association corps and **Sequoia and Kings Canyon National Parks** resulted in surveying and controlling invasives on 2,600 acres of burned parklands. At **Glacier National Park**, a fire-related project funded through the Water Resources Program and facilitated by the Crown of the Continent Research Learning Center, followed large fires of the summer of 2003 and characterized effects of wildfire on water quality.

At Sequoia and Kings Canyon National Parks, California, resource managers held a Native Plant Donation Day for the private inholding of Wilsonia. Residents received plants by pledging to plant these showy natives instead of exotic plants. Staff distributed information about invasive plants and discussed the threat. Over 750 plants were accepted by 47 families.

Invasive cactus moth (*Cactoblastus cactorum*) larvae attack native *Opuntia* cactus species. The NPS Integrated Pest Management Program (IPM) is working with U.S. Department of Agriculture Animal, Plant, and Health Inspection Service (USDA-APHIS) to detect new infestations in susceptible parks. Photo: Ignacio Baez, USDA-ARS

- The NPS Integrated Pest Management Program cooperated with the U.S. Department of Agriculture to research the effectiveness of pheromone traps to detect the presence of an aggressive non-native invasive moth that has devastated a cactus (*Opuntia*) in the United States. Traps are being installed in Florida and the Gulf States parks initially; if successful, the traps will be installed in all parks with *Opuntia* species.
- The Park Service and the state of Wyoming signed a Memorandum of Understanding covering the sharing of information on the biology and movements of wolves in the greater Yellowstone area.
- Working through universities in the Cooperative Ecosystem Studies Unit (CESU) network, the Water Resource Program funded a pilot watershed assessment of seven coastal parks on the South Atlantic and Gulf Coasts that will guide resource management planning, support the development of Vital Signs Monitoring Plans, and respond to the President's call for NPS Ocean Strategy implementation.

Funding increases since 2000 have allowed the National Park Service to improve a variety of projects: the Natural Resource Preservation Program; a greatly expanded and accelerated Inventory and Monitoring (I&M) Program; 17 Cooperative Ecosystem Studies Units (including 12 with NPS research brokers/coordinators); increased expertise in parks and servicewide programs, the Challenge-funded Biological Resources Management Program; and 16 Exotic Plant Management Teams. As a result of these, the National Park Service is developing more sophisticated information and tools for improved management and sometimes more cost-effective approaches for the future. For example:

- A plant ozone injury risk assessment for all 270 I&M parks was completed to assist parks and networks in determining whether ozone injury surveys should be conducted in their areas.
- A labor intensive technique in the pond-breeding amphibian monitoring protocol used at **Cape Cod National Seashore** was compared to a simpler maximum count method, finding that the simpler approach sacrificed little in the way of accuracy but resulted in significant efficiencies.
- A predictive model of non-native plant spread for the Sonoran Desert Network, which will use information from its invasive plant early detection protocol, is being developed by University of Arizona cooperators.
- Potential tsunami and river flooding inundation hazards were modeled and displayed for **Pu'ukohola Heiau National Historic Site** to address and assist with the planned relocation of the park's visitor center to a coastal site and to provide information for visitor safety and emergency operations.
- A Night Sky Team was funded to establish monitoring protocols and quantitative methods and to collect baseline data at several parks, ultimately to protect dark night skies. In addition, the team provides technical assis-

Since its inception, the Challenge has provided tangible benefits through information based management, increased expertise, partnerships, and resource leveraging.

tance on internal facility lighting, community outreach, and partnering.

- Several projects will assist in planning effective restoration efforts. At **Redwood National Park**, a project looked at whether summer stream temperatures limit juvenile coho salmon in Redwood Creek, finding the creek to be divided into four main reaches based on temperature. At **Olympic National Park**, migratory pathways and potential sources of mortality of federally threatened bull trout were studied. The project, with cooperators that included the U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Geological Survey, Washington Department of Fish and Wildlife, and The Wild Salmon Center, revealed that bull trout moved between freshwater and the Pacific Ocean and among watersheds along coastal Washington, that the trout spawn exclusively in the park, and that they are highly susceptible to incidental mortality in gill-net and recreational fisheries directed at other Pacific salmonids. The Park Service also conducted a workshop addressing the ecological history of the American chestnut, impacts of its loss, developments in chestnut blight resistance, research on chestnut genetic issues, restoration considerations, objectives, opportunities, and NPS policies.

These are just a few of the exciting results of the application of new expertise, information, and partnerships for improving the management of natural resources in units of the national park system.

In FY 2000, Congress demonstrated its commitment to natural resource management in national parks through the implementation of the Natural Resource Challenge. Since its inception, the Challenge has provided tangible benefits through information based management, increased expertise, partnerships, and resource leveraging. The Natural Resource Challenge continues to provide significant and relevant contributions as the Park Service works to meet the expectations of the American public and Congress that their national parks will be "unimpaired for future generations."

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Chapter One: Funding

This report responds to directions in House Report 106-22 for the FY 2000 appropriations for the National Park Service and other Department of Interior and related agencies. In the House report, the NPS was requested to provide information concerning the expenditures and related accomplishments resulting from a series of increases to Natural Resource Stewardship Programs beginning in FY 2000, known as the Natural Resource Challenge. This report addresses FY 2004 expenditures and accomplishments for all Natural Resource Stewardship Programs, exclusive of Everglades Restoration and Glen Canyon Adaptive Management Program, as well as communicates the successful implementation of the Challenge to date. A detailed history of the Challenge is included as Appendix A.

The Challenge included a series of requests for new funding that were designed by field superintendents and subject matter experts to meet future natural resource management needs. Many of the increases resulted in accelerating or expanding earlier programs, while a few resulted in entirely new activities. The table below shows the funding for Servicewide Natural Resource Stewardship Programs, distinguishing those affected by Natural Resource Challenge funding, and identifies the funding level for FY 1999, the year before the first Challenge increases, and FY 2004. Most of the differences where increases are shown were as a result of the Challenge.

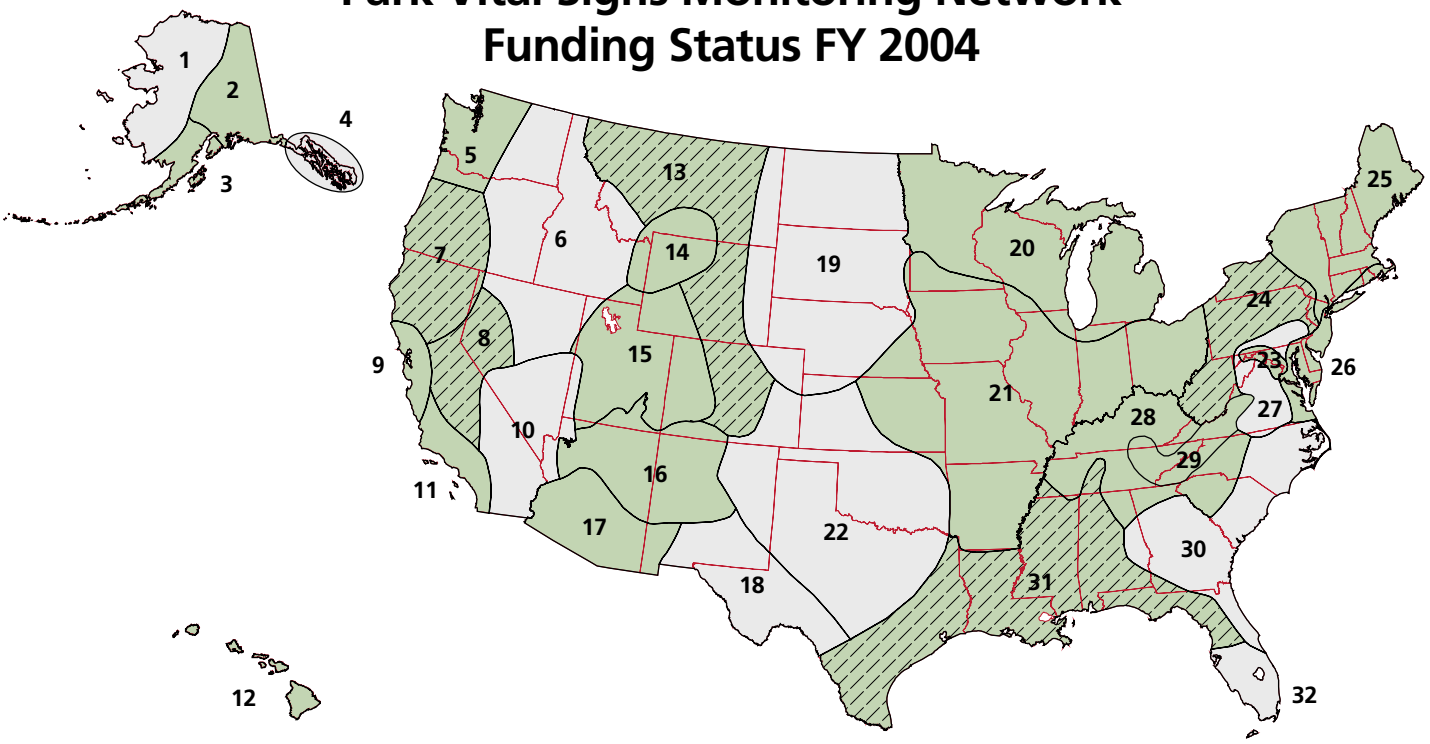
NPS Natural Resource Stewardship Program Funding (dollars in thousands)

PROGRAM COMPONENT	FY 1999	FY 2004
SERVICEWIDE NATURAL RESOURCE PROGRAMS		
Natural Resource Challenge-Affected Programs		
Air Quality Program	$ 6,285	8,890
Biological Resources Management Program	–	8,575
Cooperative Ecosystem Studies Units [1]	–	131
Geologic Resources Program	1,918	2,651
Inventory and Monitoring Program [1]	5,787	36,932
Natural Resource Data and Information Program		1,521
Natural Resource Preservation Program	5,432	12,484
Research Learning Centers [1], [2]	–	– [223]
Resource Damage Assessmt & Recovery Program (incl. Oil Spill Pollution Act)	873	1,265
Resource Protection Fund	–	294
Water Resources Program	4,754	12,071
Programs Not Affected by Natural Resource Challenge		
Cave and Karst Research Institute	–	344
Everglades—Comprehensive Everglades Restoration Plan (CERP)	–	4,722
Everglades—Critical Ecosystem Studies Initiative	1,200	3,937
Everglades Task Force Support	800	1,308
Geographic Information System (GIS) Program	1,336	1,291
Glen Canyon Adaptive Management Program	–	97
Natural Sounds Program (formerly Overflight Program)	200	921
SUBTOTAL—Servicewide Natural Resource Programs	**$ 28,385**	**$ 97,433**
NATIONAL PARK SYSTEM UNITS, OTHER FIELD UNITS, AND CENTRAL OFFICE NATURAL RESOURCE STEWARDSHIP PROGRAMS	**$ 65,832**	**$ 100,357**
TOTAL NATURAL RESOURCE STEWARDSHIP	**$ 94,417**	**$ 197,790**

[1] Reflects program funding after transfers to parks or regions
[2] Not requested as part of the Natural Resource Challenge

Sea star, Channel Islands National Park, California. Marine protected areas established within the national park and adjacent national marine sanctuary enhance protection of the marine ecosystem.

Park Vital Signs Monitoring Network
Funding Status FY 2004



17 monitoring networks funded FY 2001–2003 for core park vital signs

5 monitoring networks funded FY 2004 for core park vital signs

10 monitoring networks not funded as of FY 2004

1 **Arctic Network** (5 parks)

2 **Central Alaska Network** (3 parks)

3 **Southwest Alaska Network** (5 parks)

4 **Southeast Alaska Network** (3 parks)

5 **North Coast and Cascades Network** (7 parks)

6 **Upper Columbia Basin Network** (8 parks)

7 **Klamath Network** (6 parks)

8 **Sierra Nevada Network** (3 parks)

9 **San Francisco Bay Area Network** (6 parks)

10 **Mojave Desert Network** (6 parks)

11 **Mediterranean Coast Network** (3 parks)

12 **Pacific Island Network** (9 parks located in Hawaii, American Samoa, Guam, and Saipan)

13 **Rocky Mountain Network** (6 parks)

14 **Greater Yellowstone Network** (3 parks)

15 **Northern Colorado Plateau Network** (16 parks)

16 **Southern Colorado Plateau Network** (19 parks)

17 **Sonoran Desert Network** (11 parks)

18 **Chihuahuan Desert Network** (6 parks)

19 **Northern Great Plains Network** (13 parks)

20 **Great Lakes Network** (9 parks)

21 **Heartland Network** (15 parks)

22 **Southern Plains Network** (10 parks)

23 **National Capital Region Network** (11 parks)

24 **Eastern Rivers and Mountains Network** (9 parks)

25 **Northeast Temperate Network** (10 parks)

26 **Northeast Coastal and Barrier Network** (8 parks)

27 **Mid-Atlantic Network** (11 parks)

28 **Cumberland/Piedmont Network** (14 parks)

29 **Appalachian Highlands Network** (4 parks)

30 **Southeast Coast Network** (17 parks)

31 **Gulf Coast Network** (8 parks)

32 **South Florida/Caribbean Network** (6 parks, including U.S. Virgin Islands, not shown)

The following table shows FY 2003 funding and changes resulting from FY 2004 increases and other actions for all of the programs affected by the Natural Resource Challenge.

The next three chapters focus on describing the accomplishments achieved in FY 2004 through the natural resource programs and parks affected by the Natural Resource Challenge. Additional detail about previous years and allocation of the funding within programs may be found in Chapter 5 and several of the appendices.

FY 2004 Changes to Natural Resource Stewardship Programs [1] (dollars in thousands)
With Natural Resource Challenge Contributions Highlighted

PROGRAM COMPONENTS	FY 2003	FY 2004 Program Increases	FY 2004
SERVICEWIDE NATURAL RESOURCE PROGRAMS			
Air Quality Program	$ 8,998	$ –	$ 8,890
Challenge contribution	2,800	–	2,800
Biological Resources Management Program	7,930	741	8,575
Challenge contribution	7,985	–	7,985
Cooperative Ecosystem Studies Units [2]	443	–	131
Challenge contribution	1,993	–	1,993
Geologic Resources Program	2,670	–	2,651
Challenge contribution	696	–	696
Inventory and Monitoring Program	32,385	–	36,932
Challenge contribution	28,523	4,939	33,462
Natural Resource Data and Information Program	1,542	–	1,521
Challenge contribution	1,098	–	1,098
Natural Resource Preservation Program	12,693	–	12,484
Challenge contribution	7,372	–	7,372
Research Learning Centers [2]	–	–	–
Challenge contribution	2,698	–	2,698
Resource Damage Assessment and Recovery Program (incl. Oil Spill Pollution Act)	1,276	–	1,265
Challenge contribution	500	–	500
Resource Protection Fund	298	–	294
Challenge contribution	300	–	300
Water Resources Program	11,614	–	12,071
Challenge contribution	6,872	592	7,464
Cave and Karst Research Institute, Everglades Research and Restoration, GIS, Glen Canyon Adaptive Management, and Natural Sounds Programs	13,501	–	12,843
NATIONAL PARK SYSTEM UNITS, OTHER FIELD UNITS, AND CENTRAL OFFICE NATURAL RESOURCE STEWARDSHIP PROGRAMS	$ 97,644	$ –	$ 100,134
Challenge contribution	$ 6,595	$ –	$ 6,595
NATURAL RESOURCE STEWARDSHIP PROGRAMS	$ 190,994	$ –	$ 197,790
Challenge contribution	$ 67,432	$ –	$ 72,963

[1] Includes across-the-board reductions and other changes to base, so FY 2004 changes added to FY 2003 will not equal the FY 2004 final funding
[2] Reflects program funding after transfers to parks or regions

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Chapter Two: Measuring Progress

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

Fiscal Year 2004 marked a transition between the National Park Service 2001–2005 strategic plan, and new goals based on the Department of Interior 2003–2008 strategic plan. Many of the goals from the 2001–2005 plan carry over in similar form into the new plan, but the new NPS strategic goals incorporate more comprehensive condition goals (21 natural resource-related goals instead of 9) to better align with the Department's strategic plan. The new goals are focused largely on meeting desired conditions, as established in management plans, for various types of resources, habitats and community types. During the early years of the new plan, the emphasis will be on developing baselines and identifying desired conditions—only general management plans developed since 2000 currently identify desired conditions, and often in a manner that is not measurable for performance management purposes. As a result of the transition, with this FY2004 report, accomplishments reported below relate to the previous goals that carry over to similar measures in the new plan; for the balance of the goals, most FY 2004 targets related to developing information and measurements.

Development of strategic monitoring programs began in FY 2001. When fully funded and implemented, a means to measure resource condition and performance in caring for resources will be in place, although it will take several years to develop significant trend data. Through FY 2004, 22 networks (of a total of 32 networks) involving 153 parks and an additional 29 parks for a total of 182 of approximately 270 parks managing natural resources are fully funded for condition monitoring. The first networks funded completed their monitoring program designs and will begin to implement monitoring in FY 2005. Hence, even the networks first funded are still a few years from having significant amounts of trend data and all of the networks are not yet funded. The latter are early in the planning process for monitoring. For the interim, a strategy is being developed to use information developed through inventories, planning for monitoring, and other efforts to allow reporting on resource conditions.

Of the 11 goals with FY 2004 targets reported on in the table below, all were technically met or exceeded (the Department considers actual accomplishments within 5 percent of the target to have been met)—some were exceeded to significant degrees. The 2004 paleonotologic resource condition target and the 2004 target to acquire inventories was technically met but did not quite achieve the specific target; the target was missed by 2%. The shortfall in attaining the paleontologic resource condition goal in FY 2004 resulted from the NPS imposing stricter documentation standards for reported paleontologic sites and condition classification of such sites.

The following table shows the relationship of natural resource programs to selected National Park Service Strategic Plan goals, i.e., goals from the FY 2001–2005 plan that carry over to the 2003–2008 plan. All programs respond to some elements of the new plan, but not all had specific targets for FY 2004.

Natural Resource Challenge funding expands the capacity of natural resource managers to achieve the NPS strategic plan goal that 25% of paleontological resources, like this fossilized rhino jaw bone at John Day Fossil Beds National Monument in Oregon, are in good condition.

NATURAL RESOURCE CHALLENGE ACTIVITIES SUPPORTING NATURAL RESOURCE PROGRAMS—RELATIONSHIPS TO FY 2004 STRATEGIC PLAN GOAL TARGETS

Servicewide Natural Resource-Related Program	Goal Targets for FY 2004 (NPS number/DOI number)
	Goals relating to strageies to restore, maintain, sustain, and protect resources:
Parks Receiving Natural Resource Challenge Increases (all goals pertain to parks generally)	**Ia1B/PEM 2.004** Exotic Plant Species: 2.8% of park lands (41,500 canopy acres of 2.6 million acres) have had plant invasions effectively controlled. (**exceeded**) **Ia2A./PEM 2.001** Threatened and Endangered Species: 39% of Federally listed species that occur or have occurred in parks are making progress toward recovery [numbers not identified due to changing baselines]. (**exceeded**)
Air Quality	**Ia3B/PEM 1.010** 69% (25 of 36) of reporting Class I NPS (DOI) lands meet ambient air quality standards (NAAQS). (**exceeded**) **Ia3C/PEM 1.011** 66% (14 of 21) reporting Class I NPS (DOI) lands meet visibility objectives. (**exceeded**)
Biological Resources Management	**Ia1B/PEM 2.004** Exotic Plant Species: 2.8% of park lands (41,500 canopy acres of 2.6 million acres) have had plant invasions effectively controlled. (**exceeded**) **Ia2A./PEM 2.001** Threatened and Endangered Species: 39% of Federally listed species that occur or have occurred in parks are making progress toward recovery [numbers not identified due to changing baselines]. (**exceeded**)
Geologic Resources	**Ia9/PEM 3.004** 25% (1,287) of paleontological localities in NPS inventory (5,149) are in good condition (**met**)
Water Resources	**Ia4A/PEM 1.008** Determine initial baseline for miles of streams and rivers managed by the NPS that meet State and Federal water quality standards as defined by the Clean Water Act (**met**) **Ia4B/PEM 1.008** Determine initial baseline for acres of estuaries and marine areas managed by the NPS that meet State and Federal water quality standards as defined by the Clean Water Act (**met**)
	Goals related to strategy to improve information base, resource management and technical assistance:
Inventory and Monitoring	**Ib1** Acquire or develop 59% (1,637) of outstanding data sets identified in 2002 (2,767) of basic natural resource inventories for all parks. (**met**) **Ib3A** Vital Signs: 60% of 270 parks with significant natural resources have identified their vital signs for natural resource monitoring. (**exceeded**) **Ib3B** 3.7% (10 of 270) parks with significant natural resources have implemented natural resource monitoring of key vital signs (**met**)

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Chapter Three: Progress in Protecting Park Natural Resources

This chapter focuses on those Natural Resource Stewardship programs that emphasize preserving, restoring, maintaining, and protecting park resources. Budget programs included are:

- Park and Regional Natural Resource Programs
- Air Resources Program
- Biologic Resources Management Program
- Geologic Resources Program
- Natural Resource Preservation Program (NRPP)
- Natural Sounds Program
- Resource Damage Assessment and Recovery Program
- Resource Protection Program
- Water Resources Program

PARK AND REGIONAL NATURAL RESOURCE PROGRAMS

The Natural Resource Stewardship portion of the Operation of the National Park Service (ONPS) appropriation, which includes Natural Resource Management and Natural Resource Research Support, was $197.8 million in FY 2004. Many, but not all, of the programs involved were affected by Natural Resource Challenge funding increases since FY 2000.

Of the total $99 million designated for park and regional programs, most of the funding directly benefited parks. The Challenge contributed approximately $6.6 million in park base increases in FY 2001 and FY 2002, which parks continue to receive. Nearly $2.7 million for Research Learning Centers reported in Chapter Four was transferred to parks and one region. This year's report takes a broader view than in previous years and covers all natural resource management funding. Since park and regional programs represent the largest portion of the Natural Resource Stewardship budget, regions were asked to provide an overview of park and regional programs in FY 2004 (exclusive of parks that received Challenge increases) and to identify any trends.

Natural Resource Program Status

The Natural Resource Challenge has had widespread impact on the national parks. Even parks that did not directly receive funding increases have benefited from the increased technical support available at the regional and national levels and increased project funding through the Natural Resource Preservation Program (NRPP). NRPP funds supported a variety of projects that would normally be beyond the fiscal capabilities of parks.

Regions reported significant accomplishments by parks in their regions; some of those accomplishments are highlighted below. Regions also noted some constraints on park natural resource programs as a result of across the board rescissions and due to the fact that fixed costs have not been fully funded over the last several years. Parks and regions report applying adaptive management strategies to address these recent challenges.

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

- Regional and park natural resource staffs assisted with planning activities, especially General Management and Fire Management Plans. Staff also participated in developing other specialized plans, such as the *Glacier Bay National Park and Preserve Vessel Quota and Operating Requirements Plan and EIS*, the *Denali Backcountry Management Plan and EIS*, and oil and gas management plans and environmental documents in Intermountain Region parks—often much of this work is undertaken with project funding, but base-funded staff provide significant contributions.
- Parks continue to support important monitoring activities using base funds, examples include trout monitoring at **Catoctin Mountain Park** with the Maryland Department of Natural Resources, long-term efforts such as monitoring of piping plover nests at **Fire Island, Cape Cod**, and **Assateague Island National Seashores**, and river corridor avian monitoring at **New River Gorge National River** using 444 hours of volunteer time as well as park staff. Additionally, monitoring and observations in several eastern parks revealed the movement of wildlife not traditionally associated with urban areas into park habitats. From coyotes in **Rock Creek Park**, in Washington, D.C., and **Manassas National Battlefield Park** in Virginia, to black bear at **Prince William Forest Park**, Virginia, and **Catoctin Mountain Park**, Maryland, wildlife populations are changing. Park staff also sighted a mountain lion at **Chesapeake and Ohio Canal National Historical Park**.
- Many of the activities conducted by parks with their base funds represent long-standing

The former Turbid Lake Road, Yellowstone National Park, Wyoming, shown post-restoration. The Turbid Lake Trail was re-established on the former roadbed. The project was funded through the NRPP—Disturbed Lands Restoration.

At Rock Creek Park in Washington, D.C., Natural Reource Challenge base funding increases and the National Capitol Region Exotic Plant Management Team are having an impact on invasive exotic plants. The photos show a targeted area pre-treatment in fall of 2002 and the bottom post-treatment in the fall of 2003. Crews removed Oriental bittersweet (*Celastrus orbiculatus*), porcelainberry (*Ampelopsis brevipedunculata*) and several other invasive exotic species.

resource protection efforts, such as preventing human-bear conflicts at **Yosemite National Park**, minimizing the impact of Dutch Elm Disease on urban trees in the National Capital Region parks, and exotic species control (in addition to exotic control efforts funded through the Natural Resource Challenge).
- Park natural resource personnel contributed to other park programs such as fire management planning and operations, which is often not managed in parks as a natural resource program. Other examples include natural resource GIS personnel assisting facility management at **Wolf Trap Farm Park**, and a brochure for the public on butterflies of Great Falls Park produced by the resource staff.

Challenge-funded Parks

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

Total Natural Resource Management base funds available in FY 2004 to these 36 parks approximated $16.5 million. Almost 40% of that funding came from the Natural Resource Challenge program. Funding levels for 23 of the parks ranged from $69,900 to $500,000. Seven parks had from $500,001 to $800,000, while six parks had from $1,000,000 to $1,500,000 available for managing natural resources.

Twenty of the 36 parks reported net decreases to their programs, from FY 2003 to FY 2004, ranging from less-than-one to 35%. Of the parks reporting decreases, 10 experienced significant decreases of 5% or more. Thirteen reported increases, ranging from less-than-one to 34%. Three parks reported exactly the same funding as the previous year.

Many parks—nearly a third—continue to experience difficulties retaining funds for natural resource programs due to the absorption of fixed costs and other higher priority needs. Other parks, through a combination of differing circumstances and priorities, are able to more fully maintain the gains brought about by the Challenge. In all cases it is clear that results of the Challenge are positive, clearly demonstrated by the accomplishments reported. In most cases, the Natural Resource Challenge funding greatly strengthened the ability of parks to address the most critical problems in managing exotics and improving habitat for threatened and endangered species. Additionally, the Challenge funding often provided the critical mass of capability to enable a park to attract more volunteers, partnerships, and other assistance to enhance the natural resource program. Accomplishment highlights include:

Inventories
- New populations of the state threatened goldenseal plant and state watch-list plants ginseng and Loesel's twayblade found and mapped at **Antietam National Battlefield** will enable park protection staff to better protect these often-poached species.
- An inventory at **Great Basin National Park** located populations of NPS sensitive bat species in more than half of the park's 43 known caves. Natural Resource Challenge funds now enable the park to survey and map the park's caves for the first time.
- Staff of **John Day Fossil Beds National Monument** worked with the Upper Columbia Basin Network to complete initial park inventories for butterflies, moths (in conjunction with earlier bat research), and aquatic insects.
- In conjunction with the Alaska Department of Fish & Game, a wolverine study at **Gates of the Artic National Park & Preserve** began to assess the distribution of wolverines in the northern latitudes.

Monitoring
- Wildlife staff of **Big Cypress National Preserve** monitored 57 known active red-cockaded woodpecker clusters, of which 4 were newly found this year. Staff banded 31 nestlings, determined prescribed fire needs, and participated in fuel load removal to protect colony trees with the Big Cypress Fire Management Program.

Protection and Restoration
- Challenge-funded staff at **Haleakala National Park** helped to complete the East Maui Watershed Partnership's Pu`u Pahu fence to create a buffer zone between the park's northwestern fence and Haleakala Ranch, excluding domestic animals from the park.
- Invasive plant control work at **Acadia National Park** treated exotic plants on nearly 70 acres.
- In a weeklong helicopter roundup, **Mojave National Preserve** staff removed an additional 126 burros from the park, bringing the total removals since 1999 to more than 4000 burros.
- Staff at **Padre Island National Seashore** incubated 3,033 Kemp's ridley sea turtle eggs

and released 2,608 hatchlings into the Gulf of Mexico.

- At **Hopewell Culture National Historical Park**, volunteers and staff restored 82.7 acres by converting agricultural fields into native grasslands. Additionally, more than half (443 acres) of the parkland that was in active agriculture is now under a new management system. Together, these efforts will result in habitat throughout the year for grassland birds and other wildlife.

AIR QUALITY PROGRAM

FY 2004 Allocation: $8,890,000
Available: $8,876,000

The purpose of the Air Quality Program is to preserve, protect, and enhance air quality and air quality-related values in the national park system by ensuring compliance with the requirements of the Clean Air Act and the National Park Service Organic Act. Relying largely on non-regulatory approaches to achieve air quality goals, the Air Quality Program emphasizes the collection of credible air quality information to support scientifically sound decisions about actions affecting air quality and air quality-related values in parks. Natural Resource Challenge funds augment and support air quality monitoring in parks; investigation of resources that are sensitive to air pollution effects; review of permit applications proposed by new or existing sources and provision of recommendations to reduce impacts on parks; audits of, and recommendations to reduce, air pollution sources within national parks; data analysis; provision of information to permit applicants and regulatory agencies; and other technical assistance to parks. Parameters currently measured in parks include: ozone and/or dry deposition, wet deposition, and particulate matter. Special studies at **Great Smoky Mountains**, **Isle Royale**, and **Yosemite National Parks** address cloud water chemistry, developing monitoring equipment for remote locations, and ozone precursors.

Funding and Performance Summary

The Natural Resource Challenge provided base increases of $200,000 and $2.6 million beginning in FY 2001 (Air Emissions Inventories) and FY 2002 (Air Quality Monitoring and Assistance).

As part of the Natural Resource Challenge, expertise in air quality-related skills has been expanded through the creation of 8.5 field-based positions. These positions provided significant assistance to parks in FY 2004. Most of these new air quality specialists are responsible for working closely with park neighbors, regulatory agencies, other federal land managers, and the five regional planning organizations established by the U.S. Environmental Protection Agency (EPA) to develop visibility protection programs. The specialists work to ensure park managers are receiving timely and useful information about air quality conditions and related management issues; they also provide or broker technical assistance and scientific expertise for parks. Some of the specialists serve as senior science advisors or otherwise provide technical expertise for the vital signs monitoring program. One of the specialists hired is an EPA scientist, detailed temporarily to the Park Service, who is designing and overseeing a toxic air monitoring program for parks in the Alaska, Pacific West and Intermountain Regions.

Appendix B contains summaries of the types and locations of air quality monitoring in the parks. Accomplishment highlights include:

Annual Performance Goal, Status, and Accomplishments

	FY 2003	FY 2004
FY 2003		
Air quality in 61% of reporting parks has remained stable or improved	54% (not met)	
FY 2004		
Air quality in 62% of reporting parks has remained stable or improved		Met
69% of reporting Class I NPS (DOI) lands meet ambient air quality standards		Exceeded
66% of reporting Class I NPS (DOI) lands meet visibility standards		Exceeded
Other Actions and Outcomes:		
Air Resources Field Specialists supported by Challenge: total FTE	8.5 FTE	8.5 FTE
Park emissions inventories: total parks completed or (*underway*)	9 (*47*)	45 (*12*)
Air Quality Monitoring: total parks involved	63 parks	69 parks
Visibility Monitoring: total parks involved	53 parks	54 parks
Mercury Monitoring: total parks involved	12 parks	15 parks
Ecological Effects Projects: total projects completed or (*underway*)	(*6*)	3 (*5*)
Technical Assistance to Parks		15 parks
New Source Permit Review and Recommendations		39 reviews

Emissions Inventories
Park operations substantially complied with air pollution control, permitting, and emission fee requirements in FY 2004. The audits identified and recommended additional green strategies to further reduce emissions from park operations. Additionally, the Park Service entered into an Interagency Agreement with the EPA to cooperatively develop an emissions inventory tool to calculate parks' criteria air pollutant and greenhouse gas emissions, and clarify roles and responsibilities for future cooperation.

Climate Friendly Parks
Effects of global climate change include unpredictable weather patterns, receding glaciers, rising sea level, and changing distribution of animals and plants. These effects are particularly noticeable in national parks because of their locations and unique, protected resources. Maintaining park resources requires practicing good stewardship within parks and on regional and global scales. In FY 2004, the Park Service entered into a Climate Friendly Parks initiative with EPA, under which the EPA will include audits of greenhouse gas emissions within parks (in addition to criteria air pollutants). Under this initiative, the Park Service will strive to be a leader in demonstrating sustainable stewardship practices within parks and educating the public about them in all park areas.

New Monitoring Themes—Mercury
Although mercury is a naturally occurring element, human activity can release additional mercury into the environment. Ambient concentrations of mercury are usually low, but deposition of mercury into lakes and streams can trigger biological processes that chemically transform mercury into a toxic form that can bioaccumulate in fish and animals. This accumulation can be harmful to both the host and any organism that may consume it. Natural Resource Challenge funding supports mercury monitoring at selected parks. Mercury monitoring activities expanded to include 15 parks in FY 2004. In conjunction with the National Atmospheric Deposition Program, Mercury Deposition Network, information from this monitoring will support better estimates of the amount, distribution, and seasonal trends of mercury being deposited into the ecosystem. (See Appendix C.)

Airborne Contaminants
The National Park Service initiated in FY 2002, and continued in FY 2003 and FY 2004, the Western Airborne Contaminants Assessment Project. The objective of this multi-year project is to inventory airborne contaminants in national park ecosystems using a network of sites in parks of the western United States to determine the risk from airborne contaminants to ecosystems and food webs in western national parks. Airborne contaminants can pose serious health threats to wildlife and humans, as some of these compounds tend to "biomagnify" in the food chain, having impacts on reproductive success, growth, behavior, disease, and survival. Inventories of contaminants are being conducted in key parks in the West and Alaska. Cooperators

NPS staff and researchers at Indiana Dunes National Lakeshore, Indiana, prepare enclosed "mesocosms" for testing the effects of nitrogen and metals deposition on native plants and invading cattails.

Maintaining park resources requires practicing good stewardship within parks and on regional and global scales.

include EPA, U.S. Geological Survey, U.S. Forest Service, Oregon State University, University of Washington, and NPS regions.
(See Appendix D.)

Ecological Effects Examined
Three ecological effects studies concluded in the **Great Smoky Mountains, Acadia**, and **Sequoia and Kings Canyon National Parks**. Results indicate that sulfur and nitrogen deposition in Acadia and Great Smoky Mountains varied by elevation and vegetation, and deposition including all sources (wet, dry, and cloud/fog) was much higher than total deposition actually recorded by existing monitoring stations. Within Great Smoky Mountains National Park, marked tree growth reductions (30–50%) corresponded with sharp increases in summer ozone concentrations, while lower ozone concentrations resulted in improved tree growth. In Sequoia and Kings Canyon National Parks, ponderosa and Jeffrey pines growing on dryer sites had lower ozone uptake than those on more moist sites; however, remote sensing techniques did not detect these differences.

BIOLOGICAL RESOURCES MANAGEMENT PROGRAM

FY 2004 Allocation:	**$8,575,000**
Available:	$8,556,000

Created in FY 2000 as part of the Natural Resource Challenge, the Biological Resources Management Program provides professional, science-based support for invasive species management, terrestrial ecosystem restoration, threatened and endangered species protection, integrated pest management, and wildlife management. Exotic Plant Management Teams (EPMTs) established to control invasive plants are a significant feature of the Biological Resources Management Program; this Challenge-funded program contributed directly to the National Park Service exceeding its FY 2004 goals for Invasive Plants. The service-wide target was 2.8% or 41,500 acres of infested parklands controlled; instead 3.6% or 95,556 acres were controlled with EPMTs contributing 6,782 acres. The program also directly contributed to the Service exceeding its FY 2004 target for Endangered Species, a target of 39% of park populations making progress toward recovery. Additionally, in FY 2004, the National Park Service created a Wildlife Health Team to assist parks in dealing with wildlife health issues such as chronic wasting disease.

Exotic Plant Management Teams (EPMTs)
National parks are home to complex native communities of plants and animals that are threatened by the invasion of exotic plants and animals as well as by human-caused disturbances that foster the establishment of exotic species. Exotic plants infest some 2.6 million acres in the national parks, making control of exotic species one of the most significant land management issues facing national parks. Modeled after the coordinated rapid-response approach used in wildland fire fighting, Exotic Plant Management Teams assist parks in combating and controlling exotic plants by providing a highly-trained mobile strike force of plant management specialists. Sixteen EPMTs now serve more than 200 national parks; they are as follows:

- Alaska
- California
- Chihuahuan Desert/Southern Shortgrass Prairie
- Colorado Plateau
- Florida and Caribbean Partnership
- Great Lakes
- Gulf Coast
- Lake Mead
- Mid-Atlantic Cooperative
- National Capital Region
- North Coast Cascades Network
- Northeast
- Northern Great Plains
- Northern Rockies
- Pacific Islands
- Southeast

Adaptive management is a critical part of the EPMT response. As teams have grown, the need for increased capability to set park priorities for control and restoration has been recognized. As a result, a field study partnership with the Colorado Plateau Cooperative Ecosystem Study Unit (CESU) was initiated in FY 2003 and field tested in Midwest, Pacific West, and National Capitol Region parks in FY 2004. Field trial results of the tool appear productive and a web-based program is planned.

Summary EPMT FY 2004 Accomplishments

Inventoried acres	218,217
Gross infested acres identified	107,136
Treated acres	6,782
Monitored acres	2,901
Retreated acres	490
Restored acres	387
Total person hours	92,776
Hours lost due to injury	25

Other highlights of FY 2004 include:

- EPMTs fostered numerous partnerships leveraging approximately $1.5 million in direct contributions to control invasive plants on parklands.

- Through an interagency agreement with the U.S. Geological Survey, the Alaska EPMT has now gathered baseline information on invasive species in 13 of the 17 park units in Alaska. In addition, with the U.S. Forest Service and the University of Alaska Natural Heritage Program, the team also has developed and contributed to a statewide web-based tracking database for invasive plant arrivals and distributions.
- In FY 2004, EPMTs continued collaboration with the Student Conservation Association (SCA) to build a student corps to assist in controlling invasive plants. Partnership goals are to build an Invasive Species Project within SCA that will increase park capacity to control invasive plants and animals, and to provide invasive species management training to young professionals.
- A joint effort between the EPMT-funded SCA corps and **Sequoia and Kings Canyon National Parks** resulted in surveying and controlling invasive plants on 2,600 acres of burned parklands.
- Individuals from 14 EPMTs were deployed to **Arches National Park** in a combination training, control, and information exchange project. Several EPMT personnel from multiple teams were trained and certified in chain saw use, 150 acres of sensitive riparian habitat were cleared of hazard fuels—Russian olive and tamarisk—and crews had the opportunity for invaluable exchanges of knowledge about control operations based on extensive and varied experience. Mobilization costs of $25,000 were supported through fire funding.
- The Northern Great Plains EPMT mapped and/or treated 4,477 infestations of Canada thistle—an exotic invasive shared by all 14 of the parks it serves. The infestations encompass more than 1,500 acres.
- EPMTs assisted the U.S. Fish and Wildlife Service (USFWS) in establishing mobile strike teams similar to NPS EPMTs. The National Park Service detailed EPMT personnel to the Fish and Wildlife Service to provide technical assistance to help implement the USFWS program at Charles M. Russell National Wildlife Refuge.
- Exotic Plant Management Teams participated in a conference called Team Tamarisk: Cooperating for Result, sponsored by the U.S. Departments of Interior and Agriculture, the National Invasive Species Council, the Tamarisk Coalition, and 13 other organizations. The two-day workshop produced a set of 12 guiding principals that can help to establish a framework for forging close working partnerships among states and federal agencies.

Ecological Restoration

In this component of its program, the Biological Resources Management Program continued to serve as an active member of the NPS Fire Ecology Program. Program staff assisted the NPS Fire Management Program in developing a white paper on NPS Fuels Management Strategies in response to the President's Healthy Forest initiative. Staff also served as the NPS Natural Resource Stewardship and Science representative to the Department of the Interior Fuels Policy Team developing a Departmental Manual and contract language on biomass use. At **Canyon de Chelly National Monument**, staff led an interdisciplinary team to evaluate watershed conditions. Program staff developed technical specifications for restoration of a newly purchased property at **Morristown National Historical Park**. Ecological Restoration program staff consulted with **Manassas National Battlefield Park** and **Allegheny Portage Railroad National Historic Site** to determine desired conditions and plant material needs for site restorations. Staff designed and implemented a mine-cover sampling plan to evaluate additional reclamation steps for **Prince William Forest Park**.

Integrated Pest Management Program

The Integrated Pest Management (IPM) program responded to 125 technical assistance requests submitted by parks and regions. Responses included consultations, information distribution, and facilitating pest identification through other experts. A contractor from Pennsylvania State University is preparing model contract specifications for low-risk pest management in accordance with NPS policies to assist parks with the need to contract for private indoor pest management.

In FY 2004, IPM program staff continued to coordinate actions, guidance, and policy response to variety of pest management issues. IPM staff provided leadership to the West Nile Virus Zoonotic Environmental Disease Task Force. The IPM Program, with field participation, coordinated with the U.S. Department of Agriculture in conducting research on the effectiveness of pheromone traps to detect presence of *Cactoblastus cactorum*, an aggressive non-native invasive moth that has devastated a cactus (*Opuntia*) in the United States. Initially pheromone traps will be installed in Florida and the Gulf States parks; if successful, the traps will be installed in all parks with *Opuntia* species. The National Park Service also continued cooperation with the U.S. Forest Service in the Forest Health Management System on hemlock woolly adelgid, which jeopardizes

Biological Resource projects included an inventory of the endangered San Francisco Garter snake in Golden Gate National Recreation Area, California.

NPS technicians draw blood from a mule deer to check for Chronic Wasting Disease.

old growth hemlock forests in critical riparian areas in the East. This is a difficult problem because the current technology is inadequate and expensive, and tree mortality is high. Nevertheless, five parks were able to protect high value trees using Forest Service funds. In all, 13 parks received $334,200 from the Forest Service for treatment of various insects and diseases.

Endangered Species Program

The national park system currently has 349 threatened, endangered, proposed, experimental, managed via conservation agreement, and candidate species. These are represented in 902 populations in 171 units. Another 255 populations historically existed in parks, and in many cases could be restored. While mammals and birds represent only 22% of the listed species in parks they draw a disproportionate amount of the funding (54%). More complete data are providing direction to change this trend.

The Endangered Species Program continued to play a role in negotiating Memoranda of Understanding (MOU) with other agencies as well as drafting internal NPS guidance. For example, the National Park Service and the state of Wyoming signed a MOU covering the sharing of information on the biology and movements of wolves in the greater Yellowstone area.

The program continues to provide technical assistance wherever there are endangered species related issues. Examples include: advising on monitoring programs at **Sleeping Bear Dunes National Seashore**, **Carlsbad Caverns**, and **Point Reyes National Parks**; assisting **Death Valley National Park** in assessing impacts on Devil's Hole pupfish; and advising **Channel Islands National Park** in restoring endangered foxes on the three islands in the park.

Number of Endangered, Threatened, Proposed and Candidate Species Found in National Park Units (as of September 30, 2003)

Endangered Species	200
Threatened Species	84
Experimental Species	3
Proposed Species	4
Candidate Species	51
Managed via Conservation Agreement	7
Total	**349**

Endangered, Threatened, Proposed, and Candidate Species Found in National Park Units By Taxonomic Group (as of September 30, 2003)

Group	Species
Plants	152
Invertebrates	47
Fish	37
Amphibians	6
Reptiles	18
Birds	50
Mammals	39
Total	**349**

Wildlife Program

In FY 2003, the Wildlife Program assisted several parks in evaluating and developing wildlife management actions for critical wildlife issues. At **Grand Canyon National Park**, Wildlife Program staff assisted in collecting samples for disease and genetic testing of exotic bison on the North Rim. In partnership with the USGS National Wildlife Health Center and the Colorado State University Veterinary Diagnostic Laboratory (CSUVDL), veterinary diagnostic services were provided to national park system units. More than 120 diagnostic submissions were processed by CSUVDL. Other wildlife health assistance included a cooperative field research project with the Colorado Division of Wildlife and Colorado State University investigating fertility control in elk at **Rocky Mountain National Park**.

Chronic wasting disease (CWD) continued as a priority wildlife health issue this fiscal year. The National Park Service hired a chronic wasting disease coordinator and provided technical assistance to parks, particularly **Rocky Mountain** and **Wind Cave National Parks**. Biological Resource Management Program personnel aided Wind Cave National Park in the aerial capture and chronic wasting disease testing of mule deer and conducted Wildlife Capture and Field Anesthesia Training for **Yellowstone National Park**. The Biological Resource Management Program continued interagency interactions via the CWD Implementation Team, state wildlife agencies, U.S. Geological Survey, the Food and Drug Administration, and Environmental Protection Agency.

The Park Flight Migratory Bird Program (Park Flight) concluded projects for 8 bird conservation and education projects in 11 U.S. national parks. Park Flight received grants through the Neotropical Migratory Bird Conservation Act for funding projects in **Point Reyes National Seashore**, **Golden Gate National Recreation Area**, and **Cuyahoga Valley National Park**. The program helped establish a collaborative relationship between Cuyahoga Valley National Park and Point Pelee National Park in Ontario, Canada. As part of the Park Flight technical exchange effort, ten international interns from Guatemala, El Salvador, Nicaragua, Panama, Mexico, and Argentina assisted with bird

Despite evidence of overall population decline, the Northern Leopard Frog persists in Grand Canyon National Park, Arizona.

A paleontologist at the Mammoth Site laboratory in Hot Springs, South Dakota, extracts vertebrate fossils from a large block recovered in Wind Cave National Park.

monitoring and education efforts at ten national park system units. These interns contributed more than 3,600 hours valued at more than $62,000.

Biological Resource Projects—National Level Support

Biological Resource Management Program competitive funds are used for biological resource projects that address issues facing various park units. These projects address a myriad of resource management needs for aquatic and terrestrial plants and animals throughout the national park system. In FY 2004, 29 projects were funded in 24 parks for a total funding of $723,300. Following are highlights for some of the projects:

- **Lake Clark National Park and Preserve** staff completed fieldwork on a project using radio-collared moose to determine which variables affect moose sightability during standard aerial population surveys. With this information, a sightability model will be developed to adjust the moose population estimate. During 180 sightability trials, park staff recorded variables such as group size, cover type, percent cover, position of animal, snow cover, and lighting. A Michigan Technological University scientist will complete the data analysis and develop the sightability model.
- **Grand Canyon National Park** conducted the second year of the first detailed, extensive study of amphibian populations within Grand Canyon National Park. The inventory includes side canyon areas and wetland habitats on the North and South Rims of the Canyon, as well as the main river corridor. The main objective of the study is to assess the current status of the Northern Leopard Frog. Known populations of this species have disappeared along the Colorado River in the park, and it is now largely or entirely absent through much of the region.
- A project to determine the relative abundance and distribution of five rare and endemic subalpine and alpine plant species in **Great Basin National Park** surveyed approximately 10,200 acres of subalpine and alpine habitat. The survey located a potential new species of grass, and found that four of the plants occurred on a total of 2,322 acres. The survey did not find one of the species; surveys will continue next year.
- At **Haleakala National Park**, park staff surveyed, brushed, cleared, completed compliance, and built 0.8 miles of feral pig fence along the Alaenui fence corridor. Completion of this fence secured the Lower Kipahulu, Kaumakani and Oheo management units from feral pig ingress, allowing for a more effective feral pig removal effort in the lower Kipahulu unit beginning in FY 2005.
- The caves of **Sequoia and Kings Canyon National Parks** contain unique resources including endemic animals, delicate mineralogical features, paleontological resources, and cultural relics whose preservation relies on reliable, strong cave gates that bar entrance to those lacking proper permits. In FY 2004, park staff installed a new gate at the Red Belly entrance to Crystal Cave, and replaced older, broken gates at Soldiers and Clough Caves.

GEOLOGIC RESOURCES PROGRAM

FY 2004 Allocation:	**$2,651,000**
Available:	$2,661,000

In FY 2000, the Natural Resource Challenge provided the first funding for geologic resource management programs outside of the minerals management activities supported by the Geologic Resources Program (GRP). Challenge funding now supports seven geoscience specialists in the GRP who provide expertise at the national level in cave resources and karst processes, coastal resources and processes, disturbed lands restoration, geologic hazards management, and paleontology. These professional geologists support parks, regions, vital signs networks, and the Inventory and Monitoring Program. Additionally, since FY 1995, staffing levels in geosciences increased more than 30% to an estimated 100 positions across the Service in FY 2004. At least ten of these new positions (including the seven in GRP) resulted from the Challenge; many parks also restructured positions to address geology concerns.

In addition to those shown here, two other goals relevant to the NPS Geologic Resources Program are reported in the NRPP-Disturbed Lands, and Inventory and Monitoring sections.

In FY 2004, parks reported 1,202 (23%) of the 5,149 baseline paleontologic localities in good condition. This minor shortfall in servicewide performance was due primarily to the Park Service imposing stricter documentation requirements in FY 2004 on recorded localities and classification of localities in good condition to achieve servicewide consistency in reporting annual performance, and is considered as meeting the goal. Also note that parks reported an additional 148 newly discovered and documented fossil localities (not included in the baseline) in good condition in FY 2004.

Highlights of accomplishments include:

- At **Wind Cave National Monument**, a major project included excavation of newly discovered fossilized bones of the small horse, Mesohippus.
- Disturbed land restoration staff provided oversight for 13 Natural Resource Preservation Program (NRPP) restoration projects in 12 parks, restoring nearly 300 acres of severely disturbed land. Examples include restoration of degraded grasslands in the Nine Point Draw Watershed at **Big Bend National Park** and the restoration of 105 acres of disturbed wetlands at **Manassas National Battlefield Park** in cooperation with the Smithsonian Institution.
- The Geoscientists-in-the-Parks program, staff placed 45 geoscientists in 29 parks, using $50,000 in NRPP funds, achieving more than a 4:1 private partner funding match.
- Program specialists also responded to more than 83 park technical assistance requiring geologic expertise. Staff assisted with surveying for contaminants at the Old Yuma Mine in **Saguaro National Park**, a plan to evaluate geomorphic and hydrological changes along the East Alsek River and lagoon at **Glacier Bay National Park**, planning for restoration of former inholdings at **Chesapeake and Ohio Canal National Historical Park**, mitigation of landslides along **George Washington Memorial Parkway**, and restoration planning for the removal of stock ponds on the North Rim Road at **Black Canyon of the Gunnison National Park**.
- Geologic Resources and Water Resources Program staff coordinated the NPS Cooperative Conservation Initiative (CCI) solicitation, working closely with Department officials on the project approval and follow-up process for 106 park submitted projects totaling $7.871 million in federal funds in FY 2004. FY 2004 contributions by the 311 partners exceeded $10 million.
- GRP staff worked directly with Bat Conservation International, the state of California, and other nonfederal and international partners to implement an FY 2004 CCI project to protect critical bat habitat in abandoned mines and caves at **Death Valley National Park**, **Joshua Tree National Park**, **Whiskeytown-Shasta-Trinity National Recreation Area**, **Lake Mead National Recreation Area**, **Coronado National Memorial**, and **Organ Pipe Cactus National Monument**.
- With assistance and oversight from GRP staff, personnel at **Obed Wild and Scenic River** worked with the site operator to successfully plug an exhausted oil well. At **Jean Lafitte National Historic Park and Preserve** in Louisiana, the program staff provided technical and regulatory assistance to help ensure minimal impacts to park resources from an oil and gas exploration well, contributing to the operator's decision to move the well's surface location outside the park.
- In FY 2004 the National Park Service worked to establish a jointly administered management structure for the National Cave and Karst Research Institute (the Institute) near Carlsbad, New Mexico, and to foster stronger ties with partner organizations, currently the city of Carlsbad and New Mexico Institute of Mining and Technology (NMT). During 2004, the Institute initiated a free lecture series in Carlsbad, New Mexico. Each of the four lectures was well received, averaging about 60 attendees. Additionally, GRP and the NMT co-sponsored a session at the Geological Society of America National Meeting entitled, From Subterranean Crawlways to Scientific Hallways: Research on Our Public Cave and Karst Lands.

Annual Performance Goal, Status, and Accomplishments

	FY 2003	FY 2004
FY 2003 30% of known **paleontological localities** in parks are in good condition (note: an improved inventory added 2097 new sites to create a new total of 5,149 known sites—substantially affecting achievement of this goal)	1133 localities (22%…not met)	
FY 2004 25% (1,287) of 5,149 known **paleontological localities** in parks are in good condition		1202 localities (23%, met)
Other Actions and Outcomes:		
•Geoscience Specialists supported by Challenge: total FTE		10
•Geoscientists-in-the-Parks Program: number of scientists (*total parks*)	25 (*20*)	45 (*29*)
•Geoscientists-in-the-Parks Program: private:federal funding match	4:1	4:1
•Mineral Development Reviews: total operations (*total parks*)	73 (*20*)	54 (*20*)
•Technical Assistance to Parks	79 responses	83 responses

Jenny Cook, a Geoscientist-in-the-Park at Grand Canyon National Park (Arizona) sponsored by GeoCorps America, helped visitors understand the geology of the canyon and the fossils. She had children act as crinoids to help others understand these creatures. Jenny provided guided walks and campfire programs.

NATURAL RESOURCE PRESERVATION PROGRAM (NRPP)

FY 2004 Allocation:	**$12,484,000**
Available:	$12,469,000

While park base operating funds support most ongoing resource management activities, parks usually have little or no flexible, dedicated funding for cyclical and one-time project needs. The Natural Resource Preservation Program is a primary source of funds for special projects, providing the only dedicated source of NPS funding for natural resource management projects costing more than $50,000. Funding for NRPP increased from $5.432 million in FY 2000 to $12.484 million in FY 2004 through the Natural Resource Challenge. The NRPP supports projects in a variety of areas such as wildlife, fisheries, and vegetation management; specialized inventories; planning; mitigation actions; and restoration activities. More than half of NRPP funds ($6.9 million) support general park-level natural resource management projects. The balance strategically targets specific needs such as Small Park Projects, Disturbed Lands Restoration, Threatened and Endangered Species Projects, and funds distributed to the regions to support natural resource projects in parks. Additionally, some funding is provided for U.S. Geological Survey biological technical assistance.

In addition to contributing to the Park Service's general resource protection goal, many of these projects directly contributed to the National Park Service exceeding its goals for containing of exotic vegetation, restoring disturbed land, and achieving stable or improving populations of threatened and endangered species.

Highlights of FY 2004 accomplishments in each of these categories are presented below. For a complete listing of projects funded under the Natural Resource Preservation Program, see Appendix E.

Natural Resource Management Projects

The largest segment of the Natural Resource Preservation Program supports a broad range of competitively selected, multi-year natural resource management projects that may cost as much as $900,000 each, although projects rarely exceed $600,000. With funding provided by the Challenge, the total number of natural resource management projects funded through this program significantly increased from 49 projects in FY 2000 to 63 projects in FY 2004. Projects eligible for funding through this source include resource management actions; tactical biological studies; development of new physical science theory, management approaches, and protocols; and combined research and follow-up resource management or mitigation actions. The majority of projects funded fall within these categories: restoration, exotic species control, resource assessment and mapping, and natural resource management plan development. Thirty projects received their last year of funding in FY 2004, some highlights follow:

- In a project to eradicate feral hogs at **Cumberland Island National Seashore**, hunting and trapping resulted in the removal of more than 700 feral hogs. Approximately 200 may remain scattered throughout the island to be removed by park staff. Reports indicate a marked decrease in feral hog activity, both in direct observation of animals and the level of destruction through rooting. Sea turtle nests (primarily Loggerhead sea turtles, federally listed as threatened) suffered no disturbance during the most recent nesting season, whereas in the past as many as 25% of the nests were lost to hog depredation.
- A contractor and the park's public Youth Core crew completed fencing installed along seven miles of the northern boundary of **Lake Meredith National Recreation Area**. The fence prevents trespass livestock and vehicles from entering the park and causing damage to vegetation that is now in recovery.
- Six California condors were released during 2004 in a project to restore the species to **Pinnacles National Monument**. The goal of this project is to establish a population of 20 endangered condors in the park. Through local school programs, wayside exhibits, and interpretive programs, the park introduced the community to endangered species recovery efforts and the condor recovery program. Partners include the Ventana Wilderness Society, the U.S. Fish and Wildlife Service, the Los Angeles Zoo, and the San Diego Wild Animal Park.
- A NRPP project in the Intermountain Region engaged the efforts of 5 investigators in completing a detailed inventory and maps of noxious weeds in priority sections of 19 parks, covering more than 95,000 acres. Among the parks in this project were **Devils Tower National Monument**, **Arches**, **Zion**, **Glacier**, **Big Bend**, and **Canyonlands National Parks**. The project will enable these parks to better target eradication and restoration efforts.
- At **Great Basin National Park** an inventory of the park's 12 alpine caves (above 9000 feet) resulted in the discovery of an additional passage in one of the caves, and initial discovery of three additional caves. The park's inventory now includes fifteen alpine caves, thirteen of which are surveyed and inventoried. The park's cooperating investigator for the surveys discovered two species of springtail (*Collembola*) that are new to science.
- To restore the ecological integrity of a rare coastal bluff scrub plant community, including at least 12 listed plant and animal species, park staff and contracted crews at **Point Reyes National Seashore** removed iceplant, a non-native species at Lighthouse Headlands. During this three year project, successful eradication of iceplant at this location resulted in restoration of 100.5 acres of coastal bluff habitat. Volunteers dedicated a total of 1,875 hours to the project. Monitoring data indicate a significant increase in native plant species richness in areas where iceplant has been removed.
- At **Olympic National Park**, a NRPP project sought to determine migratory pathways and potential sources of mortality of federally threatened bull trout. The project revealed that bull trout moved between freshwater and the Pacific Ocean and between watersheds along coastal Washington. This is the first study to verify that anadromy is a primary life history form in bull trout. Results demonstrate that bull trout inhabit a diverse range of estuarine, freshwater, and marine habitats, and spawn exclusively in the park. The study demonstrated that bull trout are highly susceptible to incidental mortality in gill-net and recreational fisheries directed at other Pacific salmonids. An understanding of the extent of anadromy and diversity of habitats occupied by bull trout will inform the establishment of appropriate conservation and recovery strategies for this species. Collaborators included U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Geological Survey, Washington Department of Fish and Wildlife, and The Wild Salmon Center.

Threatened and Endangered (T&E) Species Projects

The long-term goal of this group of projects is to reverse the decline of listed species and to re-establish species now extirpated from parks. Despite the obvious importance of implementing identified recovery plan actions, limited funding precludes many parks from implementing needed actions. Therefore, this NRPP project funding emphasizes on-the-ground conservation actions. Larger threatened and endangered species projects are also funded within the Natural Resource Management portion of NRPP and are eligible for regionally-administered NRPP funding as well. NRPP-T&E funding directly contributed to the National Park Service significantly meeting part and exceeding part of its goal for FY 2004. Of populations with critical habitat in parklands or requiring NPS recovery actions, 24.8% of those park populations were stable and 16.4% were increasing or not-at-risk. In total, 41.2% were making progress toward recovery.

Of 10 projects funded by this source in FY 2004, 6 received their final year of funding, including

the following:

- A 3-year project at **Lake Mead National Recreation Area** resulted in installation of approximately 6 miles of barriers and restoration of 18 miles of tracks and abandoned roads. The purpose of the project is to protect sensitive resources, particularly desert tortoises, from illegal off-road vehicle traffic and habitat loss. Project objectives were accomplished in full.
- At **Sleeping Bear Dunes National Lakeshore**, a project intended to increase piping plover chick fledging success through intense monitoring, and predator and disturbance management discovered that 2004 was the best plover nesting and fledging year since monitoring began at Sleeping Bear. The park supported 34.5% (19/55) of the Great Lakes breeding pairs and 38.7% (36/93) of the Great Lakes chicks fledged from the park's beaches. This was the second year for the highest number of breeding plovers on North Manitou Island (7 pairs), with a habitat expansion of 100 feet due to gull deterring methods and low lake levels.
- Under the interagency Northwest Forest Plan, biologists of **Olympic National Park** monitored 53 spotted owl sites during the 2002–2004 breeding seasons. U.S. Forest Service crews monitored roughly 80 owl sites adjacent to the park during this period. This cooperative demographic study was one of 14 analyzed for demographic rates and population trends across the range of the Northern Spotted Owl. On the Olympic Peninsula, the analysis demonstrated that the number of young fledged per female was stable, but survival rates declined during the 16 years analyzed. During this period of study, this spotted owl population declined at a rate of 4.4% a year. Park biologists documented the continued expansion of barred owls into spotted owl habitat. Sites where barred owls were present had lower rates of occupancy by spotted owls. From the sites now occupied by barred owls, spotted owls moved significantly farther away from their previous territory than sites without barred owls. Biologists estimate that barred owls now exclude spotted owls from at least 25% of the forested area of Olympic National Park.

Disturbed Lands Restoration Projects

Beginning in FY 2000, a portion of NRPP funds targeted projects related to disturbed land restoration, reflecting the tie between the Challenge funding and the Park Service's strategic plan. Disturbed lands are parklands altered by development, such as facilities, roads, mines, and dams, or by agricultural practices, such as cropping, grazing, and timber harvest. Restoration is the process of assisting the recovery of disturbed areas and reintegrating the site into the surrounding natural system using direct manipulation. Parks reported a total of 6,600 acres restored, exceeding the NPS Strategic Plan goal target to restore 4,700 acres in parks by 30 September 2004; this program contributes to this goal.

Of 13 projects funded by this source in FY 2004, 8 received their final year of funding, including the following:

- Restoration of more than 3 miles (14 acres) of abandoned road in **Yellowstone National Park** exceeded project objectives, including the restoration of 20 separate wetlands. Heavy equipment restored original contours, salvaged, and placed topsoil and plant material to speed revegetation. Park and Montana Conservation Corps crews planted the site with locally collected native seeds and transplants of sedges, grasses, forbs, shrubs, and trees. The Turbid Lake Trail was re-routed out of wetlands and reconstructed to NPS trail standards.
- In the second and final year of this project, **Lassen National Park** completed restoration of an abandoned downhill ski area within the park, bringing the total acreage restored to nearly 70 acres, more than half-way towards the park's goal to restore 135 acres of disturbed lands by September 30, 2005. The project included restoration of a wetland area on the site. In addition to the work done in hand seeding and planting trees and shrubs, other native species successfully established in the area from adjacent sites or seeds and rhizomes already present in the soil. This was an extremely successful and cost-effective disturbed lands restoration project.
- Alpine sewage lagoons used for the past 12 years at **Rocky Mountain National Park** are no longer needed following the 2001 installation of more environmentally compatible vault toilets. In preparation for reclaiming the site, a local contractor removed the perimeter fence, the remaining sewage and lagoon lining, and re-contoured the area to its original shape. During the past year, a local nursery held native plant material collected from the site in preparation for replanting. The restoration effort also used additional plants grown from seed collected from the site during the past five years. In FY 2004, park staff and volunteers planted nearly 10,000 native alpine tundra plants in this one-acre site previously used for the sewage lagoons. A local volunteer group,

Biological technician raising a piping plover nest within exclosure to reduce chance of flooding at Platte Point, Sleeping Bear Dunes National Lakeshore, Michigan. The efforts were partially successful in that all four eggs hatched but none fledged.

Native plant community at Lighthouse Headlands in Point Reyes National Seashore, California.

Wildlands Restoration Volunteers, contributed approximately 660 volunteer hours to the project, allowing the saved NRPP funds to go toward further invasive plant monitoring and supplemental irrigation at the project site. The most recent monitoring of the site documented an almost 85% success rate among transplanted plants, which is excellent for the very harsh growing conditions of alpine tundra. This site will continue to be a showcase example of native plant restoration on the alpine tundra for many years.

- Prior to federal acquisition of certain lands for **Manassas National Battlefield Park**, a developer graded more than 100 acres that were ultimately included within the park boundaries. Restoration work began in 2003, restoring original contours to more than 100 acres, and forming about 30 acres of emergent wetlands, 15 acres of forested wetlands, and native warm season grass meadows. Seeding of upland areas included several native wildflower and grass species. The park also contracted for the planting of more than 500 native trees of 7 species including red oak, sweet gum, tulip poplar, and ash. This project represents a unique fusion of history and science meeting the resource management needs of both the Smithsonian Institute and the National Park Service.

Small Parks Projects

Natural resource projects in small parks are the target for certain NRPP funds provided to regions. Regional allocation of these funds occurs according to the natural resource management workload of the small parks in each region. For the purposes of this funding, small parks include those parks that fall in the lower third of funding for all parks. Funded projects included a wide variety of management actions such as natural resource management and monitoring plans, exotic species control, restoration of native ecosystems, natural resources surveys, inventories, assessments and analyses, and fence repair for resource protection. FY 2004 funds supported 66 projects in at least 55 parks, at costs ranging from $3,800 to $58,000.

Here are some highlights:

- A non-vascular plant survey conducted at **Sitka National Historical Park** in Alaska identified approximately 114 species of bryophytes, 86 mosses, 27 species of liverworts, 9 fern species and 1 club moss. Several species are apparently restricted to very few (1-10) locations due to limited amount of preferred habitat in the park. The most unusual species collected was Schistostega pennata, a circumboreal species confined to damp, acidic rock or soil in caves or crevices (in this park created by upturned tree roots). Occurring on the sensitive plant lists of Oregon, Idaho, Wisconsin, Montana, Alberta, and New Brunswick, this species has very narrow habitat specificity.
- A project at **Chattahoochee River National Recreation Area** in Georgia targeted improving reproductive productivity of the Georgia aster. Project goals included stabilizing Georgia aster populations within the park through propagation of seeds, plantings, and controlling invasive species encroachment. During FY 2004, the targeted Georgia aster populations stabilized and expanded due to planting efforts.

Regional Block Allocation Projects

NRPP funds provided to regions for park projects support work that improves natural resource knowledge and condition, including specialized inventories (those currently outside the scope of the servicewide I&M Program's 12 databases), and mitigation actions (i.e., fossil inventories and exotic plant or animal control). The funds are evenly distributed among the regions at approximately $200,000 per region per year. FY 2004 support totaled $1,360,000 allocated to 78 projects in 51 parks, at a project cost ranging from $1,730 to $65,500. Funded projects included a wide variety of management actions such as ecosystem restoration, exotic species control, seismic hazard inventories, wildlife and vegetation inventories and assessments, soundscape monitoring, public outreach, and employee development. Examples include:

- Developing an integrated pest management plan for **Denali National Park**.
- Assessing stockponds, catchments, and check dams at **Zion National Park** to determine if they should be retained or removed.
- Conducting a paleontologic inventory in partnership with the Museum of Western Colorado.
- Evaluating the effects on vegetation of white-tailed deer at **Chesapeake and Ohio Canal National Historical Park** and exotic Sitka deer at **Assateague Island National Seashore**.
- Assessing densities and impacts of derelict lobster and crab traps at **Biscayne National Park**.
- Exotic species control projects at **Grand Canyon National Park** and **Buffalo National River**.

Alaska Special Projects

Established in FY 2003, this funding category enables the National Park Service to undertake projects to better protect and manage Alaska's

Floatplanes moving research team from Matcharak Lake, Gates of the Arctic National Preserve, Alaska.

national park units managed under the Alaska National Interest Lands Conservation Act (ANILCA) and other Alaska-specific requirements, including providing for subsistence harvests. Providing opportunities for human subsistence requires a program of studies that: 1)obtain important resource data and information to facilitate management of subsistence species while maintaining healthy populations, and 2)document historic subsistence use levels and patterns in rural communities. FY 2004 projects included the following:

- NRPP Alaska Special Projects supported several Alaska parks participating in the Western Airborne Contaminants Assessment Project underway in the Alaska, Pacific West, and Intermountain Regions. One objective of this study is to determine the risk to ecosystems and food webs in high latitude and high elevation national parks from long-range transport of airborne contaminants. A multidisciplinary team of research scientists from the EPA, U.S. Geological Survey, Oregon State University (OSU), U.S. Forest Service , and the United Kingdom are conducting the study. The team collected samples from four lake basins in three Alaska national parks (**Denali National Park and Preserve**, **Noatak National Preserve**, and **Gates of the Arctic National Park and Preserve**). Analyses of FY 2003 snow samples found increasing levels of mercury at higher elevations in **Denali National Park**.
- Other projects supported by NRPP Alaska Special Project funds include continuing studies on marine birds in **Glacier Bay National Park and Preserve**, sockeye salmon in **Wrangell-St. Elias National Park and Preserve**, and sockeye salmon in **Aniakchak National Monument and Preserve**. Each of these projects, at least in part, collects and evaluates resource data related to subsistence species.

USGS Biological Technical Assistance Agreement—Park-Oriented Biological Support

The U.S. Geological Survey-Biological Resources Division and the National Park Service, through the Natural Resource Preservation Program, jointly support biological projects that provide exploratory research and technical assistance to parks. Of 21 separate projects funded in FY 2004, 5 projects received their last funding allotment. Information on the project topics and status reports on the projects are contained in Appendix F. Many of this year's projects addressed continuation of projects underway from previous fiscal years. Selected project highlights include:

- Declining populations of some Sierra Nevada amphibian species prompted a study examining the potential effect of airborne pesticides on amphibian larvae. The project involved field translocation experiments in **Yosemite**, **Sequoia and Kings Canyon**, and **Lassen Volcanic National Parks** in California and a controlled laboratory experiment to test for pesticide exposure effects seen in the field.

Results of this study will provide information useful for addressing toxic pesticides and restoring amphibian populations.

- A **Yellowstone National Park** study investigated the causes of summer elk calf mortality. The study examined the fate of 44 elk calves less than 6-days old that were captured in May and June 2004, tagged with mortality transmitters, and monitored through the end of FY 2004. Thirteen elk calves survived through this time period; the others were killed by bears (18), coyotes (4), wolves (3), golden eagle (1); wolf or bear (1), or unknown predators (2), or died due to unknown, non-predation causes (2). Basic results followed those observed in FY 2003. The study will continue in FY 2005 with an objective of tagging and monitoring 35–50 more neonate elk calves.

Servicewide Projects

In addition to parks, there are often project needs outside specific servicewide programs that require funding unavailable from other sources. These special needs are often interdisciplinary, and may include activities with professional organizations, certain publications, or work on servicewide databases. Specific project needs that cannot be accommodated operationally are identified for funding by NRPP, fee monies, or other sources. A significant amount of the funding and projects provides specialized assistance to parks, either through direct provision of experts or through special topic workshops on issues affecting parks, or the development and support of tools to assist parks. Projects related to night sky, geo-hazards, management of non-federal oil and gas in parks, and fish population assessments are examples funded in FY 2004. Support of efforts to establish and provide leadership to Cooperative Ecosystem Studies Units (CESU) remains a major focus, as does development, production, and distribution of education and information related material. Several special projects were initiated through this program in FY 2004, including the following:

- An assessment of the ecological content and context of parks in the national park system, designed to help managers understand the ecological relationship of parks to their surrounding landscape, provide information for the public, and cooperative planning with other agencies. Towards the same objective, the Park Service initiated a pilot project with NatureServe to identify opportunities to partner with adjacent land surrounding parks to protect biodiversity, enhance outdoor recreational opportunities, and control invasive species.
- The National Park Service formed a Night Sky Team to establish monitoring protocols, quantitative methods, and collect baseline data at several parks towards developing management tools to protect dark night skies. The team also provided technical assistance on internal facility lighting, community outreach and partnering, and provided interpretative materials.
- The Park Service initiated reviews of the past functioning of two U.S. biosphere reserves to determine how best to renew biosphere reserve activities consistent with U.S. action to rejoin and participate fully in the United Nations Educational, Scientific and Cultural Organization (UNESCO). The five units in the Southern Appalachian Biosphere Reserve in Tennessee and North Carolina and the one unit in the Mammoth Cave Biosphere Reserve in Kentucky are being reviewed to assess past performance and current capacities for conducting the three main functions of biosphere reserves: conservation, sustainable development, and capacity building. The project is scheduled for completion in mid-2005.

NATURAL SOUNDS PROGRAM

FY 2004 Allocation:	**$921,000**
Available:	$918,000

Established in FY 2000, the NPS Natural Sounds Program assists parks in plans to manage sounds in a way that balances the myriad expectations of park visitors with the protection of those resources. The Natural Sounds Program addresses sound-related matters raised by Congress, NPS Management Policies, and NPS Director's Orders. An important element of this mission is working with the Federal Aviation Administration (FAA) to implement the National Parks Air Tour Management Act (NPATMA) wherein Congress mandated that FAA and the National Park Service jointly develop Air Tour Management Plans (ATMPs) for the more than 130 parks that have commercial air tour operations. Five staff members supported by base funds work in the NPS Natural Sounds Program. The Program was not funded by the Natural Resource Challenge.

Surveys indicate that many visitors who recreate in national parks seek to escape the clamor of everyday life—they come to "get away from it all," "find peace and quiet," or "solitude." The type of park unit (e.g., national battlefield, national seashore, national recreation area, or national park) and its specific features help to shape visitor expectations. Anticipations may include quiet, the sounds of nature (e.g., wind, birds, geysers, elk bugling, wolves howling, or waterfalls), sounds reflecting our cultural and historic heritage (e.g., cannonballs firing, tribal

dances, or reenactments) and sounds associated with recreation (personal water craft, snow mobiles, air tours, or park operations). Natural sounds also are intrinsic elements of the environment often associated with parks and their purposes and vital to the functioning of many park environments, such as wildlife, which depend on the ability to transmit and receive sound for many life essential functions. The Natural Sounds Program helps to evaluate current park sounds and plan for achieving desired sound conditions, including assisting parks with ATMPs and working with the military regarding aircraft noise issues.

Significant accomplishments for FY 2004 included:

- Developed acoustical protocols and tools, including coordination with the Department of Transportation (DOT), FAA, and the John C. Volpe Center to develop and adopt a common database schema for acoustical data sets collected in national parks. Using a common schema will allow the agencies to more easily share acoustical data in the future.
- Assisted with ATMPs for **Glacier National Park**, **Lake Mead National Recreation Area**, **Hawaii Volcanoes National Park** and other Hawaiian parks.
- Headed the NPS negotiating team for the Grand Canyon Alternative Dispute Resolution process. Participated in several meetings as Modeling Team member for the National Park Service, and worked with FAA, on presentations to groups involved.
- Deployed acoustical monitoring equipment at **Lake Mead National Recreation Area**, **Mount Rushmore National Monument**, **Badlands** and **Glacier National Parks**. This was in support of parallel planning efforts for ATMPs and Sound Management Plans. Data have been archived for analyses.
- Coordinated the production and distribution of 6,000 natural sounds interpretive cards that were used by more than 40 parks.
- Completed final year of acoustic and audio/video fieldwork on soundscapes and assess impacts to American Peregrine Falcons in interior Alaska due to military aircraft.
- Worked with the superintendent of **John Day Fossil Beds National Monument** and other officials to resolve the low flying military overflights at the monument and assisted other parks on similar issues.

RESOURCE DAMAGE ASSESSMENT AND RECOVERY PROGRAM

FY 2004 Allocation:	**$1,265,000**
Available:	$1,259,000

Under the Park System Resource Protection Act (PSRPA) (16 USC 19jj), the Oil Pollution Act (OPA) of 1990, the Clean Water Act as amended by OPA (CWA), and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the National Park Service conducts damage assessments and restoration for injuries to park resources in national park system units. The Resource Damage Assessment and Recovery Program supports: 1) direct technical assistance to parks in conducting damage assessments for incidents injuring park resources and in planning and implementing restoration projects; 2) outreach and training on damage assessment for park staff; and 3) completion and Director's approval of policies and procedures for the program. In FY 2004, of a total of 52 ongoing active cases, 15 cases in 6 parks were settled without litigation. Examples of ongoing cases and restoration projects include:

FY 2004 Damage Assessment Case Status

State	Park	Case Name	Project/Resource Type	Statute	Status 2004	Amount
TX	BIBE	Enterprise Rent-a Car	Replant desert vegetation	*19jj*	*Complete*	$2,054
CA	MOJA	Morningstar	Airplane Crash	19jj	Settled	47,000
CA	MOJA	Interconnect Towers	Damage, road grading case	19jj	Settled	$31,910
CA	PORE	Mystery Tarballs	Oil spill; marine birds	OPA	Response and Past Costs	$23,465
CO	GRSA	Zapata Fire	Fire	19jj	Settled	$19,095
DC	ROCR	Economides	Encroachment	19jj	Settled	$8,078
FL	BISC	My Jo	Resource Damage	19jj	Settled	$215,340
GA	CHAT	Rottenwood Creek	Resource Damage, Acid Spill	19jj	Settled	$2,136
GA	CHAT	Rivercliff II Mudslide	Resource Damage Mudslide	19jj	Settled	$14,595
GA	CHAT	Cousins/GE	Encroachment	19jj	Settled	$83,408
GA	CHCH	Colonial Pipeline	Oil Spill	OPA	Settled	$82,704
GA	MALU	Simplex Grinnell, LLP	Visitor center flooded	19jj	Settled	$12,950
MA	MIMA	Scooch Car Crash	Repair historical rock wall	*19jj*	*Complete*	$812
OK	CHIC	Phelps	Encroachment, Tree Cutting	19jj	Settled	$10,000
WV	APTR	Elias	Encroachment	19jj	Settled	$3,000
					Total	**$556,547**

Ranger with confiscated fish that had been illegally caught in the Channel Islands Marine Preserve, California.

Collecting sound data for Air Tour Management Planning at Haleakala National Park, Hawaii.

- At **Golden Gate National Recreation Area** settlement was reached in a case involving the removal of redwood trees and significant site disturbance within the park. The park will now be able to restore the disturbance including removal of illegal roads and trails.
- At **Cuyahoga River National Recreation Area**, more than $1,000,000 collected for damages to natural resources from the Kreji dump site is being used to remove and restore the site to natural conditions at the Jaite Paper mill. Final site characterizations are currently underway. These will determine if any additional contaminants of concern should be removed or addressed. Development of the restoration plan will begin in FY 2005.

RESOURCE PROTECTION PROGRAM

FY 2004 Allocation:	**$294,000**
Available:	$294,000

In its third year of funding, the Resource Protection Program is supporting projects that use innovative approaches involving natural resource specialists, protection rangers, and partners from other agencies and universities. The new resource stewardship and protection curriculum, which was proposed by several regions, is now moving to Phase III and providing training across the Park Service. A model to focus protection efforts on those natural resources most at risk is also in its third stage and moving its methods from Appalachian Mountain parks to other regions. Funded projects increasingly show the innovation and collaboration between divisions and other agencies that this funding source encourages. Completed projects include:

- New surveillance techniques, developed in conjunction with other agencies, are being tested at **Capitol Reef National Park** to protect endangered cacti that are advertised on Internet sites.
- The new marine reserves at **Channel Islands National Park** were patrolled more intensively to inform those diving and fishing from boats of the new restrictions that were in place FY 2004.

WATER RESOURCES PROGRAM

FY 2004 Allocation:	**$12,071,000**
Available:	$12,049,000

The Water Resources Program (WRP) serves parks through a broad range of activities in water quality; water rights; floodplain management; ground water analysis; watershed and wetlands protection; water resources management planning; fisheries and marine resources management and protection; policy, legislative, and regulatory analysis; information management; and training. An increase of $600,000 in FY 2004 provided for water quality monitoring in 7 networks, in conjunction with park vital signs monitoring.

The Challenge related components of the WRP include new capability to track the attainment of water quality standards in national park system units, in support of the Park Service's strategic plan, and expanded efforts to improve aquatic resources through project support and field-based aquatic resource specialists. For FY 2004, the performance management goal was to determine baselines for new water quality related goals consistent with the Department of the Interior's strategic plan. The National Park Service intends in the long-term to utilize water quality data provided by its monitoring program to supplement other available water quality information to determine whether park waters meet desired conditions. However, at this time desired conditions have not been established and the Park Service is continuing to use information from states regarding whether park waters have been identified as impaired. While the National Park Service continues to determine desired conditions for its waters, in FY 2004 the Park Service modified its database to track impaired waters by the categories established by the Department of the Interior—streams, lakes, estuarine, and marine waters.

Water Resource Projects

Highlights of FY 2004 accomplishments in various project categories appear below. For a complete listing of projects funded in FY 2004 under Water Resource Protection, see Appendix G.

Water resource protection projects help to fund data collection and analyses that target development of scientific information to benefit decision-makers, including federal managers, court judges, or state administrators. Results are often intended to support settlement negotiations conducted to avoid contested case hearings, contested land use decisions, or to support the implementation of settlements. Hydrologic characterization is a need common to all water resources protection issues addressed by this budget.

The majority of FY 2004 water resource protection funds supported ongoing studies designed to characterize surface or ground water flow systems, and to study the relationship between water quantity and flow timing and water-dependent park resources. In the western U.S.,

Water quality is a key vital sign in determining overall aquatic ecosystem health.

ongoing projects are developing modeling capabilities to predict effects of large-scale development in regional ground water flow systems. In the eastern U.S., hydrologic studies are developing information regarding effects of impoundments on surface river systems. Decision-makers utilize these tools to understand the potential for impacts to park water resources in the future from existing water development proposals. Additionally, hydrologic data are often required to implement settlement agreements.

Additionally, the National Park Service joins with other non-federal entities to increase effectiveness of its water resource protection funding. Some studies occur as a result of collaboration with state or private entities with common science objectives. For example, hydrogeologic analyses conducted for **Great Sand Dunes National Park and Preserve**, combined with work conducted by The Nature Conservancy and local Water Conservation Districts, support water rights protection for the park. In another area, the Nevada State Engineer, southern Nevada water purveyors and private developers use hydrologic data collected by NPS studies for **Lake Mead National Recreation Area** and **Death Valley National Park**, thereby contributing to the larger-scale investigation of water availability in southern Nevada.

Water Resources Program competitive projects support a wide-range of park-based activities. Projects include riparian/stream, wetland, and watershed restoration; regulatory assessments; design and implementation of best management practices required to improve water quality to meet state-mandated polluted runoff or non-point source pollution control; one-time assessments or inventories of water quality baseline conditions or contaminants; wetland inventories; groundwater assessment and monitoring; well and spring inventories; channel and bank stability investigations; floodplain assessments; water resources management planning; and other water resources-related projects.

To augment the professional fishery expertise within the National Park Service, a limited amount of WRP base funds support cooperative relationships between the academic community and the NPS fisheries program. These funds help to foster graduate student research at national park system units and to cooperatively fund fishery students engaged in park projects. The program introduces top caliber fishery students to NPS programs, while expanding the level of expertise available to parks. Two new projects initiated in FY 2004 included one in conjunction with Colorado State University and one with Montana State University.

A total of 17 projects received final water resources competitive project funding in FY 2004. Two are highlighted below.

- Installation of municipal wells and wastewater treatment facilities adjacent to **Cape Cod National Seashore** boundaries prompted concerns regarding the possibility of groundwater withdrawal/water table modifications affecting dune slack wetlands. This study identified and mapped 340 dune slack wetlands within the boundaries of the park. Preliminary results include identification of 105 wetland plant species; none were state or federally listed species. Results of analyses of hydrology, vegetation, and other variables will improve dune slack conceptual models and assess the severity of threats from water table modifications or other stressors.
  At **Redwood National Park**, a project intended to determine whether summer stream temperatures are a limiting factor for juvenile coho salmon in Redwood Creek involved the use of thermal infrared imaging of Redwood Creek. Used to measure the surface water temperature along the main channel of Redwood Creek and identify warm versus cool reaches, thermal images captured stream temperature during the warmest time of the day and on the hottest day of the summer. The water temperature profile of Redwood Creek was quite variable, with large changes of stream temperature over relatively short distances. For example, changes in water temperature greater than 1°C occurred in less than a half-mile and many were associated with the inflow of tributaries or springs. Based on the temperature data, Redwood Creek can generally be divided into four main reaches that showed similar temperature characteristics.

Water Quality Monitoring

Presently about 110 park units have one or more waterbodies that do not meet state water quality standards for one or more pollutants on approximately 1,550 miles of rivers and streams, and 742,300 acres of lakes, reservoirs, estuaries, and marine areas. Planning and design of the program continues to be implemented in full integration with the NPS Park Vital Signs Monitoring Program. Water quality is a key vital sign in determining overall aquatic ecosystem health. Additionally, by fully integrating the design of these programs, considerable cost efficiencies have and will continue to be realized in staffing, planning and design, administration, implementation, data management, and

Melanie Cook, biotechnician for Yukon-Charley Rivers National Preserve, Alaska, processes macroinvertebrate samples along the margin of a lake sampled in 2004.

Tim Brabets, USGS Hydrologist, and Tom O'Keefe, University of Washinton, collecting water quality sample near transect 2 on the Kijik River, Lake Clark National Park & Preserve, Alaska.

reporting.

Full program funding supported 24 Park Vital Signs Monitoring Networks in FY 2004, including 7 new networks. The majority (23) of these networks fully committed their water quality funding to compilation of background information, analysis of issues and threats, detailed program planning, and supporting synoptic-level field assessments. One network initiated its monitoring plan.

During FY 2004, work continued in development of program technical guidance, technical protocols, detailed study plan and Quality Control/Quality Assurance Plan guidance, and database management. Database templates are being developed for networks so that data can be managed consistently with the requirements of the EPA's STORET database, and also as part of Networks' Park Vital Signs Monitoring databases. The servicewide NPS water quality database being constructed by the program has more than 2.5 million water quality observations. This database is the starting point for most Network water quality data compilation and analysis efforts.

Water Resource Protection—Aquatic Resource Professionals

In FY 2003, the Challenge funded three additional aquatic resource specialists: a groundwater hydrologist at **Chickasaw National Recreation Area**; a marine ecologist at **Fire Island National Seashore**; and a groundwater hydrologist at **Lake Mead National Recreation Area**. This brings the aquatic resource specialists in the field to a total of 16 new positions funded by the Challenge; however, in FY 2004, one position (at **Grand Teton National Park**) remained vacant. Twelve of 15 occupied positions are duty-stationed in parks, with the remaining three located in the Sonoran Network Office, the Center for Urban Ecology in the National Capital Region, and the Utah State Office. In the future, as attrition occurs, the Park Service does not expect to continue to maintain all of these positions.

Prior to funding provided by the Challenge, only 20 parks had aquatic resource professionals on staff. The new professional staff provide technical assistance to parks, identify and conduct technical investigations to determine the condition of park aquatic resources, determine if actions of the National Park Service or external parties impair or impact resources, assist in developing and implementing aquatic resource mitigation and restoration projects, and interpret and implement NPS water resource-related policies and regulations. While these 15 Challenge-created positions work on a wide range of water resource-related issues facing the parks, some particularly significant issues addressed in FY 2004 include:

- Continuing collaboration with the Woods Hole Research Institute on a project measuring the percent of impervious surfaces for selected watersheds in the National Capital Region. At this stage, the project has delineated watersheds and obtained impervious surface maps. In the future, this project will relate water quality and flow parameters to the percent of impervious surfaces for each watershed.
- A cooperative agreement between the National Park Service, the Maryland Biological Stream Survey (MBSS), and Frostburg State University to develop protocols for monitoring of benthic invertebrates, fish, and stream habitats. The MBSS protocol will be modified to suit NPS needs and be modified for Virginia ecosystems.
- Synthesized nearly 600 aquatic research documents from 9 different park units in the upper Great Lakes area. The resulting document draws together the results of previous aquatic studies, provides an analysis of dominant research themes and remaining knowledge gaps, and offers detailed recommendations for future monitoring and research on both a park-specific and a Network-wide basis.
- Participated on the Natural Resource Assessment Team to conduct a comprehensive field review and assessment of the ecological impacts of Hurricane Isabel in the fall of 2003. The team was charged with identifying modifications to geological, biological and water resources, determining the nature and extent of the modifications, assessing the implications and significance of the modifications and recommending management response to the modifications.

Watershed Condition Assessment Program

FY 2004 marked the second year for the newly established Watershed Condition Assessment Program (WCAP), a program supported by a permanent increase to the Water Resources Program base through the Challenge. The WCAP will integrate data and knowledge pertaining to water and other watershed resources to help define desired conditions, and assess existing conditions, within park managed uplands, streams, riparian areas, wetlands, and coastal/marine areas. Information developed through assessments of watershed conditions will support the needs of park planning, resource protection, and resource restoration activities. This new program is timely in light of the movement towards condition-based resource plan-

ning and decision making by the National Park Service. Information developed by the WCAP will also complement information from the Vital Signs Program (also a component of the Challenge), to develop science-based information on conditions and trends relative to important park resources. Program efforts in FY 2004 emphasized continuation of baseline condition assessments at coastal and marine parks, continued development of a compendium of watershed assessment methods and classification systems for potential use by parks, and funding of backlogged watershed resource and water quality assessment projects. Two full-time staff members were hired in the latter part of FY 2004 to support long-range program components. Examples of work supported in condition assessments in FY 2004 are below:

- Assessment needs of coastal areas differ from strictly upland environments because of salinity regimes, the potential transport of pollutants or invasive species from ocean currents, and the high degree of development on the coast. Working through universities in the Cooperative Ecosystem Studies Unit Networks, this project continued a pilot study of seven coastal parks on the South Atlantic and Gulf Coasts. Draft reports describing the status of coastal park resources are available for **Padre Island** and **Cumberland Island National Seashores**, and a final report on **Cape Lookout National Seashore** is currently in press. Still in-progress are reports on **Fort Pulaski National Monument**, **Canaveral National Seashore**, **Timucuan National Historical and Ecological Park**, and **Gulf Islands National Seashore**. These Coastal Watershed Condition Assessment Reports will help guide resource management planning and support the development of Park Vital Signs Monitoring Plans.
- A project at **Glacier National Park** followed large fires of the summer of 2003 characterizing effects of wildfire on water quality. Preliminary results indicate that nutrient concentrations in runoff from basins that burned at high intensity were significantly higher than in basins that did not burn.

Water Resource Technical Assistance

This was the fundamental component of the Water Resources Program before the Natural Resource Challenge and has not been expanded with Challenge funding. Through this effort, the Water Resources Program provides direct assistance to parks on high priority needs using a combination of its own staff and expertise acquired through cooperative agreements. Examples of accomplishments include:

- Conducted a follow-up assessment of riparian areas in **Channel Islands National Park** to assess condition change after the 1998 removal of livestock from Santa Rosa Island.
- Assisted in the planning for native trout restoration in **Great Basin**, **Great Sand Dunes**, and **Rocky Mountain National Parks**.
- Provided fisheries assistance for the Upper Colorado River Endangered Fish Recovery

Lake trout captured during resident fish study, Lake Clark National Park & Preserve, Alaska.

Implementation Plan.

- Participated in the U.S. Coral Reef Task Force and Marine Protected Area Interagency Committee and the development of the National Park Service's Ocean Strategy.
- Assisted **Olympic National Park** in presenting the sediment management plan for Elwha River dam removal to the Port Angeles, Washington, city council in support of its decision to formally support the Elwha River Restoration Project.
- Provided assistance for the development of alternative wastewater discharge locations at Lake Meade.
- Provided assistance to park managers and planners related to the Furnace Creek flash flood of August 2004 in **Death Valley National Park**.
- Evaluated alternatives for management of a uranium tailings pile at Moab, Utah.

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

This chapter focuses on accomplishments in programs primarily directed at developing reliable information for resource management. Detailed financial information related to these goals appears in Chapter 5. Programs included are:

- Cooperative Ecosystem Studies Units
- Geographic Information System Program
- Inventory and Monitoring Program
- Natural Resource Data and Information Program
- Research Learning Centers

COOPERATIVE ECOSYSTEM STUDIES UNITS (CESUs)
Cumulative Increases: $1,993,000 (FY 2001 and FY 2003)
FY 2004 Allocation: $131,000 (portion not transferred to regions)

Cooperative Ecosystem Studies Units (CESUs) are multi-agency partnerships with the nation's universities and other institutions, organized around bio-geographic areas. Their broad scope includes the biological, physical, social, and cultural sciences needed to address park management issues. Currently, 181 universities (including 42 minority institutions) and 24 state, tribal, and non-governmental partners participate in the CESU Network. Seventeen individual CESUs are part of a national network competitively established with leadership from the National Park Service, the U.S. Geological Survey (USGS), and other federal agencies. The Park Service is one of 13 federal agencies in the CESU Network.

As a result of Natural Resource Challenge funding, 12 CESUs now have a NPS research coordinator duty stationed at their host universities. Regional offices help support NPS participation in the remaining five CESUs through collateral duties, additional funding, or assigning additional responsibilities to existing staff. NPS coordinators are "brokers," working with park 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 the CESU Network. At several CESUs matching expertise to needs is now facilitated through databases of experts. Through their direct connection with parks to facilitate projects, CESU coordinators are instrumental in fostering cohesion and enhancing communication among park clusters and diverse program offices. Through the CESUs, collaboration with other programs is increasing. NPS coordinators are working more closely with Research Learning Centers, Exotic Plant Management Teams, and Inventory and Monitoring (I&M) Networks. NPS coordinators also provide technical assistance to park staff in developing proposals for the Cooperative Conservation Initiative and other funding sources, including USGS-NRPP funding.

NPS projects administered through CESU agreements, and the expertise available for these projects, became increasingly diverse in FY 2004. Research projects remain a strong focus; however, technical assistance, education projects, and conducting workshops are becoming an increasingly important component of NPS activities through CESUs. Natural resource needs continue to be well served by CESUs. Working with international partners, several NPS coordinators in border areas are exploring innovative approaches to deal with management challenges that cross international boundaries; such as, neotropical hummingbird monitoring. Additionally, several CESUs noted an upward trend in interdisciplinary, social science, and cultural resource projects. Projects related to planning and transportation are also on the rise.

In FY 2004, projects implemented through CESUs increased from a total of more than 540 projects and $19 million in FY 2003 to 650 projects and $27 million.

Following are some examples of FY 2004 accomplishments:

- Joseph Grinnell conducted vertebrate distribution, habitat use and species abundance studies in **Yosemite National Park** from 1914 to 1920. With funding from the Yosemite Fund, researchers from the University of California at Berkeley, Museum of Vertebrate Zoology, and staff from Yosemite National Park collaborated to determine if there are differences in vertebrate populations as observed in Grinnell's studies and re-sampling of the original transects. Preliminary analysis indicated that there are significant changes in vertebrate species distribution, habitat, and abundance. Species occurred at higher elevations than they

Shoreline change is an important monitoring indicator for Acadia National Park, Maine.

occurred at nearly a hundred years ago and some species used considerably different habitats. These data will assist park managers in long-term resources management and identify further investigations and studies.

- The Dyke Marsh Wildlife Preserve in Virginia provides valuable habitat for a large variety of birds. A volunteer group called Friends of Dyke Marsh initiated a breeding bird survey in 1994. Data analyzed from this monitoring project from 1994–2003 indicate that more shorebirds were recorded during the latter years of the survey, but that some species (such as eastern phoebe and eastern bluebird) disappeared from the survey routes. The bald eagle, first recorded in 2000, was present in all subsequent surveys.
- The U.S. National Arboretum supports a valuable population of organisms that are important for pollination of plant species. The managers of the National Capital Region natural resources and representatives of more than 40 different organizations participated in a habitat conservation workshop entitled "Promoting Pollinators in Public Places," co-sponsored by the University of Maryland, the U.S. National Arboretum, and the Urban Ecology Research Learning Alliance. Sessions provided opportunities for hands-on learning and case studies. Participants broke into small groups and received specific advice and information on promoting pollinator-friendly habitats and monitoring pollinator populations. Another workshop is planned for 2005.
- Growing interest exists in long-range American chestnut (*Castanea dentata*) restoration. In response, the Park Service conducted a workshop entitled, Restoration of Chestnut to Forest Lands within the National Park System. The venue was the North Carolina Arboretum in Asheville. Twenty-four speakers addressed the ecological history of the American chestnut, impacts of its loss, developments in chestnut blight resistance, research on chestnut genetic issue, restoration considerations, objectives, opportunities, and NPS policies. Pennsylvania State University organized the workshop. More than 80 people from the National Park Service, USDA Forest Service, state forests, academic and non-profit institutions participated. New technologies and practical applications for restoration of American chestnut will be presented in an upcoming report.
- A one-day workshop was designed and delivered by staff from Flagstaff Area National Monuments and faculty from Northern Arizona University's (NAU) Center for Sustainable Environments to introduce the concept of environmentally preferable purchasing or Green Procurement to the staff of government agencies and owners of private businesses. Nationally recognized facilitators from the Center for a New American Dream and the U.S. Environmental Protection Agency guided a group of 37 participants towards an understanding of green procurement strategies and components of an Environmental Purchasing Plan. Held on the campus of Northern Arizona University, workshop sponsors included the city of Flagstaff, NAU, the National Park Service, EPA and the Center for a New American Dream.
- Economic information is often used for planning, concessions management, budget justifications, policy analysis and marketing. A research project conducted by Michigan State University (MSU) researchers, adapted the Money Generation Model (MGM2, developed by Stynes and Probst in 2000) to provide information to national heritage areas. Seven NPS Alliance members were assisted in the design and implementation of economic surveys. Members included Motorcities Automobile, Augusta Canal, Cane River, Essex, Lackawanna Valley, Silos and Smokestacks Natural Heritage Areas, and the Ohio and Erie Canal National Heritage Corridor. MSU scientists analyzed the data and estimated the economic impacts of the heritage areas. The final report, Economic Impacts of National Heritage Areas; Summary Results from Seven National Heritage Area Visitor Surveys, appears on the MGM2 website: <http://www.prr.msu.edu/mgm2/>.

GEOGRAPHIC INFORMATION SYSTEM PROGRAM

FY 2004 Allocation:	**$1,291,000**
Available:	$1,290,000

Geographic Information Systems (GIS) have contributed to NPS resource management since the mid-1970s, when Yosemite and Great Smoky Mountains National Parks embarked on the first geospatial projects. The funded program originated as a natural resource program and many GIS data layers remain natural resource-related, but the technology has been adapted for various cultural resource disciplines, facility location information, interpretation, and other uses throughout the national park system. The NPS GIS Program is now led by the Office of the Chief Information Officer (OCIO), in recognition of its broad applicability across many NPS programs. The funding essentially operates as seed funding and is distributed to regions to fund a combination of Regional Technical Support Centers (RTSC), support operations and projects, in addition to a natural resource GIS coordinator. A GIS Committee represent-

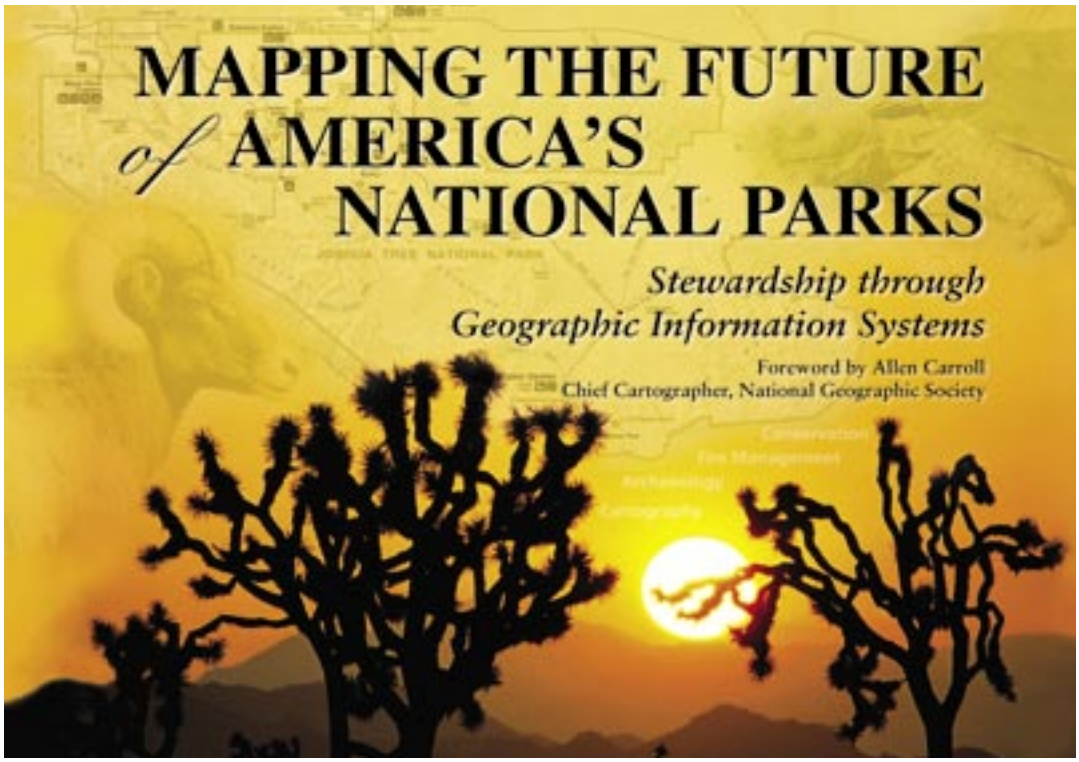
ing many regional, park, and program GIS users provides policy, funding and operational recommendations to the Chief Information Officer and the Associate Director for Natural Resource Stewardship and Science. Additionally, there is significant coordination within the Department of the Interior through the Interior Geographic Data Committee and across government through the Federal Geographic Data Committee.

In FY 2004, approximately half of the GIS program funding supported park and regional staff or support provided by contractors and cooperators. About one-third of the funding financed projects with the balance covering other support costs. This funding is matched nearly ten-fold for efforts undertaken by, or coordinated through the RTSCs, with approximately $5 million for staff and support and $5 million for projects from various sources.

The goal of the NPS GIS Program is to provide quality geographic data, information, and applications utilizing GIS for park planning, program operations, and scientifically-based management of park resources. Today, most national park system units use GIS data and technology. GIS provides powerful visualization and analysis tools to assist park managers with resource management problems. GIS allows resource managers to bring together and geographically link information that otherwise may be impossible to integrate. Managers may then discover changes, patterns, and trends in the resources.

Examples of GIS projects in FY 2004 include:

- Through the cooperative efforts of numerous parks, Inventory and Monitoring networks, regions, and service-wide programs, the Park Service published the book, *Mapping the Future of America's National Parks* in cooperation with ESRI.
- Tsunami (tidal wave) and potential river flooding inundation hazards were modeled and displayed using GIS for **Pu'ukohola Heiau National Historic Site** to address and assist with the planned relocation of the park's visitor center to a coastal site and to provide information for visitor safety and emergency operations.
- Development of a GIS model was begun as part of the St. Croix Scenic Assessment project to evaluate the scenic landscapes of the St. Croix valley. The model bases scenic values on the application of scenic assessment parameters. Scenic quality is one of the major attributes of the St. Croix River valley, and is a primary reason for the 1968 designation of the **Saint Croix National Scenic Riverway** as a unit of the national park system. The project is a partnership between the National Park Service, the University of Minnesota, the Minnesota Department of Natural Resources, and the non-profit St. Croix Scenic Coalition.



The new book *Mapping The Future of America's National Parks* highligts the value of GIS in the everyday management and conservation of America's special places.

INVENTORY AND MONITORING PROGRAM

FY 2004 Allocation:	**$36,932,000**
Available:	$36,896,000

This program provides park managers with information about what they manage (inventories) and the condition of the resources they manage (monitoring) so that informed decisions can be made about actions that affect natural resources. The program, which began in the early 1990s, has expanded greatly as a result of Natural Resource Challenge increases. In FY 2000, the National Park Service organized 270 natural resource parks into a system of 32 networks to provide an efficient means of carrying out expanded inventory and monitoring (I&M) activities. The program as a whole increased from its FY 1999 level by nearly six-fold by FY 2004. In FY 2004, the program received a net increase of $4,511,000.

Through the program, each of the parks involved is to obtain 12 basic inventory products and park networks are to develop and implement programs to monitor the most critical vital signs (indicators of park ecosystem health) in all parks with significant natural resources. The vital signs monitoring portion of the program began in FY 2001. Earlier-designed prototype monitoring programs serving 22 parks continue and provide assistance to the more extensive but less intensive vital signs monitoring programs carried out through networks.

As of FY 2004, more than 1,600 park-inventory data sets have been compiled. These inventories represent 7 complete inventory data sets for all natural resource parks (natural resource bibliographies, vertebrate and vascular plant species lists, base cartography data, baseline water quality data, water body location and classification, air quality data, and meteorological data), and progress on the remaining five inventories.

Additionally, 22 networks encompassing 185 parks have been funded to monitor vital signs, including five networks in FY 2004. The 22 networks are involved in a three-phase planning process to develop quality, peer-reviewed monitoring program designs that will provide the best possible information for management. The first 17 networks completed the vital signs identification phase (phase 2 of 3). In these networks, the following categories of vital signs predominated: invasive plants, land use, cover change, weather and climate, water chemistry, surface water dynamics, and land bird distribution and abundance, ozone, and soil function dynamics.

The I&M program directly achieves goals of the National Park Service strategic plan. The Service's inventory goal had a target in FY 2004 to complete 1,637 (59.2%) of the 2,767 outstanding data sets. An additional 123 data sets were collected in FY 2004, for a total of 1,630 (58.9%) of the outstanding data sets, slightly short of the target. Lack of verification of completed inventories led to the shortfall. The Service's goal for park vital signs in FY 2004 was for 60% (162) of 270 parks with significant natural resources to identify their vital signs for natural resource monitoring, and 3.7% (10 of 270) parks with significant natural resources to implement natural resource monitoring of key vital signs parameters. As a direct result of the strategy of organizing parks into 32 vital signs monitoring networks, 22 networks (representing 153 parks) and 23 additional parks (176 parks in all or 65%) identified park vital signs by the end of FY 2004—exceeding the goal—and 10 parks implemented vital signs monitoring—meeting the goal. The latter represented prototype monitoring parks that were funded prior to the Natural Resource Challenge. The FY 2004–FY 2008 NPS strategic plan will focus on implementing the measurement of park vital signs, rather than identifying them; this is a direct

Basic Inventory Data Sets

	End Of FY 2004		End Of FY 2005	End Of FY 2006	FY 2007–10[1]
	Underway	Completed	Completed	Completed	To be Completed
Natural Resource Bibliographies	0	270	270	270	0
Base Cartography Data	1	269	270	270	0
Species Lists	0	270	270	270	0
Species Occurrence and Distribution	267	3[1]	150	270	0
Vegetation Maps	45	51	63	78	192
Soils Maps	31	59	70	100	170
Geology Maps	227	52	108	150	120
Water Body Location and Classification	0	270	270	270	0
Baseline Water Quality Data	0	270	270	270	0
Air Quality (station) Data	0	270	270	270	0
Air Quality-Related Values	220	48	100	150	100
Meteorological Data	0	270	270	270	0

[1] Reflects a change from the figure in the 2003 Natural Resource Challenge Report to Congress. Field work on all 270 park data sets completed in 2004. Parks reviewing and certifying the accuracy of these inventories in 2005–2006.

A researcher wearing a "bug jacket," inside an electric bear fence, uses a field centrifuge to spin fish blood samples at McLeod Lake in Denali National Park, Alaska.

Monitoring macroinvertebrates for water quality at Wolf Trap Farm Park, Virginia. Baseline Water Quality Assessment Reports have been completed for 234 park units.

result of new funding.

Universities, other non-governmental entities, and non-NPS government agencies produced inventory and monitoring products totaling more than $16 million during the year. Efficiencies and leveraging were obtained by partnering. For example, in FY 2004, I&M funding was combined with funding from the U.S. Geological Survey and the NPS Fire Program to further accelerate vegetation mapping. Alaska land cover mapping combined I&M funding in a variety of cooperative projects, including those with the U.S. Geological Survey, Ducks Unlimited, National Wetlands Inventory, and the University of Alaska.

Inventories

As of the end of FY 2004, seven data sets were essentially completed, and the balance are underway. The status of these inventories is shown in table below. In FY 2004, inventory funding primarily supported six of the basic inventories: species occurrence and distribution, vegetation mapping, soils mapping, geologic resource inventories, baseline water quality data inventories, and Air Quality Related Values (AQRV).

- In FY 2003, most networks received the last of five years of funding for completing species occurrence and distribution inventories, or biotic inventories, and in FY 2004 largely completed work on these inventories. In addition to current field inventories, parks in all networks actively collected historical information on vouchers and species occurrence in parks, resulting in 337,845 voucher records and 264,948 species listings entered into NPSpecies for I&M park units.
- By combining FY 2003 Challenge funding with other funding provided by the U.S. Geological Survey and NPS Fire Program, the Park Service was able to complete 21 more vegetation mapping projects (51 total complete), continue 67 ongoing projects, and initiate 14 new park mapping projects. Vegetation information is especially important for (1) the management and protection of wildlife habitat, (2) modeling vegetation flammability and fuel implications for fire management, (3) analyses for site development suitability, and (4) evaluation of resources at risk.
- Funded through the inventory portion of the Service-wide I&M program, the Alaska Landcover Mapping Program is distinct from the vegetation mapping effort for other parks; the scale of parks in Alaska dictate different mapping approaches. Partners in this effort include the U.S. Geological Survey-EROS Field Office, Ducks Unlimited, National Wetlands Inven-tory, and the University of Alaska. By the end of FY 2004, land cover maps and other products were completed for a total of 9 Alaskan park units.
- To address National Park Service's responsibility under the Clean Air Act, the Park Service is identifying air quality related values in national parks, which often include sensitive plant and animal species, sensitive lakes and soils, and visibility. One project completed in FY 2004 provides a plant ozone injury risk assessment for all 270 I&M parks. This will assist parks and networks in determining whether ozone injury surveys should be conducted in their areas.
- There are completed digital geologic maps for 52 parks, and maps for an additional 21 parks are in progress. In addition to traditional bedrock and surficial geologic mapping, in FY 2004 projects undertaken covered submarine geologic resources as well as coastal landform mapping in 7 shoreline parks, and submerged resource mapping in the three parks on the west coast of the island of Hawaii.
- Baseline Water Quality Assessment Reports have been completed for 234 park units, providing a complete inventory of all available water quality data; descriptive statistics and graphics characterizing annual, seasonal, and period-of-record central tendencies and trends; and comparisons of park data with relevant EPA national water quality criteria. Changes in EPA and USGS databases requiring software changes have delayed the remaining 36 reports. Additionally, in FY 2004, the National Park Service initiated supplemental water quality inventories for 18 parks to fill in gaps in core data, bringing the total to 70 parks in which supplemental inventories are initiated or completed.
- Soils mapping is being undertaken, primarily with the Natural Resource Conservation Service, although other sources are being explored. At the end of FY 2004, there were 41 completed soil inventories and 127 underway.

Natural resource inventories reveal many new and exciting insights into the natural resources contained in parks. Not only are the investigations increasing our knowledge and understanding about park resources, but the information provided addresses a wide variety of resource management issues and activities. Brief descriptions of some highlights from FY 2004 inventory efforts appear below:

As in previous years, biologic surveys in FY 2004 resulted in species new to science, documenta-

tion of range extensions of species, and species newly documented for parks. Examples include:

- Biological inventories at **Padre Island National Seashore** found a toad that may be new to science. The toad population's genetic isolation for several thousand years may have resulted in its distinctive characteristics.
- Mammal and herpetology surveys at **George Washington Birthplace National Monument** and **Thomas Stone National Historic Site** documented one new mammal species at each of these parks. These finds make a total of 13 new species recorded for Thomas Stone NHS and 6 new species records for George Washington Birthplace NM since the project began and added new county records and range extensions for several species of frogs and salamanders. Information on mammalian species distribution and abundance is available for the first time in these parks.
- Inventory work documented 37 new additions to the park species lists in the Arctic Network. Among these, surveys documented the tiny shrew (*Sorex yukonicus*), one of the most poorly documented small mammals in North America, found in **Bering Land Bridge National Preserve**, **Gates of the Arctic National Park and Preserve**, and **Cape Krusenstern National Monument**. This work also documented major range extensions for the barren ground shrew (*S. ugyunak*), and the pygmy shrew (*S. hoyi*), which was found for the very first time in Cape Krusenstern NM and Gates of the Arctic NP&P.
- Surveys at **Assateague Island National Seashore** included the discovery of five uncommon species rarely seen or previously unknown to occur in the park—grey treefrog, northern water snake, eastern garter snake, rough green snake, and red-bellied turtle.
- At **Santa Monica Mountains National Recreation Area**, a plant species not documented in the park since the 1930s was located.
- The **Niobrara National Scenic River** inventory found a significant range expansion for the false map turtle and inventories on the **Missouri National Recreational River** documented significant range expansions for Cope's tree frog and the six-lined racerunner.

Inventory work added to information on locations of threatened and endangered species populations:

- The Ozark Hellbender has been documented at six new sites in **Ozark National Scenic Riverways**; the species is a candidate for listing.
- An anchialine pool inventory at **Kaloko-Honokohau National Historical Park** identified three endemic shrimp species, including a candidate species.

Inventories are documenting important information on new exotic species invasions:

- Plant inventories at **Fort Laramie National Historic Site** documented an exotic watercress, representing a new record for Wyoming.
- Inventories at **Delaware Water Gap National Recreation Area** produced the first report and documentation of the non-native mosquitofish in the park, an invasive that is a significant predator of some native fish species. It was found in a stream supporting a major recreational trout fishery and numerous native fish species, as well as other important species.
- A total of 424 plant taxa have been recorded for **Biscayne National Park** as of October 2004; 134 taxa had not been previously reported, including 52 that are exotic. Nine of the new exotic taxa are listed by the Florida Exotic Pest Plant Council as invasive or potentially invasive.

Information on rare community types are also being documented, including:

- In **Colonial National Historical Park**, a rare wetland community classified as Non-riverine Saturated Forest and the rare Coastal Plain Dry Calcareous Forest and Tidal Bald Cypress Forest communities were documented.
- The first significant floodplain forest occurrence documented by NY Natural Heritage on the Hudson River north of Albany was identified at **Saratoga National Historical Park**.
- Additional examples of Non-riverine Saturated Forest, Coastal Plain Depression Wetland, and Coastal Plain/Piedmont Acidic Seepage swamp were documented at **Fredericksburg & Spotsylvania National Military Park**.
- A small occurrence of Upland Depression Swamp was documented at **Appomattox Court House National Historical Park**.
- An old growth study at **Mount Rushmore National Memorial** documented the extent and location of the park's old growth forests. The preliminary results suggest that the park may support as much as 20% of the remaining old growth in the entire Black Hills.

Numerous bat inventories occurred throughout the national park system in FY 2004, yielding important records:

- For the first time, surveys at **Mammoth Cave National Park** identified active roost trees for the endangered Indiana bat, confirming that

this species uses the park for summer reproduction in addition to winter hibernation.
- Bat surveys in **Yosemite National Park** found that the number of bat species declines with elevation in the park, and only one species has reproductive populations at high elevations. Interestingly, this is a genetically distinct high elevation form, whose distribution may be limited to the highest elevations of the Sierra Nevada.
- Bat surveys at **Cabrillo National Monument** found two previously undocumented species for that area.
- Biologists at **John D. Rockefeller National Parkway** found fringed bats, a previously undocumented species for the area.
- Surveys in National Capital Network parks found a large maternity bat colony of up to 400 little brown bats at **Catoctin Mountain Park**.

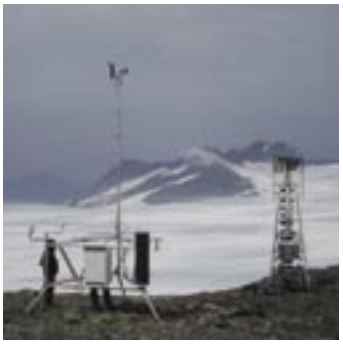
Monitoring

The launch of this major component of the Natural Resource Challenge in FY 2001 initiated planning for "park vital signs" ecological monitoring in the first 5 of 32 park networks, representing 270 parks with significant natural resources. These strategic monitoring programs will allow the Park Service to possess definitive information on resources managed by the agency, and to measure management performance. When fully funded and implemented, a means to measure resource conditions will be established. Through FY 2004, 22 networks (of a total of 32) involving 185 of the 270 parks with significant natural resources, have been funded for condition monitoring. The scientifically sound information that will result is critical for designing strategies to protect and restore natural resources and for working with others whose actions influence resource condition.

During the development of the park vital signs program, it was clear that a "one size fits all" approach to monitoring design would not be effective in the national park system considering the tremendous variability among parks in ecological conditions, sizes, and management issues and capabilities. A primary purpose of vital signs monitoring is to provide park managers with the data they need to understand and manage park resources; therefore, the data most relevant to different types of park systems would be expected to be different. Furthermore, partnerships with federal and state agencies and adjacent landowners are critical to effectively understand and manage the many resources and threats that extend beyond park boundaries; these partnerships (and the appropriate ecological indicators and methodologies involved) differ for parks throughout the system. Although monitoring priorities are determined locally, the service-wide monitoring program coordinates development of standardized protocols and approaches where appropriate. Nationwide, or at the level of the park network or ecosystem, there are also sets of indicators that are monitored in a standardized way to allow comparisons and synthesis of data across larger areas. Notable service-wide efforts include:

- In addition to internal guidance, the National Park Service and U.S. Geological Survey

Kate Patterson, Virginia Department of Natural Heritage, conducts vegetation mapping at Fredericksburg & Spotsylvania County Battlefields Memorial National Military Park. Plant inventories in the park have documented several rare community types.



At Kenai Fjords National Park, Alaska, the final stages of deployment of the Harding Icefield weather station, with the typical RAWS set up on the left, and the USGS all season precipitation tower on the right (July 2004).

Ranger Glen Clark conducts water quality monitoring at Lyndon B. Johnson National Historical Park, Texas. The Southern Plains Inventory and Monitoring Network hopes to build on existing monitoring programs like this one.

collaborated to publish long-term monitoring protocol guidelines that were published in the Wildlife Society Bulletin in 2003.
- In FY 2004, a workshop was held with I&M staff working on landscape change monitoring and their cooperators and contractors. Almost all networks are planning to use some form of remote sensing data to detect landscape level changes. The workshop objective was to ensure that development of approaches was coordinated.

Network program design occurs in three phases: 1) defining goals and summarizing existing data; 2) scoping to solicit input for indicator selection; and 3) designing sampling protocols and a plan for data management, analysis, and products. The service-wide program also ensures the completion of peer review as an essential element of the program for all monitoring components, whether designed at the park, network, or national level. In FY 2004, Challenge funding supported:

- Program development and monitoring in 22 networks (of a total of 32), involving 185 of the 270 parks with significant natural resources.
- Start-up funds initiated the phase 1 planning stage for the 10 remaining networks.

At the end of FY 2003, the first 12 networks funded completed their initial vital signs identification and at the end of FY 2004, these networks submitted their monitoring plans for peer review and approval. The plans outline available information about parks in the network, conceptual models of how the ecosystems function or the resources interact that serve as a basis for determining what indicators are important to monitor for change, the key areas of management concern and objectives for monitoring, and the vital signs selected for monitoring. Once approved, additional work will still be needed on some protocols. While standard protocols are used wherever possible, they are not always available and must often be adapted to specific local conditions and to meet standards for the program, including, for example, elements for quality control, quality assurance, and data management. The first 17 networks completed the vital signs identification phase (phase 2 of 3). The table on page 51 indicates the most common types of vital signs identified to date. In these networks, the following categories of vital signs predominated:

- invasive plants
- land/use cover change
- weather and climate
- water chemistry
- surface water dynamics
- land bird distribution and abundance
- ozone
- soil function and dynamics

Following are some examples of how these vital signs and their specific measurements were chosen and how the choices were influenced by the particular ecosystem and management context. These examples are from the five networks that completed their initial vital signs identification in FY 2004:

- Fish community structure is one vital sign chosen by the Southwest Alaska Network. Fish are good indicators because they represent a variety of trophic levels and occupy a variety of habitats, integrate changes and disturbances in the food chain, and they are easy to collect and identify. They are also of interest to Southwest Alaska parks and park managers, including **Katmai** and **Lake Clark National Parks and Preserves** and **Kenai Fjords National Park**, because of their economic and recreational value.
- Shoreline change is an important indicator for the Northeast Temperate Network's coastal parks, **Acadia National Park** and **Boston Harbor Islands**. Sea level controls the distribution and pattern of intertidal habitats, as well as having other management implications. Currently sea level is rising 2–4 mm/year along the New England coastline and is predicted to accelerate as a result of climate change.
- In the dryland ecosystem characteristics of the Southern Colorado Plateau Network, at parks such as **Grand Canyon** and **Mesa Verde National Parks**, precipitation is a major driver. As a result, soil moisture and climate are important vital signs for parks in that network.
- In several of the networks, early detection of exotic species is an important vital sign. Invasive exotics are a threat to native biodiversity and quick identification and removal not only stems the threat but is far more cost-effective than control efforts needed for established populations. For many networks and their parks, exotic plants are the target, but for others, exotic animals are also a focus.

Peer reviews for the first 12 network plans are being conducted in January 2005; after approval, networks may implement available protocols and continue additional protocol development needed. Final work on protocols will provide firmer cost information and dictate the extent to which priority vital signs can be monitored. Examples of some of the protocol work undertaken in FY 2004 include:

Common Types of Identified Vital Signs

Level 1 Category	Level 2 Category	Level 3 Category	Example Measures	Networks	Parks
Air and Climate	Air Quality	Ozone	Atmospheric ozone concentration, damage to sensitive vegetation	12	68
		Wet and Dry Deposition	Wet deposition chemistry (pH, NO_3^-, SO_4^{-2}), continuous sulfur (SO_2) dioxide concentrations	12	58
		Visibility and Particulate Matter	IMPROVE network; visibility and fine particles	13	52
		Air Contaminants	Concentrations of mercury, benzene, toluene, ethylene chloride), atrazine	6	40
	Weather and Climate	Weather and Climate	Temperature, precipitation, wind speed, ice on/off	17	125
Geology and Soils	Geomorphology	Stream Channel Characteristics	Erosion/sedimentation, channel change, rate of scouring, stream profiles, coarse woody debris	6	57
	Soil Quality	Soil Function and Dynamics	Biological soil crusts, aggregate stability, soil surface condition, nutrients, organic matter	8	59
Water	Hydrology	Groundwater Dynamics	Depth to groundwater, well recharge rate	6	49
		Surface Water Dynamics	Discharge/flow rates (cfs), gauge/stage height, lake elevation, spring/seep volume, sea level rise	13	95
	Water Quality	Water Chemistry	pH, temperature, dissolved oxygen, conductivity	17	136
		Aquatic Macroinvertebrates	Species richness, diversity, IBI of stream macroiNvertebrates, relative abundance	10	56
Biological Integrity	Invasive Species	Invasive/Exotic Plants	Early detection (predictive search models); presence/absence, area covered by exotic species	12	115
	Focal Species & Communities	Vegetation Communities	Species richness and diversity, rates of mortality and regeneration, stand structural dynamics	9	55
		Forest Vegetation	Species composition, % cover by species and layer, tree growth & mortality, regeneration	7	49
		Birds	Species composition, distribution, abundance	14	82
		Mammals	Species composition, distribution, abundance	9	46
		Fishes	Species composition, distribution, abundance	9	42
	At-risk Biota	T&E Species and Communities	Distribution,abundance, age and sex composition	7	37
Human Use	Visitor & Recreation Use	Visitor Usage	Numbers of visitors by location, activity, season	8	58
Ecosystem Pattern and Processes	Land Cover and Use	Land Cover and Use	Area in each land cover and use type; patch size and pattern (from satellite and aerial imagery)	17	137

- The Northeast Temperate Coast and Barriers network continued pilot sampling of vegetation and nekton as part of its salt marsh monitoring project and made substantial progress toward finalizing the protocols. These protocols are being developed through an agreement with the U.S. Geological Survey that will allow network parks to be part of a larger regional salt marsh monitoring effort that also includes several National Wildlife Refuges.
- The pond-breeding amphibian monitoring protocol at **Cape Cod National Seashore**, a prototype park whose work serves as a model especially for other Northeast Coast and Barrier network parks, uses a labor intensive technique. In FY 2003, both the old method and a much simpler one were implemented. In FY 2004, the results of the two methods were compared, and the simpler maximum count method proved to sacrifice little in the way of accuracy compared to the significant gains in field and data management efficiency.
- Evaluation of non-native plant mapping techniques, feeding directly into the Sonoran Desert Network's invasive plant early detection protocol, was continued through a cooperative agreement with University of Arizona cooperators at **Montezuma Castle** and **Tuzigoot National Monuments**. The information collected through this effort is being used to build predictive models for future non-native plant spread.
- **Mammoth Cave National Park** worked with the U.S. Geological Survey to reduce the impact and expense of the labor-intensive methods typically used to monitor ecologically important cave crickets. They developed new methods using digital cameras and lasers that delineate fixed transect lines. The protocol can be transferred to other cave and karst environments and resulting data may be used to examine the effect of active management of caves.
- The Central Alaska Network established agreements with the University of Alaska to develop a protocol to measure water quantity of small lakes that are susceptible to drying and warming in response to climate change and to detect the formation of small lakes that may occur with melting of permafrost. In addition, the university will explore use of information gathered through direct measurements of permafrost temperatures.
- Also in the Central Alaska network, the Alaska Bird Observatory conducted fieldwork in **Denali National Park and Preserve** to determine the best timeframe for surveying alpine nesting birds.
- Northern Colorado Plateau Network, with Bureau of Land Management and USDA Forest Service contributing funding, contracted to develop an umbrella protocol for threatened and endangered plant species that would consider and address populations regardless of ownership. This approach builds on the already existing interagency effort that has been in place for several years to inventory these species.
- The Greater Yellowstone Network built on connections with the U.S. Geological Survey Amphibian Research and Monitoring Initiative to improve some sampling design components,

Dr. Kurt Helf, Mammoth Cave National Park (Kentucky), and Dr. Bob Woodman, USGS-BRD, test a polar-coordinate sampling simulation model for the Cave Cricket Monitoring Study.

Top: Canyon de Chelly National Monument, Arizona, in 1879. Photo by John K. Hillers.

Bottom: Canyon de Chelly National Monument in 2002. Photo by Glenn Rink.

Comparison of the two photos reveals many changes to the landscape. There are now about three times as many piñon trees on the foreground terrace and much more piñon and juniper cover on the slopes in the background. The channel has shifted to the right and the second terrace is now covered with a continuous stand of native cottonwood and exotic Russian olive trees.

share funding possibilities, and allow the ability to detect changes in amphibian occurrence at a broader scale. A monitoring design workshop explored details such as site definition and how often to revisit sites; solutions were tested during a pilot study at **Yellowstone** and **Grand Teton National Parks**. The USGS Patuxent Wildlife Research Center provided technical expertise that resulted in a sampling design with a smaller catchment unit and improved spatial representation.

- The U.S. Geological Survey is developing a mussel monitoring protocol for the Appalachian Highlands network, to monitor the status of rare mussel populations and determine whether re-introductions are successful, and whether flow changes or water quality are affecting the populations. **Big South Fork National River and Recreation Area** and **Obed Wild and Scenic River** aquatic systems are affected by area coal production and also host significant mussel fauna, including six federally listed endangered species and four reintroduced species.

Earlier funded prototype monitoring programs, and monitoring previously undertaken by some parks is being integrated with vital signs monitoring. Except in these cases, trend data from vital signs monitoring will not be available until monitoring has been ongoing for several years. However, efforts undertaken through the I&M program are beginning to develop some new trend information through analysis of older data sets and comparison to newly acquired data, especially in the case of photographic data. Examples of trend information gained from these projects include:

- Relocation of sites from 1955–1956 photography and new photographs showed a striking pattern of sub-alpine spruce forest in **Denali National Park** spreading into several areas that were mostly treeless in the mid-1950s. Balsam poplar, rare in the area during the initial sampling, is now colonizing much of the study area. Warming climate in the area is documented by data from the nearby weather station and considered to be the cause of the change.
- Similar work is being conducted at **Lake Clark National Park and Preserve** using 57 repeat photographs taken during a 1928–1929 U.S. Geological Survey expedition. Comparison of the 1928–1929 and 2004 photographs reveals the changes in the park's landscape, including dramatic retreat of glaciers, rise in tree line, invasion of tundra by woody shrubs, and receding of lake levels.
- At **Canyon de Chelly National Monument** 79 historical and modern photographs spanning 120 years were compared. The photos document upland invasion of piñon and juniper, and riparian invasion by native trees (cottonwood and willow) and exotic trees (Russian olive and tamarisk) during the last 120 years. Riparian communities are significantly different in both quantity and quality of vegetation from just two decades ago. Future monitoring at fixed intervals will provide more data on the rate of change in the communities.
- In streams heavily impacted by historic coal mining activity and municipal pollution at **Big South Fork National River and Recreation Area**, field crews found significant increases in the number of fish species compared to the same sites 23 years ago, demonstrating apparent improvement of water quality and recovery of aquatic systems.
- One hundred-fifty-four vegetation sampling points were relocated in **Grand Canyon National Park**, re-establishing forested vegetation types originally sampled in 1935. Preliminary analyses indicate that species richness is surprisingly high in the ponderosa pine plant communities. In contrast to the increased densities of small trees in logged forests, the mixed-conifer type at Grand Canyon National Park appears to have tree densities that have declined. If further data and analysis confirm this, scientists' ideas about historical and contemporary changes in the mixed-conifer forest will need to be revised. Greater understanding of how the forests of Grand Canyon National Park have changed since 1935 will provide a basis for park management, particularly with the reintroduction of fire after almost 125 years of suppression.

Trends in bird populations have been detected both using comparison analyses with earlier data and through ongoing monitoring activities:

- The Pacific Island Network teamed with the U.S. Fish and Wildlife Service, U.S. Geological Survey, and state of Hawaii to compile, evaluate, and analyze all forest bird survey data collected since 1976, including data from **Hawaii Volcanoes** and **Haleakala National Parks**. Results indicate that three federally listed species that have been absent since the 1970s from former habitat in and near Hawaii Volcanoes National Park have not recovered, and three species of concern declined or are absent from lower-elevation forests in the park. On a brighter note, the species of concern and common species appear to be holding their own or increasing at higher elevations in the park, where habitat improved through reforestation in the past three

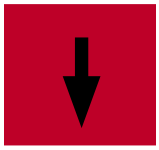
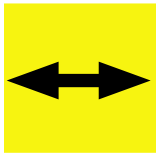
decades. Similarly, at Haleakala National Park and adjacent high elevation forests on Maui, the occurrence of three species also increased, as did one federally listed species.

- Results from landbird monitoring at **Cape Cod National Seashore** using mark-recapture techniques show declining trends in the mean annual index of total population size, and in productivity of 6 of 11 target species during the five-year study period. The negative trends in productivity suggest population declines may worsen in the near future.
- Analysis of data spanning more than 100 years shows range extensions to **Assateague Island National Seashore** for brown pelicans, double-crested cormorants, roseate terns, and others and dramatic declines for others.
- Spotted owl monitoring at **Olympic National Park** showed the most successful breeding season since monitoring began, with 36 of 53 sites occupied and 96% of females followed successfully fledging young. However, spotted owl monitoring at **Muir Woods National Monument** found a second recorded barred owl, a species originally from the East Coast and associated with declines in spotted owls.

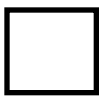
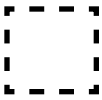
Other condition and trend results to date include the following:

- Four national parks—**Rocky Mountain**, **Glacier**, **Yellowstone**, and **Grand Teton**—are primary mid-level monitoring sites in the Rocky Mountain Region of the USGS Amphibian Research and Monitoring Initiative (ARMI), providing the ability to track and compare changes in status of amphibians in different latitudes, climate and habitat. Results from data collected show that declines have occurred to a greater extent in Rocky Mountain National Park than in the other parks.

Resource Condition Assessment Table

Resource Category	Condition Assessment	Confidence	Justification
Air		High; 10 yrs. of monitoring data within 5 miles of park	Ozone levels exceeded EPA standards 8 times during year; deposition data shows high levels of NOx and SOx; IMPROVE stations document worsening visibility; air toxicants increasing
Water		Good water quality data, but small data sets for macroinverts and mussels	pH, DO, conductivity and nutrients within normal variation for 6 monitored streams, but 1 stream shows high acidity and sedimentation levels. Aquatic macroinvertebrate data sparse but within expected limits. Freshwater mussels suggest good condition for 3 sampled streams.

Resource Condition Assessment Table

Resource Category	Status		Trends		Confidence	
Air	Significant Concern			Condition is unchanged	Based on adequate data and information; good confidence	
Water	Caution			Condition is improved	Gaps in data or interpolated; some confidence	
Geology & Soils	In good condition			Condition is deteriorating	Minimal data; low confidence	
Biota					No data available; based on expert opinion	No line
Landscapes						

Salt marsh die back in Middle Meadow at Cape Cod National Seashore, Massachussetts.

Appearance of dense native grasses (*Ruppia)* in East Harbor, Cape Cod National Seashore, Massachussetts.

- At **Cape Cod National Seashore** the salt marsh vegetation monitoring project observed the first occurrence of salt marsh die-back in the park in 2003. Salt marsh die-back was first detected on the U.S. Atlantic coast in Georgia in 2001, and more recently it has been observed in marshes along the Connecticut and southern Cape Cod coasts. In FY 2004, more intensive monitoring was initiated of die-back patches and other sites to detect any future occurrences of die-back.
- Monitoring of restoring salt marshes (Hatches Harbor and East Harbor) at **Cape Cod National Seashore** documented the return of salt marsh species to formerly fresh or brackish areas, increased density and vigor of native grasses, and decreased vigor in the fresh and brackish wetland plants that became established during the years tidal influence was impaired. Data indicate that vegetation response is on the desired trajectory and that these restoration projects are meeting ecosystem goals.
- Monitoring of the caribou herd in **Denali National Park** in FY 2004 resulted in the highest calf:cow ratio since 1989 (28 calves:100 cows). This is more than two times higher than the average observed from 1990–2003 of 13 calves:100 cows.

A framework for reporting on resource conditions is being explored. Resource categories proposed are based on the vital signs framework, which is a hierarchical system used by all 270 parks with significant natural resources to facilitate reporting of resource condition and collaboration and coordination among the networks. Initial assessments will focus on air and water resources, then biota, then geology and soils and landscapes. As more data become available from monitoring, confidence would increase. Example tables for how this might be reported is on the previous page.

NATURAL RESOURCE DATA AND INFORMATION PROGRAM

FY 2004 Allocation:	**$1,521,000**
Available:	$1,513,000

The Natural Resource Data and Information Program develops guidelines and technical procedures for using and managing GIS, remote sensing, and other natural resource data in parks, maintains 10 major relational database information systems and analyses databases for broad sharing and application of natural resource and programmatic data, produces Natural Resource Year in Review and the journal Park Science, and develops and disseminates timely information for the public, NPS managers and interpreters, students, teachers, and the media, including through administration of the NPS Nature and Science website (formerly NatureNet) and the Natural Resources Intranet. The infusion of funds from the Natural Resource Challenge initiative, combined with the periodic allocation of one-time project funding, provides the means for this program to maintain and refine Internet-based information technology solutions to successfully gather and share data and information with a vast internal and external audience. Examples include:

- The web-based Research Permit and Reporting System provides easy access for a worldwide academic audience to apply for a scientific research and collecting permit to conduct studies in the national parks. Software changes in FY 2004 focused on improved layout, allowing receipt and use of attached documents in various versions of MS-Word and Adobe PDF formats, and meeting security requirements. In addition, a grant was received to initiate a collaborative E-Authentication project with the General Services Administration (part of the President's E-Government Initiative), to allow for electronic signatures. In 2004, this system was used to receive and process more than 3,000 electronic permit applications and document more than 2900 accomplishment reports.
- Staff guided a major redesign of NatureNet, now called the NPS Nature and Science website, to enhance the visitors' experience. In addition, web-based solutions were modified to comply with Section 508 of the Rehabilitation Act, ensuring availability to visually impaired users.
- The *Views of the National Parks* project provided public web users with virtual tours of national parks that impart greater scientific knowledge. The project focused in FY 2004 on desert ecosystems and designated wilderness areas, the latter in coordination with other federal agencies.
- Partnering with the National Wildlife Federation, on-line multimedia *Park Nature Guides* about park wildlife were developed and made available to the public. About 51 parks are ready to launch *Nature Guides*, with 60 more going on-line soon.
- With the Alaska Region, the first two service-wide interpretive research and resource liaison workshops were presented. The workshops advance field interpreters' understanding of natural resource management issues.

A researcher holds a hummigbird during a migratory bird study hosted by the Continental Divide Research Learning Center at Rocky Mountain National Park, Colorado.

Dr. Rebecca Sharitz of the University of Georgia's Savannah River Ecology Laboratory collects data on forest dynamics within long-term vegetation monitoring plots at Congaree National Park, South Carolina. Dr. Sharitz's research was facilitated by the Old Growth Bottomland Forest Research and Education Center.

RESEARCH LEARNING CENTERS
Cumulative Increases: $2,698,000 (FY 2001 and FY 2002)

Thirteen operational NPS Research Learning Centers (RLC) offer infrastructure and incentives to researchers such as matching funds, lab space, low-cost housing, access to computer information systems, and extensive biological and cultural resource data sets, as well as suggestions for preferred research topics or subject area emphasis. In addition, RLC education staff members enhance data usefulness by identifying and expanding information access, through the Internet, libraries, or public research seminars, or programs with gateway communities. Furthermore, partners are associated with each center to help maximize programmatic and financial resources. Most centers meet these responsibilities using two positions, a research coordinator and an education specialist. Ultimately, the centers help parks and staffs obtain the current scientific information they need to make sound management decisions and communicate science and scholarly information about parks in a relevant way both to community members and area students. An Internet RLC clearinghouse has been developed providing best practices and RLC case study examples.

With one exception, these RLCs were funded through the Natural Resource Challenge. One of the 13 operational centers is a partnership with the Alaska SeaLife Center, and was not funded through recent Challenge increases. Other parks are also initiating centers. Most of the information contained below relates to the 12 centers funded through the Challenge. Together, these 12 centers have:

- Facilitated more than 500 research projects.
- Provided more than 19,000 nights of accommodations.
- Worked with more than 75 universities and more than 100 other partner organizations.
- Received more than 14,000 hours of research assistance from citizen scientists.
- Hosted and participated in more than 45 workshops and conferences, covering subjects such as how tributary junctions influence distributions of fish species, the impact of periodic fire on different plant species, and the moose, wolf, and loon populations of the Great Lakes area.
- Provided science education opportunities to hundreds of students and 30 elementary schools.

Examples of the kinds of research efforts and science information dissemination taking place in research learning centers in FY 2004 are:

- The Crown of the Continent Research Learning Center facilitated a research project on the impacts on water quality from the 2003 fires. **Glacier National Park** has a history of large forest fires and the 2003 season was especially active, with a total burn area of nearly 150,000 acres. Severely burned areas, especially near streams, may increase the amount of sedimentation in the streams and thereby affect water quality. A research study is surveying water quality in several burn areas for five years following the 2003 fires.
- A researcher-oriented science conference, hosted by the Continental Divide Research Learning Center, was widely attended by park staff and by reporters. It resulted in five in-depth stories in regional Denver-based newspapers, which have a combined daily circulation of 577,800. In addition, a local community newspaper with a circulation of 6,000 published an extended piece focused on research projects discussed during one of the public events.
- In June of 2004, the Schoodic Education and Research Center, along with the Maine Entomology Society, and Maine Forest Service hosted 35 professional and amateur entomologists who volunteered 1,492 hours to conduct the first-ever **Acadia National Park** moth and butterfly blitz. Participants, who were fed and housed at the center, sorted and identified specimens, identifying 168 species. Included was the most northerly record for the noctuid moth Lepipolys perscripta. The event was extensively covered by local media, including filming by the Maine Public TV science series "Quest."
- The California Mediterranean Research Learning Center worked with researchers to understand the survival and dispersal of bobcat kittens in the fragmented urban environment around Los Angeles. Park biologists know a great deal about home range size and distribution of bobcats in an urban-wilderness interface and adults appear to be viable in this landscape. Reliable information is missing on kitten survival. A graduate student has initiated a detailed study on bobcat kittens, using radio telemetry, to investigate survival, causes of mortality, and dispersal, and is also attempting to determine the reproductive viability of such a population.
- In one Center, a volunteer produced 11 different resource bulletins to let the visitors know about the kinds of research occurring in the park. These one-page bulletins can be easily and inexpensively copied to meet demand.

- The Urban Ecology Research and Learning Center, with the University of Maryland's Appalachian Laboratory and Teacher-Researcher Mentoring Program, supported two teaching fellows and provided assistance for the Mentor Researcher. This program immerses secondary school teachers in active research projects within the National Capital Region parks to improve their understanding of scientific investigations, to promote their awareness of research and resources in the Chesapeake Bay watershed, and to guide them in development of classroom activities that build on their research experience. The Great Lakes Research and Education Center participated in a similar effort, a teacher field course that involved five days aboard a Great Lakes research vessel and one day at the Indiana Dunes Environmental Learning Center.
- At least three centers began writing research plans to document how research needs are identified, current research needs, and methods to convey research results to staff, visitors, and the public.

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Chapter Five: Financial Details

This chapter presents financial details for servicewide natural resource programs. Information in Chapters Three and Four describe program accomplishments and highlight which of the programs have benefited from the Natural Resource Challenge funding provided between FY 2000 and FY 2004, and how the programs were affected.

The Natural Resource funding is requested as a series of discrete programs, including 14 servicewide programs, Everglades restoration elements, and the Glen Canyon Adaptive Management Program. Funding for the set of actions that make up the Natural Resource Challenge in some cases was requested as new programs, but also was requested under appropriate program budgets. Since many Challenge increases resulted in expansions of existing programs, only some of the Challenge budget increases are easily identifiable separate line items. In other cases, the Challenge funds are mixed with previous park or program bases. Therefore, the Challenge funding cannot be distinguished in most of the program-by-program financial information. Details of the history of Challenge funding are included in Appendix A.

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

Below are details of funding changes by program between FY 2003 and FY 2004. In addition, where appropriate, additional detail is provided regarding how funding within these programs has been allocated.

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

Park	FY 01 or FY 02 Challenge Increase	FY 2002 NR Total	FY 2003 NR Total	FY 2004 NR Total
Acadia National Park	345,000	849,827	794,395	755,087
Antietam National Battlefield	150,000	319,965	316,723	314,900
Appalachian National Scenic Trail	142,000	263,638	256,603	258,337
Big Cypress National Preserve [1]	399,000	1,033,640	1,010,000	1,108,140
Buck Island Reef National Monument [2]	100,000	270,000	216,450	216,000
Catoctin Mountain Park*	89,000	254,400	231,900	232,200
Channel Islands National Park	498,000	1,406,622	1,406,622	1,440,607
Coronado National Memorial	60,000	94,993	105,231	95,236
Curecanti National Monument	141,000	657,500	690,600	719,300
Dinosaur National Monument	189,000	501,800	559,375	568,874
Gates of the Arctic National Park & Preserve	148,000	362,401	363,039	349,164
Great Basin National Park	126,000	331,450	315,756	375,939
Great Sand Dunes National Park	180,000	291,700	287,500	281,300
Great Smoky Mountains National Park	402,000	1,245,100	1,152,700	1,003,200
Haleakala National Park	480,000	1,561,660	1,372,200	1,196,400
Homestead National Monument of America	82,000	104,500	104,500	81,198
Hopewell Culture National Historical Park*	105,000	95,000	79,322	103,047
Jewel Cave National Monument	50,000	168,500	168,500	167,140
John Day Fossil Beds National Monument	95,000	129,000	130,000	115,000
Kalaupapa National Historical Park	211,000	549,000	549,000	549,000
Lake Clark National Park & Preserve	147,000	321,500	319,810	250,000
Little River Canyon National Preserve [3]	85,000	182,426	174,027	112,900
Mojave National Preserve*	470,000	1,264,000	1,219,073	1,177,488
Monocacy National Battlefield*	118,000	120,000	116,000	116,000
Obed Wild & Scenic River	195,000	245,000	193,318	188,775
Padre Island National Seashore	95,000	408,000	403,825	543,000
Pictured Rocks National Lakeshore	55,000	194,650	207,000	211,000

The Amphibian Research and Monitoring Initiative (ARMI) is providing information to park managers about the status of amphibians in Grand Teton National Park, Wyoming.

(continued next page)

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

Park	FY)1 or FY 02 Challenge Increase	FY 2002 NR Total	FY 2003 NR Total	FY 2004 NR Total
Rock Creek Park*	163,000	436,522	393,168	359,104
San Juan Island National Historical Park	95,000	124,600	125,050	124,600
Saugus Iron Works National Historic Site	58,000	58,000	58,000	69,900
Sequoia & Kings Canyon National Parks* [4]	112,000	1,446,000	1,424,400	1,424,400
Stones River National Battlefield	132,000	132,000	137,100	127,924
Sunset Crater, Walnut Canyon, & Wupatki National Monuments	100,000	166,762	171,227	186,341
Theodore Roosevelt National Park	133,000	302,500	292,500	282,500
Virgin Islands National Park [5]	399,000	1,077,234	1,002,726	941,500
Zion National Park	246,000	536,300	515,872	518,774
Totals	**6,595,000**	**17,506,190**	**16,863,512**	**16,564,275**

Air Quality Program	
Funding allocation in FY 2003	$8,998,000
Classified Pay Increase	+13,000
Net FY 2003 Decrease [6]	-121,000
FY 2004 allocation	$8,890,000
Net FY 2004 Decrease [7]	-14,000
Total available in FY 2004	**$8,876,000**

Air Quality Program Funding by Categories	
Air emissions inventory	180,000
Air quality monitoring, analysis, & technical assistance	8,696,000
Total available in FY 2004	**$8,876,000**

Biological Resource Management Program	
Funding allocation in FY 2003	$7,930,000
FY 2004 increase	+750,000
Classified Pay Increase	+9,000
Net FY 2003 Decrease [6]	-114,000
FY 2004 allocation	$8,575,000
Net FY 2004 Decrease [7]	-19,000
Total available in FY 2004	**$8,556,000**

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

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

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

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

[4] Also received a non-Challenge $367,000 base increase in FY 2001

[5] Also received Coral Reef Initiative base increase of $300,000 and Prototype Monitoring increase of $230,000 in FY 2001

[6] The FY 2003 net decrease is the sum of funding changes contained in the Operation of the National Park Service (ONPS) appropriation [general reduction, travel reduction, across-the-board recission reductions, and information technology (IT) reduction].

[7] The FY 2004 net decrease is the sum of funding changes in response to both a bureau-determined information technology (IT) assessment and travel reduction adjustment.

Biological Resource Management Program Funding by Categories	
Exotic Plant Management Teams	$5,055,000
Restoration	439,700
Integrated Pest Management Program	448,000
Endangered Species Program	590,000
Wildlife Program	445,000
Wildlife Health Program	855,000
Biological Resource Projects-National Level Support	723,300
Total available in FY 2004	**$8,556,000**

Cave and Karst Research Institute	
Funding allocation in FY 2003	$348,000
Net FY 2003 Decrease [6]	-4,000
FY 2004 allocation	$344,000
Net FY 2004 Decrease [7]	-6,000
Total available in FY 2004	**$338,000**

Cooperative Ecosystem Studies Units	
Funding available in FY 2003 [8]	$443,000
Permanent transfer to regions [8]	-306,000
Net FY 2003 Decrease [6]	-6,000
Total allocation/available in FY 2004	**$131,000**

Cooperative Park Studies Unit Funding Distribution [9]	
North and West Alaska CESU—no Challenge funding	
Colorado Plateau CESU	$155,000
Desert Southwest CESU	155,000
Rocky Mountains CESU	155,000
Great Plains CESU	155,000
Great Lakes-Northern Forest CESU	153,000
Upper and Middle Mississippi Valley CESU—no Challenge funding	
Chesapeake Watershed CESU	155,000
North Atlantic Coast CESU	155,000
Great Basin CESU	155,000
Pacific Northwest CESU	155,000
Californian CESU—no Challenge funding	
South Florida-Caribbean CESU	155,000
Southern Appalachian Mountains CESU	155,000
Gulf Coast CESU	153,000
Piedmont-South Atlantic Coast CESU—no Challenge funding	

Geographic Information Systems Program	
Funding allocation in FY 2003	$1,307,000
Net FY 2003 Decrease [6]	-16,000
FY 2004 allocation	$1,291,000
Net FY 2004 Decrease [7]	-1,000
Total available in FY 2004	**$1,290,000**

[8] $1,596,000 received in FY 2001; $1,550,000 transferred to regions. In FY 2003, $310,000 transferred to the region for use during FY 2003. In FY 2004, the same amount less an across-the-board decrease, or $306,000, was permanently transferred to regions.

[9] Distribution of initial funding from Natural Resource Challenge increases for CESUs shown; other CESUs funded through general regional base funds. Does not show changes to base that may have occurred to funds transferred to regions.

Gray Tree Frog (*Hyla versicolor*), herptile inventory project at Saint Croix National Scenic Riverway, Wisconsin, and Voyageurs National Park, Minnesota.

Geologic Resources Program	
Funding allocation in FY 2003	$2,670,000
Classified Pay Increase	+16,000
Net FY 2003 Decrease [6]	-35,000
FY 2004 allocation	$2,651,000
Net FY 2004 Decrease [7]	+10,000
Total available in FY 2004	**$2,661,000**

Inventory and Monitoring Program	
Funding allocation in FY 2003	$32,385,000
FY 2004 increase	+5,000,000
Classified Pay Increase	5,000
Net FY 2003 Decrease [6]	-458,000
FY 2004 allocation	$36,932,000
Net FY 2004 Decrease [7]	-36,000
Total available in FY 2004	**$36,896,000**

Inventory and Monitoring Program Funding by Categories	
Resource Inventory Projects	$12,611,100
Vital Signs Monitoring	18,998,000
Prototype Monitoring	1,000,000
Monitoring Projects	101,400
Database Development	1,841,000
Regional Coordinators	845,000
Program Administration	1,499,500
Total available in FY 2004	**$36,896,000**

Allocation of Funding among Basic Natural Resource Inventories	
Species Lists	$25,000
Base Cartography Data	100,000
Biological Inventories	3,744,900
Vegetation Mapping	
Alaska	500,000
Outside of Alaska	3,848,400
Water Resource Data	1,127,800
Soil Surveys	1,450,000
Geology Inventories	1,500,000
Air Quality Related Values	315,000
Total	**$12,611,100**

Allocation of Monitoring Funding among Networks and Prototypes	
North Coast and Cascades	$345,100
Northeast Coastal and Barrier	776,500
Heartland	701,600
Sonoran Desert	670,000
Cumberland/Piedmont	476,600
Central Alaska	1,215,100
National Capital	747,000
Northern Colorado Plateau	566,950
San Francisco Bay Area	742,800
Greater Yellowstone	724,700
Appalachian Highland	416,400
Mediterranean Coast	302,000
Southwest Alaska	1,449,700
Northeast Temperate	631,200
Southern Colorado Plateau	1,208,500
Pacific Island	1,570,100
Great Lakes	1,286,500
Gulf Coast	928,400
Rocky Mountain	632,200
Sierra Nevada	655,300
Eastern Rivers and Mountains	655,900
Klamath	796,200
Arctic	150,000
Southeast Coast	150,000
Northern Semi-Arid	150,000
Southern Plains	150,000
Mojave Desert	150,000
Southeast Alaska	150,000
South Florida/Caribbean	150,000
Mid-Atlantic	150,000
Chihuahuan Desert	150,000
Northern Great Plains	150,000
Olympic NP Prototype Program	200,000
North Cascades NP Prototype Program	200,000
Mammoth Cave NP Prototype Program	200,000
Northern Colorado Plateau Prototype Program	400,000
Total	**$19,998,750**

Inventory and Monitoring Expenditures by Non-NPS Categories

Inventories	Universities	Other Non-Fed	USGS	Other Fed
Biol. Inv.	$1,483,300	$989,900	$469,600	$176,600
Veg. Mapping	567,100	2,289,800	0	308,000
Landcover (Alaska)	187,200	106,400	187,100	196,400
Water Resources	44,100	0	1,083,600	0
AQRV's	192,800	36,500	64,800	20,600
Soils	100,000	100,000	0	1,200,000
Geology	612,200	171,600	207,500	100,000
Base Carto	0	50,000	50,000	0
Misc.	1,423,900	371,000	0	25,000
Monitoring	5,763,600	3,740,200	1,641,200	699,100
Totals	**$10,374,200**	**$7,855,400**	**$3,703,800**	**$2,725,700**

Natural Resource Data and Information Program

Funding allocation FY 2003	$1,542,000
Net FY 2003 Decrease [6]	-21,000
FY 2004 allocation	$1,521,000
Net FY 2004 Decrease [7]	-8,000
Total available in FY 2004	**$1,513,000**

Natural Resource Preservation Program (NRPP)

Funding allocation in FY 2003	$12,693,000
Net FY 2003 Decrease [6]	-209,000
FY 2004 allocation	$12,484,000
Net FY 2004 Decrease [7]	-15,000
Total available in FY 2004	**$12,469,000**

Allocation of NRPP Among Project Categories and Projects Funded

	Allocation	Projects
Natural Resource Management	$6,895,000	63
Threatened & Endangered Species	488,000	12
Disturbed Lands Restoration	824,000	13
Small Park	972,000	66
Regional Block Allocation	1,360,000	78
Alaska Projects	491,000	5
USGS/BRD Technical Assistance	246,000	21
Servicewide	1,193,000	25

Natural Sound Program

Funding allocation in FY 2003	$931,000
Classified Pay Increase	+3,000
Net FY 2003 Decrease [6]	-13,000
FY 2004 allocation	$921,000
Net FY 2004 Decrease [7]	-3,000
Total available in FY 2004	**$918,000**

Little brown bat (*Myotis lucifugus*) captured and banded during mammal inventories on the Blue Ridge Parkway at Linville Falls, North Carolina.
Photo by Nora Murdock

Research Learning Centers

Except as noted, each of the Centers below received $225,000 in Challenge funding the year that they were funded (see below). Because in many cases parks and others have contributed other funding to the operation of the centers, erosions or additions to the funding are not available.

Location	Research Learning Center Name	Funding First Rec'd: FY 2001	FY 2002
Acadia NP	Acadia Center for the Environment		X
Cape Cod NS	Atlantic Learning Center	X	
Gateway NRA	Jamaica Bay Learning Center for Applied Research on Urban Ecology		X
Glacier NP	Crown of the Continent Learning Center		X
Great Smoky Mountain NP	Purchase Knob Learning Center	X	
Indiana Dunes NL	Great Lakes Research and Education Center		X
National Capital Region	Urban Ecology Learning Alliance		X
North Cascades, Mount Rainier & Olympic NPs	North Coast and Cascades Learning Center		X
Point Reyes NS	Pacific Coast Learning Center	X	
Rocky Mountain NP	Continental Divide Research and Learning Center	X	
Santa Monica Mountains NRA	Center for Teaching New America		X
Seward, Alaska Sealife Center	Ocean Alaska Science and Learning Center	X*	

Resource Damage Assessment and Recovery Program [10]

Funding allocation in FY 2003	$1,276,000
Classified Pay Increase	+5,000
Net FY 2003 Decrease [6]	-16,000
FY 2004 allocation	$1,265,000
Net FY 2004 Decrease [7]	-6,000
Total available in FY 2004	**$1,259,000**

***Did not receive Natural Resource Challenge funding, but was developed in response to the Challenge.**
[10] Combines two former line items: Oil Pollution Act and Resource Protection Act

Surveying for vascular plants at Wish Creek Wetland, part of Olympic National Park's coastal strip in Washington.

Resource Protection Fund	
Funding allocation in FY 2003	$298,000
Net FY 2003 Decrease [6]	-4,000
Total allocation/available in FY 2004	**$294,000**

Water Resources Program	
Funding allocation in FY 2003	$11,614,000
FY 2004 increase	+600,000
Classified Pay Increase	+20,000
Net FY 2003 Decrease [6]	-163,000
FY 2004 allocation	$12,071,000
Net FY 2004 Decrease [7]	-22,000
Total available in FY 2004	**$12,049,000**

Water Resources Program Funding by Categories	
Water Resource Projects	
Water Resource Protection	$1,138,700
Competitive Projects	371,400
Other Projects	15,000
Water Quality Monitoring	2,375,000
Water Resource Protection—Aquatic Resource Professionals	1,200,000
Watershed Condition Assessment Program	
Competitive Projects	1,122,955
Critical Projects	376,800
Coastal Projects	428,772
Other Projects	1,024,593
Water Resource Technical Assistance	3,996,200
Total	**$12,049,000**

Allocation of Water Quality Monitoring Funding

Network	
Central Alaska	$98,000
Heartland	82,000
Northeast Coastal and Barrier	90,000
National Capital	71,000
Cumberland/Piedmont	59,000
Appalachian Highlands	70,000
Northern Colorado Plateau	108,000
Greater Yellowstone	71,000
Sonoran Desert	64,000
North Coast and Cascades	82,000
San Francisco Bay	70,000
Mediterranean Coast	76,000
Southwest Alaska	139,000
Northeast Temperate	60,000
Southern Colorado Plateau	124,000
Pacific Island	151,000
Great Lakes	123,000
Gulf Coast	89,000
Rocky Mountain	61,000
Sierra Nevada	63,000
Eastern Rivers and Mountains	63,000
Arctic	151000
Klamath	76,000
Southeast Coast	121,000
Servicewide Data Management	213,000
Total	**$2,375,000**

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Right: A member of the Great Lakes Exotic Plant Management Team removes Lyme Grass on north Manitou Island, Sleeping Bear Dunes National Lakeshore, Michigan.

Left: Ruby Zambrano Muñoz from Panama holds a Wilson's Warbler during her Park Flight Migratory Bird Program international internship at Bandelier National Monument in New Mexico.

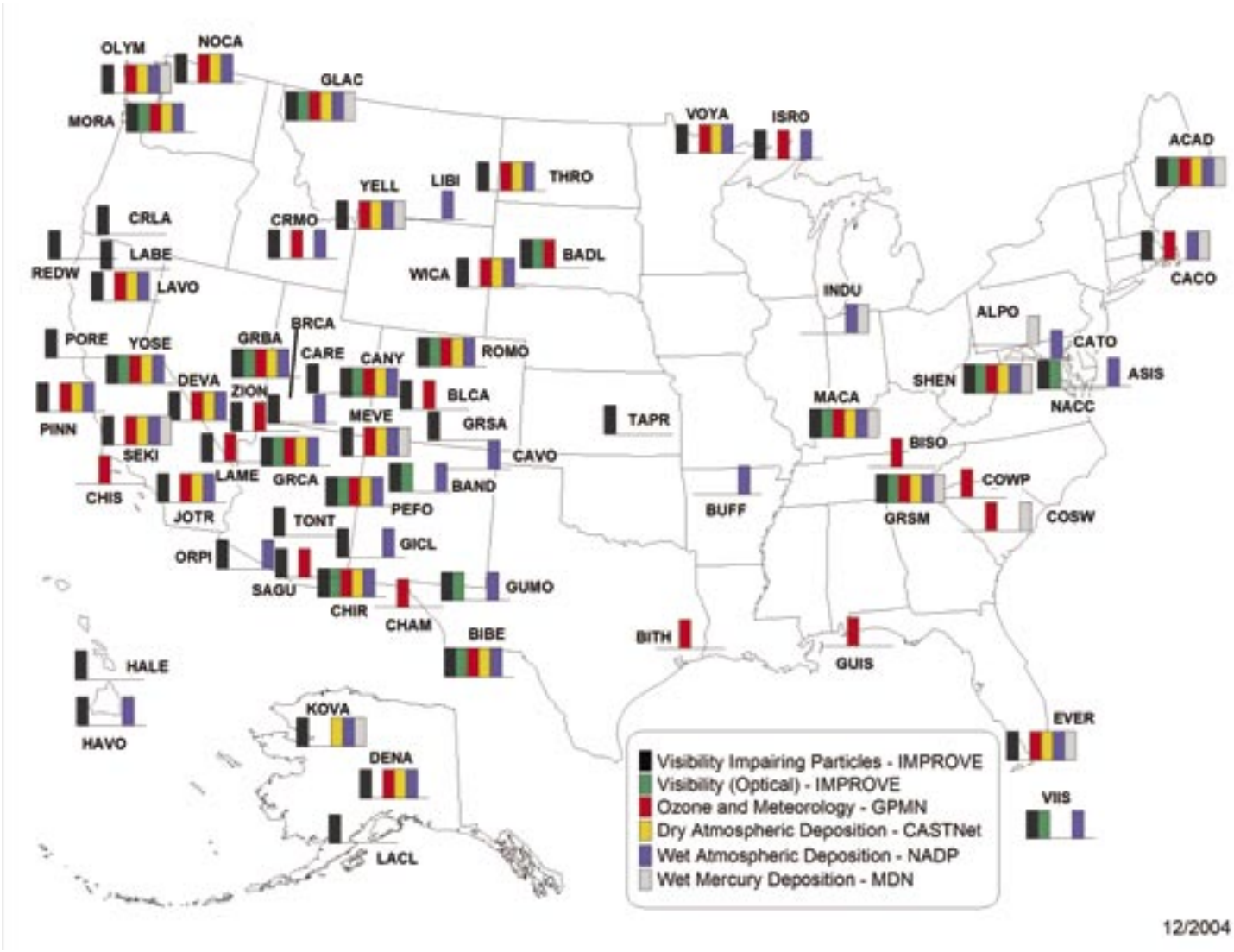
Appendix A: Natural Resource Challenge Funding History*

Challenge Elements	Increase FY 2000	Increase FY 2001	Increase FY 2002	Increase FY 2003	Increase FY 2004	Increase FY 2005	Cum. Funding FY 00–05	Request FY 2006	Total through FY 2006
Inventory & Monitor Resources									
Basic inventories (except vegetation mapping)	7,309			1,987			9,296		9,296
Vegetation mapping (with USGS)		1,746		2,235			3,981		3,981
Park air emissions inventory		200					200		200
Monitor vital signs in park networks		4,191	4,200	6,855	4,939	3,068	23,253	4,931	28,184
Monitor water quality in park networks		1,272		497	592	521	2,882		2,882
Watershed assessment				3,080			3,080		3,080
Expand air quality monitoring and related activities			2,600				2,600		2,600
Make natural resources data useable		1,098					1,098		1,098
Fix Critical Problems									
Natural Resource Preservation Program project funding	2,875		4,000				6,875	(3,931)	2,944
Alaska Natural Resource Projects				497			497		497
Establish resource protection fund			300				300		300
Water resource protection & restoration/project funds		823					823		823
Water resource protection & restoration/ field specialists			1,000	200			1,200		1,200
Native/nonnative species mgt & Exotic Plant Mgt Teams	3,449		2,400	2,136			7,985		7,985
Implement Resource Protection Act/restore resources			500				500		500
Protect geologic resources	696						696		696
Park invasive species control/ T&E species recovery		3,395	3,200				6,595		6,595
Attract Scientists									
Establish learning centers		898	1,800				2,698		2,698
Establish Cooperative Ecosystem Studies Units		1,596		397			1,993		1,993
Annual Increase	14,329	15,219	20,000	17,884	5,531	3,589		1,000	77,552
Total Annual Funding	**14,329**	**29,548**	**49,548**	**67,432**	**72,963**	**76,552**		**-**	**77,552**

*** All dollars in thousands.**


USGS

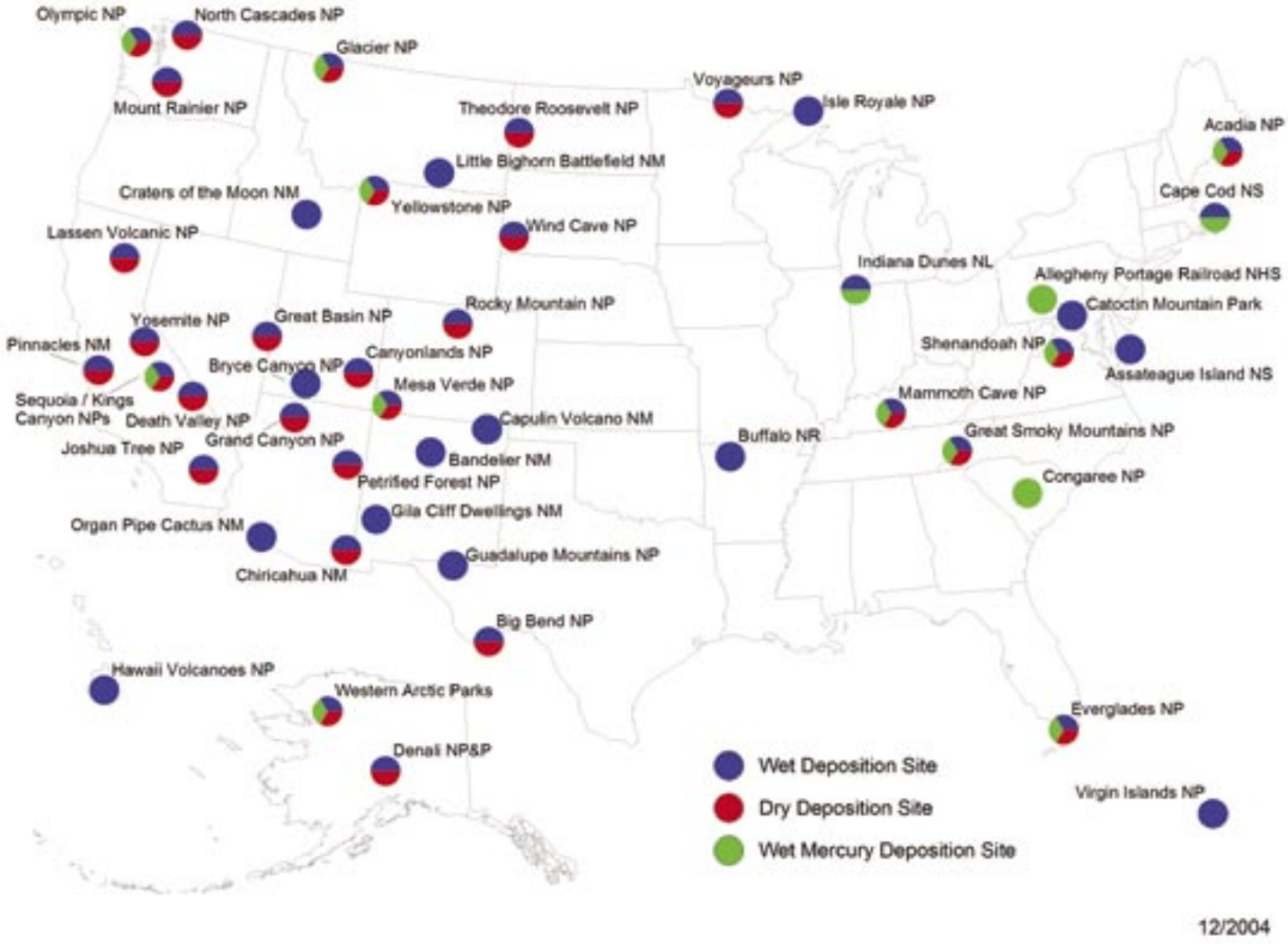
Appendix B: Air Quality Monitoring in NPS Units



Dr. Bob Woodman, USGS-BRD and Bobby Carson, Air Quality Specialist install a passive ozone monitoring device at Mammoth Cave National Park, Kentucky, as part of a network-wide ozone study in 2004.


N

Appendix C: NPS Dry and Wet Deposition (Including Mercury)



National Atmospheric Deposition Program (NADP) wet deposition collector and Clean Air Status and Trends Network (CASTNet) dry deposition monitor at Sequoia and Kings Canyon National Parks, California.

Right: Collecting sediment samples at Gates of the Artic National Park and Preserve, Alaska.

Left: Snow sampling for contaminants at Olympic National Park, Washington.

Appendix D: New Toxics Monitoring

Persistent Organic Pollutants (POPs)

Network	Park	Start			
Toxics	Noatak NPres	FY 2002	FY 2003	FY 2004	FY 2005
Toxics	Denali NP & Pres	FY 2002	FY 2003	FY 2004	FY 2005
Toxics	Olympic NP	FY 2002	FY 2003	FY 2004	FY 2005
Toxics	Sequoia & Kings Canyon NP	FY 2002	FY 2003	FY 2004	FY 2005
Toxics	Glacier NP	FY 2002	FY 2003	FY 2004	FY 2005
Toxics	Rocky Mountain NP	FY 2002	FY 2003	FY 2004	FY 2005
Toxics	Yellowstone NP				FY 2005
Toxics	Big Bend NP				FY 2005
Toxics	Gates of the Arctic NP & Pres		FY 2003	FY 2004	FY 2005
Toxics	Katmai NP & Pres				FY 2005
Toxics	Wrangell-St Elias NP & Pres				FY 2005
Toxics	Glacier Bay NP & Pres				FY 2005
Toxics	Mount Rainier NP		FY 2003	FY 2004	FY 2005
Toxics	Bandelier NP				FY 2005
Toxics	Crater Lake NP				FY 2005
Toxics	Great Sand Dunes NP				FY 2005
Toxics	North Cascades NP				FY 2005
Toxics	Yosemite NP				FY 2005

Appendix E: Natural Resource Preservation Program Funded Projects

NRPP—Natural Resource Management fully funded projects

Region	State	Park	Project Title	Total Project Funding	FY 2004 Funding
SER	SC	Cowpens National Battlefield	Develop feral hogs reduction plan	$62,000	$42,000
SER	GA	Cumberland Island National Seashore	Eradicate feral hogs	171,000	55,000
MWR	SD	Badlands National Park	Emergency salvage of collection of fossils	341,000	108,000
SER	LA	Jean Lafitte National Historical Park	Establish a bio-control program for Salvinia	111,000	39,000
IMR	TX	Lake Meradith National Recreation Area	Protect native habitat by completing north boundary fence	153,000	51,000
MWR	IN	Indiana Dunes National Lakeshore	Restore biological resources of Cowles Bog Wetland	101,000	21,000
PWR	CA	Pinnacles National Monument	Re-establish California Condors	572,000	193,000
IMR		Intermountain Region	Initiate noxious weed inventory and mapping program	605,000	256,000
PWR	NV	Great Basin National Park	Wild cave inventory and management	216,000	62,000
PWR	CA	Point Reyes National Seashore	Remove iceplant at lighthouse headlands	339,000	114,000
PWR	CA	Pinnacles National Monument	Restore climbing area	94,000	27,000
AKR	AK	Denali National Park & Preserve	Determine baseline along proposed north access corridor	370,000	126,000
MWR	MN	Voyageurs National Park	Document changes in reservoir mgmt on mercury in fish	311,000	107,000
MWR	MI	Isle Royale National Park	Implement wilderness management plan	270,000	71,000
IMR	AZ	Pipe Spring National Monument	Geologic mapping and seismic profile investigations	308,000	80,000
IMR	WY	Fossil Butte National Monument	Geological mapping of primary formations	209,000	67,000
IMR	CO	Rocky Mountain National Park	Restore Glacier Creek livery and wetland	103,000	42,000
IMR	TX	Big Bend National Park	Stop feral hog invasion	130,000	30,000
NCR		National Capital Region	Dragonflies and damselflies likely affected by West Nile	63,000	25,000
PWR	OR	Oregon Caves National Monument	Complete cave restoration	54,000	23,000
PWR	CA	Golden Gate National Recreation Area	Restore Ft. Baker Mission blue butterfly habitat	632,000	252,000
IMR	UT	Capital Reef National Park	Threatened and endangered plant pollinators	151,000	21,000
IMR	MT	Glacier National Park	Lake McDonald fishery management	174,000	59,000
IMR	MT	Glacier National Park	Assess wolverine population	186,000	70,000
PWR	WA	Olympic National Park	Determine migratory pathways, spawning areas for listed bull trout	229,000	70,000
IMR	CO	Rocky Mountain National Park	Implement invasive plant management plan	150,000	68,000
PWR	WA	Olympic National Park	Wilderness recovery at Boulder Hot Springs	54,000	40,000
NCR	VA	George Washington Memorial Parkway	Should we restore dike-marsh?	159,000	59,000
SER	FL	Biscayne National Park	Quantitative analysis and scenario testing of fisheries management	95,000	43,000
NER	MD	Assateague Island National Seashore	Evaluate episodic water quality event in coastal bay	125,000	57,000
PWR	CA	Channel Islands National Park	Model weed invasion using existing spatial and ecological data	88,000	88,000
		Washington Office	Travel Cut		60,000
			Total	**$6,626,000**	**$2,426,000**

Top: NRPP-NRM project *Restore Biological Resources of the Cowles Bog Wetlands at Indiana Dunes National Lakeshore.* A Student Conservation Associate and Biological Science Technician monitor experimental plots designed to determine system response to herbicide treatments followed by various treatments of the litter and plant density.

Bottom: NRPP-Alaska Special Projects. Collecting measurements and samples from a Sockeye salmon in Aniakchak National Monument and Preserve.

NRPP—Natural Resource Management new and ongoing projects

Region	State	Park	Project Title	Total Project Funding	FY 2004 Funding
PWR	HI	Kalaupapa National Historical Park	Exclude ungulates from Pu'u Ali'i Plateau	$663,000	$265,000
AKR	AK	Lake Clark National Park & Preserve	Refine techniques to survey harvested brown bear populations	285,000	143,000
MWR	SD	Wind Cave National Park	Monitor for chronic wasting disease	428,000	67,000
IMR	CO	Rocky Mountain National Park	Implement interim actions for CWD management	246,000	101,000
SER	KY	Mammoth Cave National Park	Propagation and restoration of endangered mussels in the Green River	526,000	117,000
PWR	HI	Haleakala National Park	Prevent *Miconia* invasion from displacing Haleakala rainforest	878,000	393,000
PWR	CA	Channel Islands National Park	Reintroduce island fox on San Miguel and Santa Rosa islands	826,000	362,000
IMR	NV	Lake Mead National Recreation Area	Continue salt cedar control	153,000	51,000
NCR	VA	George Washington Memorial Parkway	Saving the Potomac Gorge through partnerships	240,000	160,000
IMR	WY	Grand Teton National Park	Bison demographic monitoring: disease surveillance	796,000	280,000
IMR	WY	Yellowstone National Park	Multi-trophic level ecology of wolves, elk, and vegetation	175,000	58,000
MWR	ND	Theodore Roosevelt National Park	Evaluate factors influencing the distribution and movement of elk	162,000	56,000
PWR	CA	Pinnacles National Monument	Eradicate feral pigs	844,000	253,000
NER	WV	New River Gorge National Riverway	Fecal bacteria source tracking	205,000	121,000
MWR	SD	Badlands National Park	Document significant fossil localities within the Poleslide Member	290,000	92,000
NCR		National Capital Region Parks	Assess condition and identify stressors of aquatic resources	248,000	164,000
IMR	UT	Zion National Park	Restore highly impacted backcountry areas	327,000	103,000
IMR	CO	Rocky Mountain National Park	Prepare a situation assessment for elk management environmental impact statement	122,000	18,000
MWR	OH	Cuyahoga Valley National Park	Control invasive plant species and sensitive resource areas	180,000	46,000
NER	NY	Gateway National Recreation Area	Investigation and restoration of the Jamaica Bay salt marsh ecosystem	524,000	281,000
IMR	UT	Bryce Canyon National Park	Protect dark night skies	272,000	126,000
AKR	AK	Western Arctic National Parks	Inventory and status assessment of lichens in Noatak	74,000	19,000
PWR	CA	Point Reyes National Seashore	Cape ivy removal	770,000	160,000
MWR	MN	Voyageurs National Park	Assess impacts of forest fires on levels of mercury in lake and forest environments	150,000	50,000
MWR	MN	Voyageurs National Park	Assess the impacts of International lake level management by using interdisciplinary approach	899,000	341,000
NER	MA	Boston Harbor Islands National Recreation Area	Boat wake impacts: their role in shore erosion processes	411,000	151,000
IMR	CO	Dinosaur National Monument	Vegetation classification and mapping/ fuels mapping	130,000	100,000
AKR	AK	Glacier Bay National Park & Preserve	Evaluating campsites: predicting bear-human conflicts	215,000	108,000
PWR	WA	Olympic National Park	Atmospheric pollutant loading/Trans-pacific Airmass	287,000	10,000
NER	VA	Shenandoah National Park	Assess hydrology for sensitive wetland system	132,000	30,000
IMR	NM	Carlsbad Caverns National Park	Assess Mexican free-tailed bat population	368,000	203,000
PWR		Pacific West Region Parks	Western airborne contaminant assessment	642,000	100,000
			Total	**$12,468,000**	**$4,529,000**

NRPP—Threatened and Endangered Species fully funded projects

Region	State	Park	Project Title	Total Project Funding	FY 2004 Funding
PWR	NV	Lake Mead National Recreation Area	OHV Damage control in dessert tortoise critical habitat	$150,000	$44,000
PWR	CA	Pinnacles National Monument	Re-establish California red-legged frogs in Bear Gulch Reservoir	103,000	32,000
NCR	MD	Chesapeake and Ohio Canal National Historic Park	Restoration and recovery for listed *Harperella*	151,000	47,000
PWR	HI	Hawaii Volcanoes National Park	Complete re-introduction of Silversword	55,000	25,000
MWR	MI	Sleeping Bear Dunes National Lakeshore	Wildlife management/preserve piping plover	46,000	21,000
PWR	WA	Olympic National Park	Effectiveness monitoring Northern spotted owl demographic rates	112,000	57,000
			Total	**$617,000**	**$226,000**

NRPP—Threatened and Endangered Species new and ongoing projects

Region	State	Park	Project Title	Total Project Funding	FY 2004 Funding
SER	KY	Mammoth Cave National Park	Restoration of Echo River Passage	$93,000	$31,000
MWR	SD	Badlands National Park	Develop long-term translocation guidelines for the black-footed ferret population	87,000	84,000
IMR	AZ	Grand Canyon National Park	Foraging ecology of threatened Mexican Spotted Owl	150,000	81,000
PWR	CA	Point Reyes National Seashore	Threatened Western snowy plover recovery	150,000	66,000
			Total	**$480,000**	**$262,000**

NRPP—Disturbed Lands Restoration fully funded projects

Region	State	Park	Project Title	Total Project Funding	FY 2004 Funding
IMR	NV	Lake Mead National Recreation Area	HOV Restoration-North Shore Scenic Drive Areas	$248,200	$74,000
IMR	TX	Big Bend National Park	Nine Point Draw Watershed Restoration—Phase 2	234,900	70,800
IMR	WY	Yellowstone National Park	Reclaim 3 Miles of Abandoned Turbid Lake Road	209,800	68,800
PWR	CA	Pinnacles National Monument	Old Pinnacles Road Restoration	249,400	22,400
PWR	CA	Lassen Volcanic National Park	Restoration of An Abandoned Ski Area	203,700	50,700
IMR	CO	Rocky Mountain National Park	Restore Alpine Sewage Lagoons	82,000	11,700
IMR	CO	Curecanti National Recreation Area	Restore Elk Creek Pump House and Extraction Site	48,800	58,800
NCR	VA	Manassas National Battlefield Park	Restoration of Disturbed Lands	148,200	148,200
			Total	**$1,425,000**	**$495,400**

NRPP—Disturbed Lands Restoration new and ongoing projects

Region	State	Park	Project Title	Total Project Funding	FY 2004 Funding
IMR	UT	Timpanogos Cave National Monument	Restore Natural Cave Drainage	$114,000	$38,000
AKR	AK	Denali National Park & Preserve	Reclamation of Placer-Mined Glacier Creek	198,000	80,000
PWR	CA	Yosemite National Park	Ecological Restoration of Gaylor Pit	80,500	70,200
PWR	CA	Yosemite National Park	Happy Isles Dam Removal	52,800	45,800
NCR	VA	Prince William Forest Park	Disturbed Land Restoration of the Bradford Track	107,600	94,600
			Total	**$552,900**	**$328,600**

NRPP—Small Park Projects

Region	State	Park	Project Title	Total Project Funding	FY 2004 Funding
AKR	AK	Klondike Gold Rush National Historic Park	Evaluate resource protection at the historic town site of Dyea	$30,000	$10,000
AKR	AK	Sitka National Historical Park	Complete a non-vascular plant survey	30,000	9,400
IMR	UT	Arches National Park	Analyze vegetation changes from late 1800s to present using historic photography	27,500	10,500
IMR	CO	Colorado National Monument	Restore native vegetation at the visitor center and administrative areas	6,200	6,200
IMR	WY	Devils Tower National Monument	Control/eliminate non-native invasive plant species	40,000	20,000
IMR	UT	Timpanogos Cave National Monument	Develop a vegetation management plan	10,000	10,000
IMR	AZ	Walnut Canyon National Monument	Survey bio-soil communities to support resource conditions monitoring	9,500	9,500
IMR	AZ	Casa Grande Ruins National Monument	Restore native plants along park boundary fence	20,000	7,600
IMR	UT	Cedar Breaks National Monument	Suppression of spruce bark beetle infestation in developed areas	13,400	5,000
IMR	CO	Colorado National Monument	Control non-native plants and plan for re-vegetation	40,000	20,000
IMR	MT	Grant-Kohrs Ranch National Historic Site	Fencing Repairs to improve resource management	40,000	20,000
IMR	UT/ CO	Hovenweep National Monument	Re-establish historic vegetation long-term monitoring plots	16,800	8,400
IMR	AZ	Montezuma Castle National Monument	Develop and implement exotic plant management plan	39,500	19,500
IMR	AZ	Pipe Spring National Monument	Restore native bunch grasses	39,700	20,000
IMR	TX	San Antonio Missions National Historical Park	Assessment of bird species—a park-wide bird inventory including migratory birds	13,300	4,900
IMR	AZ	Sunset Crater Volcano National Monument	Assess soil genesis and disturbance impacts within unique volcanic cinder terrain	24,100	19,500
IMR	AZ	Tonto National Monument	Document nuisance rattlesnake movements and behavior	39,900	19,900
IMR	AZ	Coronado National Memorial	Understanding migration patterns of the endangered lesser long-nosed bat	18,500	18,500
IMR	NM	Capulin Volcano National Monument	Identify and map areas of disturbance	12,200	12,200
IMR	WY	Fossil Butte National Monument	Assess paleobotanical resources	39,500	20,200
MWR		Midwest Regional Office	Regional RAMS and PMIS training	35,000	6,510
MWR	AR	Arkansas Post National Memorial	Hunting Boundary Demarcation at the Memorial Unit	3,143	3,040
MWR	IA	Effigy Mounts National Monument	Develop Issue Based Natural Resource Profiles and Resource Management Education Materials	19,927	13,920
MWR	OH	Hopewell Culture National Historical Park	ZRAT Control Exotic Vegetation at Mound City Group Unit	30,000	14,010
MWR	NE	Homestead National Monument of America	Partner with Great Plains CESU to Develop Management Plan for Historic Trees (LCS#05085)	9,375	9,210
MWR	NE	Homestead National Monument of America	Develop Compliance, Planning and Implementation for Woodlands Project	14,500	5,390
MWR	ND	Knife River Indian Villages National Historic Site	Protection of prairie habitat by controlling exotic plant utilizing integrated approach	27,500	23,420
MWR	SD	Mount Rushmore National Memorial	Implement Integrated Pest Management Plan	8,330	8,330
MWR	AR	Pea Ridge National Military Park	Complete a Historic Vegetation Base Map at Pea Ridge National Military Park	19,805	18,520
MWR	MN	Pipestone National Monument	Baseline Insect Collection at Pipestone National Monument	17,900	16,760
MWR	NE	Scottsbluff National Monument	Research Vegetation Composition of Grazed vs. Ungrazed Prairie	11,890	11,660
MWR	KS	Tallgrass Prairie National Preserve	Conduct Baseline Geomorphological Research Fox Plamer Creeks	22,632	13,430
MWR		Midwest Regional Office	Training park resource management staff in new RMP guidelines	15,350	15,350
MWR		Midwest Regional Office	Regional Assessment	NA	17,750
NCR	VA	Prince William Forest Park	Develop management plan for *Isotria Medioloides*, a federally listed threatened species	9,750	9,750
NCR	VA	Prince William Forest Park	Initiate a vegetation monitoring program	9,750	9,750
NER	MA	Boston Harbor Islands National Recreation Area	Develop IPM plans and map exotics	120,400	58,000
NER	PA	Valley Forge National Historical Park	Assess sediment loads in Valley Creek	74,750	50,250
NER	VA	Colonial National Historical Park	Control phragmites in park wetlands	22,500	4,900

(continued next page)

NRPP—Small Park Projects (continued)

Region	State	Park	Project Title	Total Project Funding	FY 2004 Funding
NER	MD	Hampton National Historic Site	Remove exotic plants from riparian buffers	$4,255	$4,260
NER		Northeast Regional Office	Assessment	NA	3,890
PWR	CA	Cabrillo National Monument	Use mussels to assess marine water quality	4,000	4,000
PWR	ID	City of Rocks National Reserve	Research and map fire history	10,000	10,000
PWR	CA	Devils Postpile National Monument	Reconstruct pre-Euro-American fire history	17,220	17,210
PWR	CA	Devils Postpile National Monument	Inventory of invertebrate fauna	30,000	30,000
PWR	OR	Fort Clatsop National Monument	Noxious weed control in boundary expansion	28,000	12,000
PWR	CA	John Muir National Historic Site	Mount Wanda sub-watershed management plan	20,000	20,000
PWR	CA	John Muir National Historic Site	Cattle Pond Dam removal and restoration	8,220	8,220
PWR	HI	Multiple Pacific Island Network Parks	Assess threat of invasive marine plants to small parks in Pacific Island Network	87,536	37,550
PWR	WA	Whitman Mission Natltional Historic Site	Re-vegetate 20 acres in historic scene	10,044	10,040
PWR	WA	Whitman Mission National Historic Site	Re-vegetate restored Doan Creek streambanks	43,884	18,980
SER	SC	Cowpens National Battlefield	Provide term resource management assistance	75,700	37,100
SER	TN	Stones River National Battlefield	Expansion of Xeric Limestone Prairie habitat for the federally endangered Tennessee Coneflower	7,900	7,900
SER	TN	Obed Wild and Scenic River	Exotic plant survey and eradication project	5,000	5,000
SER	FL	De Soto National Mounument	Base inventory of invertebrates	24,300	24,300
SER	GA	Fort Pulaski National Monument	Conduct shoreline erosion study	24,300	24,300
SER	VI	Buck Island Reef National Monument	Elkhorn coral and abundance	16,900	16,900
SER	SC	Kings Mountain National Military Park	Inventory and treat invasive exotic plant species	30,600	12,100
SER	KY	Abraham Lincoln Birthplace National Historic Site	Restoration American Chestnut	12,100	12,100
SER	GA	Chattahoochee River National Recreation Area	Increase reproductive productivity of Georgia Aster, a federal candidate species	9,000	9,000
SER	GA	Ocmulgee National Monument	Eradicate exotic flora	14,500	14,500
SER	FL	Timucuan Ecological and Historic Preserve	Determine tidal prism of Ft. George River	15,500	15,500
SER	LA	Cane River Creole National Historical Park	Conduct A baseline inventory of the vascular plants	11,700	11,700
SER	GA	Chattahoochee River National Recreation Area	Outcompete invasive Microstegium Using native grass species (*Chasmanthium*)	9,700	9,700
SER	NC	Carl Sandburg Home National Historic Site	Manage invasive exotic plants and monitor natural resources	14,500	14,500
			Total	**$1,517,461**	**$972,000**

NRPP—Regional Block Allocation projects

Region	State	Park	Project Title	Total Project Funding	FY 2004 Funding
AKR	AK	Alaska Regional Office	Alaska Park Science Journal	$105,000	$25,000
AKR	AK	Alaska Regional Office	Alaska park technical reports	30,000	10,000
AKR	AK	Alaska Regional Office	Create public outreach materials for an ecological tour of Alaska	90,000	30,000
AKR	AK	Alaska Regional Office	Natural resource employees professionalization and technical competency enhancement	67,900	20,000
AKR	AK	Denali National Park and Preserve	Develop regional integrated pest management program to insure health of natural resources	6,000	6,000
AKR	AK	Alaska Regional Office	Assessing access to Alaska National Parks	40,000	40,000
AKR	AK	Alaska Regional Office	Alaska park cooperative and technical assistance projects	75,000	19,300
AKR	AK	Alaska Regional Office	Regional Assessment	NA	44,000
IMR	NM	Carlsbad Caverns National Park	Mitigate the effects of brood parasitism and monitor habitat for Bell's vireo at Rattlesnake Springs	13,100	13,100
IMR	CO	Dinosaur National Monument	Monitor peregrine falcon population after delisting from endangered species list	40,000	20,000
IMR	AZ	Grand Canyon National Park	Control ten high priority exotic plant species	39,300	19,400
IMR	CO	Great Sand Dunes National Park and Preserve	Evaluate habitat and conduct baseline fisheries study of the Sand Creek drainage	40,000	20,000

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NRPP—Regional Block Allocation projects (continued)

Region	State	Park	Project Title	Total Project Funding	FY 2004 Funding
IMR	WY	Grand Teton National Park	Using watershed characteristics to focus monitoring efforts in high-elevation lakes	$15,500	$15,500
IMR	AZ	Petrified Forest National Park	Survey wilderness paleontological and biological resources for management planning	38,800	18,800
IMR	WY	Yellowstone National Park	Documenting the presence and distribution of lynx	40,000	20,000
IMR	UT	Zion National Park	Assess Stockponds, Catchments, and Check Dams to determine if they should be retained or removed	20,000	20,000
IMR	CO	Colorado National Monument	Conduct Paleo Inventory in partnership with Museum of Western Colorado	20,000	13,900
IMR	TX	Lake Meredith National Recreation Area	Complete urban interface boundary fence	40,000	20,000
IMR	UT	Timpanogos Cave National Monument	Assess water quality and air mass movements in cave system	39,300	13,600
MWR	AR	Buffalo National River	Control Exotic Species, Feral Swine (year 2 of 2)	45,640	23,840
MWR	NE	Missouri National Recreation River	Zoological survey of Missouri NRR 39-mile district (yr 2 of 2)	34,340	23,830
MWR	WI/ MN	St. Croix National Scenic River	sampling for pesticides in listed Mussel habitats of the St. Croix River (2 of 2 yr)	22,480	4,480
MWR	NE	Scotts Bluff National Monument	Restore native Prairie Species (year 2 of 2)	29,520	13,820
MWR	SD	Wind Cave National Park	Cave and Karst Inventory of Wind Cave National Park (yr 2 of 2)	29,710	22,830
MWR	MN	Grand Portage National Monument	Conduct Integrated Pest Management Study	10,000	10,000
MWR	WI/ MN	St.Croix National Scenic River	Gastropod survey	9,600	9,150
MWR	SD	Wind Cave National Park	Remove Trail Constructin debris (cost split between RBG- yr 1, NRPP submittal, year 2-3)	466,300	9,350
MWR	Multi	Midwest Regional Office	Culling Strategies and considerations in National Park Units with Emphasis on Bison and Elk	17,480	16,930
MWR	MI	Isle Royale National Park	Inventory, Mass and Assess Recreation Impact in the Pristine Zone	49,470	23,640
MWR	AR	Buffalo National River	Ecology of Bull Elk in Arkansas, Phase 1	25,140	23,840
MWR	Multi	Midwest Regional Office	Train Park Resource Management staff in new RMP guidelines	88,610	8,710
MWR	Multi	Midwest Regional Office	Assessment	NA	3,880
NCR	MD	Catoctin Mountain Park	Control invasive exotic plants	9,120	9,120
NCR	MD	Chesapeake and Ohio Canal National Historical Park	Evaluate impacts of white-tailed deer on vegetation	16,020	16,020
NCR	VA	George Washington Memorial Parkway	Subterranean explorations: Ground water amphipods	9,720	9,720
NCR	DC	National Capital Parks Central	Restoration of ecological balance in Constitution Gardens Lake	5,230	5,230
NCR	DC	National Capital Regional Office	Fostering natural resource stewardship	9,320	9,320
NCR	DC	National Capital Regional Office	Building a vegetation classification of the National Capital Region	24,730	24,730
NCR	DC	Rock Creek Park	Restoring meadows	3,430	3,430
NCR	VA	George Washington Memorial Parkway	BioBlitz-surveying under represented taxonomic groups	19,720	19,720
NCR	VA	George Washington Memorial Parkway	Inventory of snails	8,130	8,130
NCR	DC	National Capital Parks Central	Conduct pollinator (bees and butterflies) inventories in horticultural areas	11,430	11,430
NCR	DC	National Capital Parks Central	Complete urban forest inventory in two units	11,830	11,830
NCR	VA	Prince William Forest Park	Continued disturbed lands reclamation at the Cabin Branch Pyrite Mine	9,720	9,720
NCR	VA	Prince William Forest Park	Stream bank assessment	6,020	6,020
NCR	WV	Harpers Ferry National Historical Park	Install bat gate at John Brown's Cave	3,720	3,720
NCR	WV	Harpers Ferry National Historical Park	Provide hack support for peregrine falcon restoration	5,320	5,320
NCR	MD	Chesapeake and Ohio Canal National Historical Park	Protect state threatened and endangered plants during exotic removal	1,730	1,730
NCR	MD	Catoctin Mountain Park	Prepare fire management plan and environmental assessment	7,720	7,720
NCR	MD	Chesapeake and Ohio Canal National Historical Park	Develop rare threatened and endangered species GIS dataset for resource protection	4,720	4,720
NCR	MD	Antietam National Battlefield	Protection of water quality at the Piper Farm	7,730	7,730
NCR	VA	George Washington Memorial Parkway	Develop Classification of ecological communities in Potomac Gorge Section	9,720	9,720

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NRPP—Regional Block Allocation projects (continued)

Region	State	Park	Project Title	Total Project Funding	FY 2004 Funding
NCR	VA	Manassas National Battlefield Park	Collect data on white-tail deer exclosures for natural resources interpretive programs	$9,120	$9,120
NER	NY	Fire Island National Seashore	White-tailed deer monitoring	82,000	20,000
NER	NY	Gateway National Recreation Area	Monitoring of experimental restoration	10,000	10,000
NER	MA	Cape Cod National Seashore	Impacts of hunting on rabbit populations	115,300	65,300
NER	MD	Assateague Island National Seashore	Estimation of nitrate loads in streamflow discharge to Chincoteague Bay	119,910	35,210
NER	MD	Assateague Island National Seashore	Assess impacts to vegetation from grazing of exotic sika deer	38,556	16,160
NER	VA	Shenandoah National Park	Develop a meteorology database	41,060	41,060
NER		Northeast Regional Office	Assessment	NA	6,570
PWR	WA	Ebeys Landing National Historical Reserve & San Juan Island National Historical Park	Develop Restoration Protocols for Prairies	10,000	10,000
PWR	CA	John Muir National Historic Site	Cattle Pond Dam Removal and Restoration	4,800	4,800
PWR	WA	North Cascades, Mount Rainier, and Olympic National Parks	Whitebark Pine Restoration	38,000	38,000
PWR	Multi	Multiple Pacific West Region Parks	Professional Development in Natural Resource Management	9,870	9,870
PWR	CA	Multiple California Parks	Use of Weed Free Feed in CA Parks	22,250	22,250
PWR	CA	Santa Monica Mountain National Recreation Area	Assess Distribution and Status of Mountain Lions	43,921	43,920
PWR	CA	Santa Monica Mountain National Recreation Area	Burn to Control Exotic Grasses in Valley Oaks	20,459	20,460
PWR	CA	Sequoia Kings Canyon National Parks	Evaluate Invertebrate Recovery After Fish Removal	20,000	20,000
PWR	CA	Sequoia Kings Canyon National Parks	Distribution and Habitat Association of Fishers and Other Rare Forest Carnivores	25,000	25,000
SER	SC	Cowpens National Battlefield	Conduct Acoustic Monitoring for Endangered Bird, Amphibian Call and Aircraft Overflight	67,600	32,000
SER	FL	Gulf Islands National Seashore	Determine Concentrations of Mercury Compounds in Fish, Water, and Sediments	38,600	14,600
SER	FL	Gulf Islands National Seashore	An Inventory and Damage Assessment of Non-native mammals of Cat Island Mississippi (New Lands)	24,000	24,000
SER	TN	Great Smoky Mountains National Park	Hemlock Woolly Adelgid Predator Beetle Survey	21,800	6,400
SER	SC	Cowpens National Battlefield	NEPA Compliance For Prescribed Burning Effects on T&E Dwarf-Flowering Heartleaf	22,000	22,000
SER	TN	Big South Fork National River and Recreation Area	Develop Natural Resource Interpretation Information At Big South Fork NRRA	11,700	11,700
SER	VI	Buck Island Reef National Monument	Removal of invasive non-native plants at Buck Island Reef National Monument	24,000	24,000
SER	GA	Chickamauga and Chattanooga National Military Park	Inventory, Map, and Monitor Mountain Skullcap	24,000	24,000
SER	NC	Cape Lookout National Seashore	Develop Cape Lookout Horse Database to Department of Interior Standards for Data Analysis	12,600	12,600
SER	FL	Biscayne National Park	Assess Densities and Impacts of Derelict Lobster and Crab Traps	117,000	23,000
			Total	**$2,746,816**	**$1,360,000**

NRPP—Special Alaska park projects funded in FY 2004

Region	State	Park	Project Title	Total Project Funding	FY 2004 Funding
AKR	AK	Aniakchak National Monument & Preserve	Escapement, population structure, genetics and morphology of sockeye Salmon within Aniakchak	$294,000	$80,500
AKR	AK	Glacier Bay National Park & Preserve	Identify marine bird distribution and evaluate visitor impacts	386,900	111,000
AKR	AK	Alaska Support Office	Charter aircraft services for Western Contaminant project	24,800	24,800
AKR	AK	Wrangell-St Elias National Park & Preserve	Investigate limnological conditions in Tanada Lake affecting Sockeye Salmon production	35,875	15,800
AKR	AK	Alaska Support Office	Western airborne contaminant assessment project (WACAP)	465,808	253,200
AKR	AK		Across the board assessment		5,700
			Total	**$1,207,383**	**$491,000**

NRPP—Special Alaska park projects funded in FY 2004

Region	State	Park	Project Title	Total Project Funding	FY 2004 Funding
See Appendix F					

NRPP—Servicewide Projects

Region	State	Park	Project Title	Total Project Funding	FY 2004 Funding
Special Projects					
			Biosphere reserve assessment	$15,000	$15,000
			Invertebrate symposuum	10,000	10,000
			GAP analysis of National Park System	72,000	72,000
			Seamless network to protect biodiversity	250,000	150,000
Technical and Policy Assistance to Parks					
			Management tools/protecting dark night skies	46,500	46,500
			Addressing geoscience backlog in parks	50,500	50,500
			NPS risk and vulnerability to geologic hazards	21,600	21,600
			Enhance compliance regarding non-federal oil and gas management in parks	34,300	34,300
IMR	UT	Zion National Park	Develop climate friendly action plan	25,000	25,000
			Advancement of restoration tools	50,000	50,000
			Assess threatened fish populations	12,200	12,200
Cooperative Ecosystem Studies Unit					
			CESU Council	182,800	182,800
			Catalog of biological programs in CESUs	20,000	20,000
Education and Information					
			Views of the National Park System	63,500	63,500
			Field notebooks	30,000	30,000
			Year in Review	83,900	83,900
			Park Science	60,000	60,000
			Development of Interactive Multimedia Knowledge Centers	29,000	29,000

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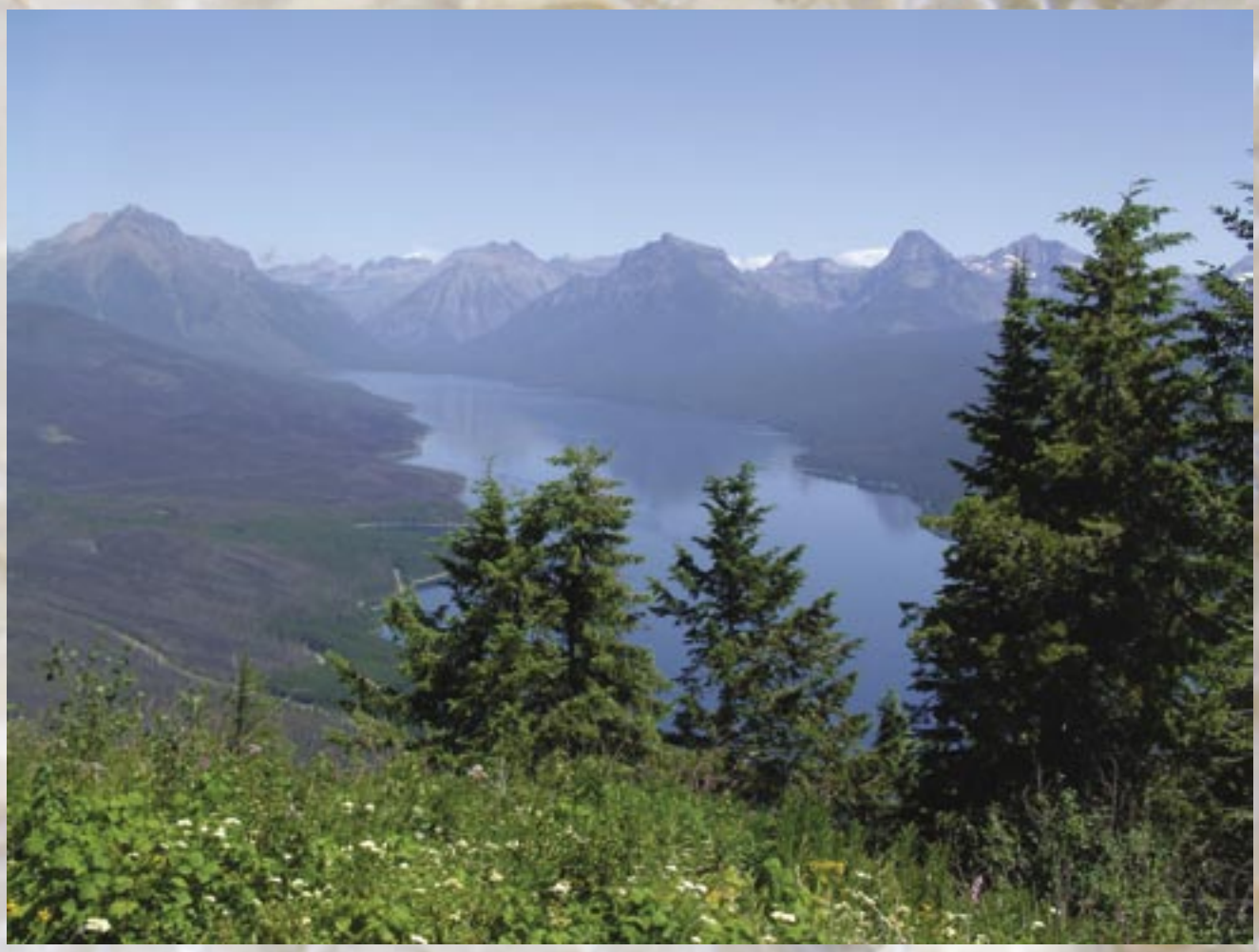
NRPP—Servicewide Projects (continued)

Region	State	Park	Project Title	Total Project Funding	FY 2004 Funding
Professional Development and Recognition					
			Director's natural resource awards	$34,900	$34,900
			Natural resource stewardship for professional development	23,100	23,100
			George Wright Society	5,000	5,000
Natural Resource Deatabase Development and Information Technology					
			Making web technology available to natural resource program center	23,500	23,500
			Improve imformation technology security to natural resource program center	60,000	60,000
			Complete Resource Activity Management System (RAMS) client user interface revisions	17,500	17,500
			Revise RAMS to allow for performance reporting	37,800	37,800
			Subtotal of Projects		**$1,158,100**
			Unobligated Funds due to contract problems, event cancellations due to hurricanes, etc.		$34,900
			Total		**$1,193,000**



Appendix F: USGS—Biological Resources

PROJECTS AWARDED IN FY 2000, ACTIVE IN FY 2004, NO FY 2004 FUNDS

Title of Project	FY 2004 Report
Integrating beaver, water and willow in the Savanna model at Rocky Mountain National Park	This study is developing a quantitative ecological model of beaver, elk, and willow interactions to be used in developing alternatives and predicted outcomes for the park's Elk and Vegetation EIS process and in developing and monitoring future adaptive management actions. In FY 2004, a visiting scientist from Argentina helped refine model parameters and develop a user interface. The results, presented to park and EIS contract staff in March, show that a beaver colony could be indefinitely supported in the park on a 5-ha willow site fenced to prevent competition with elk. They also show that beaver and willow could be indefinitely supported with low densities of elk, but that beaver would be excluded when elk density became greater than 30 elk per square kilometer. These results provide evidence supportive of EIS alternatives that suggest reducing populations and/or changing distributions of elk to recover natural beaver-willow mutualisms in the park's riparian ecosystems. Plans for FY 2005 include (1) completing a Model Interface to make the model much more user friendly for Park staff and (2) submitting scientific papers to formally present the beaver/willow model and show how competition favors elk over beaver in the park's riparian willow communities.
Ecological integrity of McDonald Watershed, Glacier National Park: Biotic indicators of water quality impairment at the reconstruction of Going-to-the-Sun Road	Bioassessment evaluates a stream's ability to support and maintain a balanced, adaptive, functioning plant and animal community. By using many factors to compare the existing condition of a stream with its expected natural species composition, diversity, and functional organization, bioassessment can show whether the stream is degraded by any physical, chemical, or biological stressors; permit diagnosis of what stressor(s) may be causing any degradation observed; and facilitate the ability to detect intermittent stressors or the cumulative effect of multiple stressors. Researchers developed specific bioassessment methods to be used in Glacier NP during reconstruction of the Sun Road to permit comparing any stream sites that may become degraded by reconstruction activities to the natural, or reference, condition of the stream. The study focused on analyzing stream bottom, physical, and chemical conditions that characterize particular stream segments and developed a description of the reference condition. The baseline data and approaches researchers compiled showed there is a lack of significant longitudinal gradients in stream flow velocity, bottom material, and particulate matter suspended in the water, but presence of a significant temperature gradient. Taken together, these findings permitted researchers to develop a bioenergetic model of the expected distribution and abundance patterns of a stream's larger invertebrate species. Although, because of changes in scheduling of the Sun Road reconstruction, researchers did not have opportunity to examine any stream conditions affected by reconstruction activities, it is believed the level of severity of any future environmental impacts can be assessed by comparing the species composition observed in the stream during or after occurrence of such impacts to the reference condition identified through the bioenergetic model. The final report provides the park with baseline data and approaches for future analysis of any eventual impacts that may occur as the Sun Road is reconstructed over the next decade.

USGS researchers are studying the impact of road reconstruction on Lake McDonald at Glacier National Park, Montana.
Photo by Sean Murdock

PROJECTS AWARDED IN FY 2002, ACTIVE IN FY 2004, NO FY 2004 FUNDS

Title of Project	FY 2004 Report
Bighorn sheep in Great Basin National Park: An assessment of population status, limiting factors and potential enhancement alternatives	Submitted final report entitled An appraisal of the opportunities to restore mountain sheep to the South Snake Range, Nevada to Great Basin National Park in January 2004. This technical assistance effort concluded that at present suitable habitat does not occur in the park. A helicopter census conducted in February 2003 revealed no bighorn sheep. Three scientists inspected habitat conditions and concluded that habitat at GRBA is currently not suitable for bighorn sheep due to a history of overgrazing by domestic livestock and fire suppression in a fire-dependant ecosystem. They reported the ecosystem at present is unstable and will change either through disease and decadent stands of woody vegetation or by the return of fire, probably as catastrophic wildfire as excess large fuels are present and continue to accumulate. They also were concerned with the presence of domestic sheep allotments and that the originally resident subspecies of bighorn sheep is not present.
Determine wind erosion rates to support protection of natural and cultural resources at Bandelier National Monument, New Mexico	Funding for this project ended in FY 2004. However, data collected up to that time were inadequate to accurately estimate wind erosion rates, due to unexpected startup technical problems with wind erosion sampling devices and the high temporal variability observed in pulses of wind erosion. Researchers continue to collect wind erosion data with the equipment installed by this project, and are working to compare our data with findings from a mirror site at nearby Los Alamos National Laboratory. The early wind erosion estimates will be folded into an EIS for ecological restoration of pinyon-juniper woodlands currently being developed by Bandelier NM to address its most pressing resource management issue, the effects of accelerated soil erosion on natural and cultural resources.
Develop and populate an avifauna database at Mesa Verde National Park	With participation of park staff throughout the process, researchers have processed over 17,000 individual reference sources compiled from a large, extensive, 70 year collection of field notes, record cards, published and unpublished reports, and other printed data about the bird fauna of Mesa Verde National Park. Researchers have entered approximately 85% of this information into an Access database following standard NPS format. The resulting standardized, easily-searchable, GIS-related database will allow park staff to query, extract, and use the wealth of information tied up in bundles of records. Synthesis of data related to species and habitat will provide a comprehensive overview of bird occurrence, distribution, and population trends at Mesa Verde NP. Project completion, planned for May 2005, will include a hands-on overview of the database and guidance for using and interpreting the data and for maintaining and updating the database as new data are obtained. Once organized and synthesized, this body of information may provide significant understanding and guidance for management of the park's natural resources.
Development of a model to evaluate impacts of fuels-reduction/prescribed fire in Pinyon-Juniper habitats on avian communities within Colorado Plateau National Parks	During the project's introductory period, focused on Zion NP (2002–2003), researchers completed a literature review, compiled historical accounts of population dynamics of breeding species, and updated a species list of birds reported within mature, mid-aged and young Pinyon-Juniper habitat and identified as resident, migrant, and vagrant nonbreeding species. Researchers established permanent transects, stratified by mature and young Pinyon-Juniper vegetation types, in areas of each vegetation type scheduled for fuels reduction, prior to proposed fuels reduction efforts. Baseline avian surveys were conducted prior to the fuels reduction effort, including additional counts conducted throughout 2004. Researchers reported the progress of the study to Colorado Plateau parks, including one park presentation that focused on preliminary results of the study, the proposed GIS model, and how to incorporate management alternatives resulting from the potential findings of this study. Researchers prepared geographic information data themes of Pinyon-Juniper habitat for 4 parks and obtained study permits from 3 parks. In FY 2005 researchers will complete the study by comparing avian communities in prescribed burned areas to unburned areas, developing the model, and extending the model to other Colorado Plateau parks. The study

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PROJECTS AWARDED IN FY 2002, ACTIVE IN FY 2004, NO FY 2004 FUNDS (continued)

Title of Project	FY 2004 Report
	will provide a copy of the GIS data theme and the model for avian habitat response to prescribed fire in differing Pinyon Juniper habitat types to each Colorado plateau park with significant Pinon-Juniper habitat. The results will allow parks to better assess potential impacts on avian community structure throughout prescribed burning management activities in Pinyon Juniper habitats.
Research in support of endangered Kemp's ridley sea turtles at Padre Island National Seashore	Since 1978, efforts have been underway to re-establish a nesting colony of Kemp's ridley sea turtles at Padre Island National Seashore (PAIS), Texas. Park Oriented Biological Support funds were received in FY 2002 and FY 2003 to collect data from nesting and stranded adults, stranded hatchlings, and dead embryos/hatchlings to analyze the number of Kemp's ridleys nesting, nesting parameters (nest site fidelity, temporal and spatial patterns of nesting, number of nests per year, and re-migration intervals), results of the project to re-establish a nesting colony, number of dead adults found, and mortality factors for adults at PAIS and elsewhere in Texas. Analyses of blood and tissue samples collected continued during FY 2004. During FY 2005, analyses will be completed and a final report will be prepared. The NPS will use project results to help manage the growing nesting colony and reduce adult mortality.
Estimating black bear abundance in Great Smoky Mountains National Park using DNA extracted from hair samples	This study is testing the feasibility of DNA sampling to estimate black bear population abundance in Great Smoky Mountains National Park and of using the results to design optimal sampling regimes and develop an efficient population monitoring technique. During the summer of 2004, researchers completed the study's second and final year of DNA sampling. Over 10 weekly periods, researchers collected 1,778 hair samples from a total of 65 sites. All but one site had bear activity during the 10 weeks. DNA analysis of the hair samples is to be completed in January 2005. Of 250 DNA hair samples collected in 2003, 205 samples were successfully analyzed (82% success rate), representing 129 different bears. Eighty eight bears are represented only once. The remaining 117 DNA samples represent 41 different bears. Researchers used the recapture rates across the 10 sampling periods to calculate population abundance, resulting in a population estimate of 291 bears (95% CI = 251-345) for the study area. The preliminary findings indicate that a sufficient number DNA samples can be collected in an efficient manner. The number of sample sites visited per week typically represented 50 to 80% of the total sample sites, providing a good sampling intensity. Most hair samples (82%) contained sufficient amounts of DNA for sequencing. The preliminary population abundance estimates for 2003 indicate that this technique can provide desirable levels of precision of the population estimates. Future analyses of the DNA data will assess the effects of sampling site density, sampling duration, and subsampling intensity on capture probabilities and the precision of the population estimates. The final report, scheduled for May 2005, will include guidelines for proper sampling regimes.
Testing and evaluation of remote sensing methods for estimating refuge characteristics of karst wetlands	The project goal is to determine feasibility of estimating density of solution holes by aerial imagery. Solution holes are depressions in the limestone substrate caused by the dissolution of limestone by water. These solution holes provide dry season refuge habitat for aquatic animals. The time table for this project was delayed due to administrative, technical, and weather challenges. Still, significant progress toward successful project completion has been made. Analysis of digital images from aerial overflights during the 2003 dry season led to a highly accurate base image map for the study area. This map revealed shortcomings that demonstrate the importance of mission timing and the inadequacy of standard image collection for this specific application. Standard air photo equipment is too costly and lacks sufficient resolution and flexibility to meet solution hole characterization requirements. Therefore, researchers formulated two alternate approaches to meet the mapping needs of the project. The first is to use a low-cost, quickly deployable, high-resolution, custom developed camera system, a prototype version of which was deployed in late

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PROJECTS AWARDED IN FY 2002, ACTIVE IN FY 2004, NO FY 2004 FUNDS (continued)

Title of Project	FY 2004 Report
	FY 2004. Analyses of resulting data are currently underway. The second approach will be the evaluation in FY 2005 of the utility of summer FY 2004 LIDAR data for solution hole mapping purposes. Processing and analyses will progress in FY 2005 and plan to complete a final report within the next 6 months.
Distribution, population dynamics, and herbivory impacts of a pioneering elk herd on Chaco Culture National Historic Park	Fourteen and 18 elk captured/recaptured, radio-collared, and evaluated for physiological condition, November 2003 and April 2004, respectively have been monitored monthly for movements, home ranges, and survival. Twelve calf elk were captured and radio-tagged June-July 2004. Vegetation surveys, grazing surveys, browse surveys, and pellet group surveys were completed, summer 2004. Fecal samples for diet composition and diet quality analysis were collected beginning June 2004. All project activities will be repeated in 2005 and 2006. Cow elk averaged 6.5% and 4.1% body fat in April 2003 and April 2004, respectively. Lactating cow elk averaged 13.1% body fat in November 2003, indicative of diets at the low end of good diet quality. November body fat levels were the second highest detected during extensive sampling of elk herds throughout the western U.S. Survival of adult cows was 1.0 and 0.9 for 2003 and 2004, respectively; the only source of mortality was hunter harvest. Calf survival to date in 2004 was 1.0. Elk location data will be analyzed for elk use areas, movements, and habitat use. Annual home ranges of cow elk averaged 16.8 square miles. Overall use of preferred woody browse species was light. Elk use areas seem to be concentrated along the top and side draws of Chacra Mesa and along Chaco Wash. Little elk use occurs on South and West Mesas. Elk appeared to make use of unusual habitat features (i.e., caves) on park and adjacent tribal, state, and BLM lands, although analyses have not yet been completed. Preliminary analyses of vegetation composition, structure, use, and water infiltration rates indicate no impacts of elk and deer herbivory on herbaceous plant communities or soil properties. Analyses of food habits and dietary quality have not yet been completed.
Effects of suspended load on stream biota	Redwood Creek, in Redwood NP, is listed by the EPA as sediment-impaired. This study used two years of monitoring of several streams in Redwood NP to assess sediment impairment in terms of the effect on health of salmon and their invertebrate prey base. Organic particles suspended in the stream water contributed significantly to stream turbidity at both beginnings and endings of storms. Organic content of the suspended sediments was highest in basins with the least amount of watershed disturbance. The nutritional value of suspended sediment particles as a food resource for invertebrates increased with an increase in the concentration of organic particles in the quantity of sediment suspended in the water. Both field and lab studies showed that the efficiency of feeding by salmon is affected by turbidity of the stream, but that some feeding goes on even at high turbidities. Links between suspended sediment composition and invertebrate prey base are being analyzed, a draft report was delivered, a master's thesis will be completed, and two papers based on this work are under review. Once the master's thesis is completed, a final report will be prepared. Preliminary conclusions are that a suspended load that is high in organic matter content can produce a positive effect on streams, whereas a high content of inorganic material in the suspended load may cause the health of fish and large invertebrate species to decline. The Park now has a solid baseline against which to compare future trends in sediment transport, suspended sediments, and stream health.
The importance of Walnut Canyon National Monument as habitat for cougars (*Puma concolor*) in an urban interface environment	Urban development, transportation corridors and non-park management all have the potential to affect cougars near Walnut Canyon National Monument. Five cougars were tracked for about 1 year each, 3 with GPS/Argos satellite collars, 1 each with GPS- and VHF-only collars. The study documented selection for rough terrain and forest cover year-round, selection for the National Monument during big game hunting seasons, no crossings of interstate highways and less than expected use of habitat near roads and residential areas. The

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PROJECTS AWARDED IN FY 2002, ACTIVE IN FY 2004, NO FY 2004 FUNDS (continued)

Title of Project	FY 2004 Report
	study also documented >80 kills by cougars, consisting of roughly equal proportions elk, mule deer and other prey. These other kills included an exceptional number of coyotes. Follow-on funding has been obtained to continue this work, which will lead tracking 7 more cougars and the production of integrated models of habitat selection as tools for impact assessment and planning.
Gaining baseline data on state-listed lake sturgeon (*Acipenser fulvescens*) and their spawning habitat across the international boundary between Minnesota and Ontario	In 2004, aerial and boat tracking of the 41 lake sturgeon that had received implants of combination radio/acoustic tags in 2002 and 2003 continued throughout the open water season. The majority of the lake sturgeon locations were located in the Canadian portion of the South Arm of Rainy Lake, where they were associated with rocky structures and water less than 10 m deep. Few fish were relocated in deeper Minnesota waters typified by more homogenous habitat. Radio tracking and spawning mats were used to identify areas utilized by spawning fish. Spawning season locations were consistent with historically known spawning areas. Lake sturgeon eggs collected on spawning mats were positively identified by hatching a sub-sample in the laboratory. Field work on the project has been completed and the data is being analyzed and will be presented in a Master's degree thesis to be completed in December 2004.
Vegetation classification and mapping tools for national parks: demonstration products for Voyageurs National Park	FY 2004 analyses of vegetation sampling data from the Voyageurs NP Vegetation Mapping Project confirmed 49 plant communities associations and provided additional plant community information. Plant community descriptions, a dichotomous key, and ordination diagrams were revised to reflect the new results and constitute vital ingredients to USGS Technical Report, Field Guide to the Plant Community Types of Voyageurs National Park. Representative ground photos have been selected for each community, and the introduction and appendixes are written. The field guide is currently in review. Two journal articles, one on vegetation classification, the other on applying classification in mapping, were drafted. Researchers are conducting additional analysis using GIS to explore plant community distribution in connection to early 20th century fires at Voyageurs NP. A third article is being written to discuss park resource management application and use of the vegetation map. In FY 2005, location maps of plant communities will be made for the field guide, the guide will undergo editing and peer review needed to meet requirements for USGS Technical Reports, and will be published. The articles will be submitted to peer review journals and a final abstract report submitted to the park. Park managers and researchers can use the field guide to identify plant communities in the field and to acquire ecological information.
Baseline monitoring of floodplain vegetation and geomorphology prior to dam removal, Elwha River, Olympic National Park	FY 2004 activities involved field data collection along 15 permanent transects established to monitor changes in geomorphology and riparian vegetation along the Elwha River. Topography was surveyed, vegetation measured, tree cores were collected to age stands of woody vegetation, and data entry began. Data entry will continue in FY 2005, along with tree ring reading, data analysis and report preparation. Much of this work will comprise a Master's thesis.
Protecting ecological resources at Acadia National Park through landscape scale conservation and easement planning	Acadia National Park desired a decision support model to help Park staff prioritize properties that might become available for conservation easements. In FY 2004, researchers met with Park staff and personnel from the Maine Coast Heritage Trust to discuss the model, developed and decided on appropriate data layers to use in the model, and developed a draft model that permits users to decide how to weight certain attributes to be used in the prioritization process and generate areas of high priority for acquisition. In FY 2005, this draft will be discussed with the Park and other interested groups, the model revised and finalized on the basis of Park input, and a final product and report turned over to the Park.

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PROJECTS AWARDED IN FY 2002, ACTIVE IN FY 2004, NO FY 2004 FUNDS (continued)

Title of Project	FY 2004 Report
Impact of stocking non-indigenous salmonids on a federally-endangered freshwater mussel within the Delaware Water Gap National Recreation Area	Qualitative mussel surveys completed for the Flat Brook show sporadic distribution of dwarf wedge mussels over an 18 mile stretch of the river within the NRA. Historic and present fish species occurrence data have been collected for the drainage. FY 2005 plans include determining the reproductive season of the mussel, which fish serve as hosts for mussel larvae, and the impact of stocked trout on those fish hosts. Data will be used by resource managers to develop strategies that balance the needs of an endangered species with those of the recreational angling public.
Evaluating the impacts of white tailed deer (*Odocoileus virginicus*) on vegetation within Pea Ridge National Military Park	Field work was completed in August 2003 and data analysis in late October 2004. Researchers stratified sampling based on four predefined community types (oak forests with exposed aspects, oak forests with protected aspects, cedar thickets, and old fields) that differed from each other in overstory density, understory density and species richness, and groundflora richness and cover. Initial analysis of the deer browse survey shows significant differences in browsing intensity between these four community types. Early comparisons between exclosed and unexclosed areas had shown the existence of vegetation differences prior to the construction of exclosures. Generally, changes in vegetation in exclosed areas are not significantly different from changes detected in unexclosed areas, a not unexpected finding given the short duration of this study. The final report for this project is being prepared.
Development of parasite risk assessment and control strategies for captive breeding of island fox (*Urocyon littoralis*) at Channel Islands NP	In FY 2002 and 2003, a working group of authorities on wildlife disease, wildlife pathology, wild canid husbandry, and wildlife parasitology familiar with island fox wild and captive populations and parasites assessed the relative risks posed by specific parasites versus dangers inherent in treating animals with concurrent infections, developed a plan to fill critical data gaps, and planned and conducted an intensive fecal parasite survey of park captive island fox pens to identify parasites of concern in each population. This work informed preparation of a draft report. In FY 2004 revisions and additional information provided by working group participants were used to develop and submit for review and comment a draft final report on parasite assessment and parasite management. The final report was submitted to the park by December 2004.
Habitat requirements of the endangered California freshwater shrimp (*Syncaris pacifica*) in streams on the Point Reyes National Seashore and Golden Gate National Recreation Area	California freshwater shrimp were sampled on four occasions between November 2003 and August 2004 from 16 sites in Lagunitas Creek and 4 sites in Olema Creek, a small tributary of Lagunitas Creek. Shrimp were captured with a combination of dip nets, minnow traps, and seines from all sites in Lagunitas Creek. Shrimp have not been caught in Olema Creek. Concurrent with the shrimp collections, researchers measured water quality and other habitat variables from each site and also sampled fish for gut contents. In general, shrimp were most numerous in habitats characterized by overhanging streambank vegetation, submerged root masses, sandy substrate, and low current velocity where threespine stickleback (*Gasterosteus aculeatus*), California roach (*Hesperoleucus symmetricus*) and Sacramento sucker (*Catostomus occidentalis*) were most numerous. Analysis of fish gut contents indicated that native sculpins (*Cottus asper* and *C. gulosus*) preyed on shrimp. In FY 2005, researchers plan to finish processing fish samples for gut contents and complete the final report. Information from this study will be useful for determining if past and current land use practices along Lagunitas and Olema Creeks are adversely influencing shrimp abundance.
Evaluation of canid scents as a management tool to reduce mammal predation on piping plover nests in coastal barrier parks	In FY 2004, data were organized and placed in a relational database and analyses are underway. Predators were difficult to attract at some sites and small sample sizes may preclude complete analyses. In some areas, it appeared that scents of dominant predators affected smaller predators but this awaits further review and statistical comparisons. Some parks are faced with increasing generalist predator populations (i.e., meso-predator release hypothesis) that prey on endangered

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PROJECTS AWARDED IN FY 2002, ACTIVE IN FY 2004, NO FY 2004 FUNDS (continued)

Title of Project	FY 2004 Report
	shorebirds. Agency policies prefer to allow native predators to function without intervention where possible and alternatives to removal are sought. This approach would reduce predation without manipulating other predator populations, thus leaving predator-prey interactions intact. A report will be submitted in the first quarter of FY 2005 and a journal article prepared.
Southern Colorado Plateau Park network: Vegetation mapping needs assessment	The Southern Colorado Plateau Park Network (SCPN) needed an initial assessment of park vegetation mapping needs preliminary to deciding on vegetation monitoring for each of the park units in the network. Only three of 19 parks in the network have recent vegetation mapping efforts. The project developed an extensive work plan for vegetation mapping that outlined each step required for implementing mapping with team roles defined and interactions described. It adhered to USGS-NPS Vegetation Mapping Program guidelines and to National Vegetation Classification Standards. In addition, the study identified existing tabular and spatial data available to initiate mapping projects. The SCPN used the plan to guide vegetation mapping at Petrified Forest NP, Mesa Verde NP, and Canyon de Chelly NM. The work plan has guided the network in developing team composition and project strategies for projects at other network parks.

PROJECTS AWARDED IN FY 2002, ACTIVE IN FY 2004, RECEIVED FY 2004 FUNDS

Title of Project	FY 2004 Report
Technical assistance in determining size and composition of non-native and native ungulate populations at Point Reyes National Seashore	Previously captured and instrumented non-native fallow deer (*Dama dama*) have been located bimonthly and 40 animals survive to date. A second aerial census of the Seashore's fallow deer was completed in January 2004. During censuses, all visible fallow deer were counted from the air and instrumented animals were located both from the air and on the ground. Average group size was obtained in addition to a Lincoln-Petersen index. The 2 years of data are being analyzed to develop a fallow deer population estimate for the Seashore. This estimate and associated herd composition data will be included in the park's Exotic Deer Management Plan Draft Environmental Impact Statement, to be released to the public in December 2004. In addition, a final study report is being prepared.
Water developments in Theodore Roosevelt National Park, North Dakota: Implications for ungulates and herbivory	Researchers used a time-lapse video camera system for a second year of extended monitoring of wildlife during 2004 to estimate frequencies of water development use by bison, feral horses, elk, mule deer, and pronghorn. Researchers also sampled vegetation in the vicinity of water developments and at control sites to assess effects on plant succession of herbivory associated with water developments. During FY 2005, researchers will complete data analyses and prepare a report for the National Park Service. The report will provide information required for management decisions regarding the need to continue maintaining specific water developments in the South Unit of the park.
Assessing the risk of aerially borne pesticides to declining amphibian species in the national parks of the Sierra Nevada Mountains, California	This project involves three experiments to examine dose/response relationships of pesticides on amphibian larvae. One, which examined the effect of environmentally realistic concentrations of chlorpyrifos, diazinon, malathion and their combinations on Pacific treefrogs, was funded by the POBS funds, conducted in 2003, and the analysis of results is underway. This experiment, using a surrogate species to test effects of atmospherically transported pesticides on declining amphibian species in the Sierra Nevada Mountains, involved field translocation experiments in three national parks in California and a laboratory experiment to test for, in a controlled environment, pesticide exposure effects seen in the field. The research involved tissue sample analysis for cholinesterase activity, water sample analysis for pesticide residues, selected tissue sample analysis for pesticide residues, and tissue sample analysis for DNA. Statistical analyses are in progress. Final

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PROJECTS AWARDED IN FY 2002, ACTIVE IN FY 2004, RECEIVED FY 2004 FUNDS (continued)

Title of Project	FY 2004 Report
	analysis will use survivorship, growth, time to metamorphosis (or Gosner Stage 41-45), and percent malformations as measures of response to pesticide exposure. The related experiments included (1) exposure from egg to metamorphosis of two frog species to endosulfan and chlorpyrifos at several concentrations and (2) exposure of 90 day old individuals of one species to several concentrations of diazinon, malathion, and chlorpyrifos parent and oxon chemicals (oxon forms of these pesticides are caused by partial breakdown of the parent compounds, are typically the form found in field investigations, and generally are more biologically active and toxic than the parent forms). These studies individually add to understanding of risks amphibians encounter from pesticides in the Sierra Nevada Mountains. When combined with field studies on the presence of pesticides in tissues, sediment, and water and on translocation experiments, they may provide a strong scientific foundation for addressing toxic pesticides and restoring amphibian populations.
Determining rates and causes of summer elk calf mortality in Yellowstone National Park	This study investigated the fate of some 44 elk calves less than 6-days old that were captured in Yellowstone National Park in May and June 2004, tagged with mortality transmitters, and monitored through the end of FY 2004. Thirteen calves survived through this time period; the others were killed by bears (18), coyotes (4), wolves (3), golden eagle (1); wolf or bear (1), unknown predators (2), and unknown, non-predation (2). Basic results were similar to those observed in FY 2003. For FY 2005, attempts will be made to radio-tag and similarly monitor 35-50 more neonate elk calves.
Amphibian habitat fragmentation in Salt Creek, Canyonlands National Park: implications for reproduction and distribution	In 2004, additional tests of the fate of toad eggs laid in road crossings showed that numbers of eggs left in pools following one vehicle pass were very low, about half the eggs were lost after a single pass on average. Extrapolating to the maximum number of vehicles that could pass through a pool each day, 24 (12 vehicles are allowed into the lower part of Salt Creek each day, 24 assumes all drive back out the same day), about 0.5% of the eggs originally in the pool would remain after 24 vehicles drove through the pool. Visual/auditory encounter surveys of amphibians in open road, closed road and no road segments of Salt Creek Canyon conducted in late afternoon and shortly after dark once a month, May through September, revealed 57 amphibians seen in the no road section, 516 in the closed road section, and 376 in the open road section. Data collected on habitat characteristics of randomly selected sections of the canyon that relate to suitability for *Ambystoma tigrinum* (tiger salamander) and *Rana pipiens* (leopard frog) in each of the three management zones (open-, closed, and no-road zones) have not been compiled and entered yet. Presence and abundance of aquatic habitat, vegetative cover, benthic characters and associated macroinvertebrates and amphibians were documented. During winter FY 2005, the project will compile and analyze the habitat data, analyze toad data to assess population differences between management segments, and finalize the eggs-vehicle interaction data analysis and write the final report for the project. Canyonlands NP will use these data to assess the impact of vehicle use on amphibian populations in the canyon.

PROJECTS AWARDED IN FY 2004, RECEIVED FY 2004 FUNDS

Title of Project	FY 2004 Report
Effect of groundwater withdrawal on avian abundance and species richness in riparian areas of National Parks in the desert southwest	Field work and data collection have not yet begun. Scientists and managers from USGS, NPS, and University of Arizona have met to identify potential replicate study sites in the region in addition to those at Saguaro National Park; to identify additional partners; and to identify additional funding sources, deadlines for applying to these sources, and which partner will take the lead on submitting proposals for each of these opportunities. FY 2005 plans include obtaining additional matching funds to extend the project to many replicate riparian areas throughout the desert southwest, choosing the most appropriate replicate study sites, and coordinating with hydrologists at USGS, NPS, and UA to obtain data from all groundwater wells in the region.
Measuring the impact of wastewater on concentration of nutrients, fecal bacteria, and human enteric virus in ground and surface waters in Dry Tortugas National Park	This project is designed to 1) monitor fecal pollutants and nutrients in the carbonate island water lens underlying historic Fort Jefferson, 2) determine the island's geologic framework, and 3) determine annual fluctuations in the ephemeral freshwater lens. It is suspected that pollutants in the ground and surface water could be influencing surrounding coral reefs. The first and most difficult phase of the study, begun in August, has been completed. The drill team of 2 geologists, 1 microbiologist, and 1 hydrologist worked in the water-filled moat surrounding historic Fort Jefferson to core-drill 8 of 10 monitoring wells to 18 ft below sea level and screen them with 1.5 inch diameter PVC casing. They drilled the other 2 wells to 46 and 62 ft respectively. The 62 ft well, installed in the Fort parade ground, was screened to 62 ft. Coralline Pleistocene limestone was encountered at 55 ft. Preliminary results were provided to the Fort Jefferson restoration project now in progress and a short write up of the study team and its adventures was prepared for two DOI publications. Quarterly sampling from the wells and surface waters will begin in mid November 2004 and extend for 2 years. The work has proceeded as originally planned.
Documenting current stream productivity and fish populations prior to dam removal in the Elwha River: Setting the stage for long-term monitoring of ecosystem responses.	Removal of two dams on the Elwha River and return of anadromous salmonids to the upper river represent a high park restoration priority. Establishing baseline values of fish communities and marine derived nutrients is required prior to dam removal to track the ecological effects of restoration on the aquatic ecosystem. FY 2004 results included convening a workshop of partners to develop protocols; establishing study areas in stream reaches below, between, and above the dams; sampling fish, macroinvertebrate, and periphyton communities; collecting tissue samples from fish, macroinvertebrates, and algae for stable isotope analysis; and collecting salmon tissues from samples of *Oncorhynchus mykiss* populations between and above the dams to determine genetic structure. FY 2005 plans include both repeating the above sampling protocols; collecting riparian plant tissues for stable isotope analysis; and sampling in tributaries above and below natural barriers to salmon migration.
Monitoring avian community changes and habitat use in the Giacomini Wetland Restoration Project in the Golden Gate National Recreation Area and reference wetlands along Tomales Bay	Spatially explicit area and point count surveys of the avian community were initiated in 2004. An ArcGIS database is being designed to include vegetative cover, elevation, bird abundances and behavior to help track avian response to restoration actions. Reference sites have been established to compare avian response to the wetland restoration and local fluctuations in bird abundance.
Estimating distribution and amphibian occupancy of vernal pool breeding habitat	Distribution and amphibian occupancy of small ephemeral wetlands is not well understood in northeastern parks. Researchers have helped identify ephemeral wetland breeding habitats and estimate habitat occupancy by wood frogs and spotted salamanders. In FY 2004 egg mass counts to estimate population of wood frogs and spotted salamanders , were conducted at 4 pools each in Acadia NP, Cape Cod NS, Rock Creek Park, and Shenandoah NP. Ground searches also were conducted at Rock Creek to determine the location of all vernal pools. In Acadia and Cape Cod, where the distribution of vernal pools is known, a subset of pools was selected to assess the proportion of

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PROJECTS AWARDED IN FY 2004, RECEIVED FY 2004 FUNDS (continued)

Title of Project	FY 2004 Report
	area (i.e., vernal pools) occupied (PAO) by wood frogs and spotted salamanders. In FY 2005, these surveys will be continued and additional population estimation surveys will be conducted at 4 to 10 pools in Delaware Water Gap NRA, where some counts have been conducted since 2001. PAO surveys will be conducted at 40 of the 281 known pools at Delaware Water Gap, as well as at all 8 known pools in Rock Creek and 10 pools in the Potomac Gorge area of the Chesapeake and Ohio Canal NHP. Future research will determine vernal pool locations and conduct PAO sampling of pools found in the southern half of Shenandoah NP and throughout Gettysburg NHP. For all population estimation and PAO surveys, habitat variables (e.g., pool area, pool depth, distance to road, percent adjacent forest cover, water pH and temperature) will be recorded; these can be used as covariates in analyses of detection and site occupancy.
Impact of recreational and invasive species on resident aquatic species: Whiskeytown Recreation Area	In FY 2004, eight streams were sampled three times (late May/early June; early Aug; late Sept) to determine presence and abundance of native frogs and invasive species. Egg masses for foothill yellow-legged frogs were found at half the streams and a high count (n = 38 total) as well as larvae at 7/8 sites. They were absent in only one creek, which was also the only stream with the invasive bullfrog present. At 6 sites in and around Whiskeytown Reservoir 115 turtles (113 native; 2 introduced) were captured. Turtles appear to be stable. In FY 2005 several sites will need to be resurveyed, particularly the main feeder stream into the reservoir as a major forest fire occurred in this basin in late summer 2004. Increased effects from sedimentation are expected in areas with frog reproduction. Future research will focus on potential avoidance of sites by frogs where invasive fish are present. Turtle surveys need to be expanded into feeder streams and at more sites in the reservoir.
Distribution of black bears in the Elwah Valley, Olympic National Park: Environmental baseline for assessing ecosystem effects of salmon restoration	This project examines seasonal patterns of distribution and movements of black bears in Olympic NP prior to dam removal in the Elwha Valley. Park Oriented Biological Support funds supplemented other funding to assess the long-term ecological effects of salmon restoration on park bear populations and distributions. During 2004, radio-collars containing global positioning system (GPS) receivers were placed on 8 black bears in the Elwha watershed, bringing the total number of monitored bears to 15. Additionally, field tests of accuracy of GPS radio-collars in coniferous forests were completed. Preliminary results indicate that individual bears range broadly throughout the Elwha watershed, with use of riparian zones along the Elwha River concentrated during late spring. In FY 2005 the plan is to place GPS radio collars on 3-4 more black bears and collect location data twice daily on instrumented bears until summer 2006. The project will produce a master's thesis during 2005 summarizing bear movements and distribution through 2004. Results will provide an ecological baseline for assessing effects of future salmon restoration in the Elwha Watershed on black bear movements, will help Olympic NP wildlife managers reduce seasonal human/bear conflicts in the Elwha backcountry, and will set the stage for establishing a long-term black bear monitoring program.
Evaluating vertebrate monitoring indicators for sound decision making: Technical assistance to the Sonoran Desert Network inventory and monitoring program	Changes in funding led to a need to redesign the project. The current plan is to start project activities in spring or mid summer 2005.

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PROJECTS AWARDED IN FY 2004, RECEIVED FY 2004 FUNDS (continued)

Title of Project	FY 2004 Report
Augmentation and expansion of endangered freshwater mussel populations in the Big South Fork National River and Recreation Area	During FY 2003 nearly 40,000 endangered juvenile mussels were released into the park. In FY 2004 gravid adult mussels collected from areas in the park were used to infest several species of captive fish with glochidia from these mussels to produce several thousand juvenile mussels. The juveniles, held in captivity for 2 months, experienced complete mortality. Plans for FY 2005 include using newly designed culture systems for juvenile mussels to continue efforts to produce and release into the Big South Fork Cumberland River artificially propagated juveniles of 2 federally endangered mussel species. The goal of this project is to restore as many of the 5 federally endangered mussel species in the Park as possible through population augmentation with juvenile mussels, and to expand their ranges within the Big South Fork Cumberland River.
Assessing the relationship between acid precipitation, calcium depletion, and avian productivity in Great Smoky Mountains National Park	Black-capped Chickadee populations have been declining in the Southern Appalachians over the past two decades, and have disappeared as breeders from several high elevation sites where they once occurred. High elevations of the Great Smoky Mountains receive some of the highest rates of deposit of air-borne nitrate and sulfate in eastern North America. One effect of the resulting acidification is loss of the essential element calcium. This study will use the Black-capped Chickadee as a model for evaluating the effects of acid precipitation on high elevation bird communities in the Southern Appalachians. FY 2004 funding initiated a Research Work Order at North Carolina State University to support a graduate student to conduct the research, with field work to begin in March 2005.
Riparian vegetation response to tamarisk invasion and flow regulation in Dinosaur National Monument	The stratigraphy of alluvial sediments together with precise aging of tamarisk are being used to improve understanding of the historical timing and pattern of tamarisk establishment and spread within Dinosaur NM. This work will be expanded in 2005 to different geomorphic settings on the Green and Yampa rivers. Additionally, woody vegetation cover, by species, has been sampled along three experimental river reaches, using transects aligned with permanent, long-term, surveyed channel cross-sections. Four cross-sections, stratified by geomorphic setting, are located at sites that have been paired according to management of tamarisk on alluvial surfaces: Physical removal (Treatment) or no removal (Control). Additional measurements, including vertical structure of woody riparian vegetation, along with cover and diversity of herbaceous riparian vegetation across a range of geomorphic surfaces, are planned for 2005. More than a decade of channel-change and empirical stage/discharge information at each site, along with an improved historical, process-oriented understanding of tamarisk invasion, will provide a detailed description of the response of riparian vegetation to flow regulation and tamarisk invasion, as well as an assessment of the ecological efficacy of management interventions, such as physically removing tamarisk from specific geomorphic settings within the Park.
Effects of road mortality on native anuran populations at Saguaro National Park	As a result of changes in funding, field work did not start in 2004. A master's student will begin work in January 2005 and conduct field work in summer 2005 and summer 2006.
Population status and ecology of ashy storm petrel in Channel Islands National Park assessing one of the most vulnerable endemic seabirds in the California Current	FY 2004 results included 13 nights spent capturing, measuring, banding, and radio-marking storm-petrels on two islands in the Channel Islands National Park. At Santa Barbara Island (SBI), researchers captured and banded 187 Ashy Storm-petrels, 20 Black Storm-petrels, and 1 Leach's Storm-petrel. At Scorpion Rock off Santa Cruz Island (SCI), researchers captured and banded 220 Ashy, 0 Black, and 1 Leach's Storm-petrel. Eight previously banded Ashy Storm-petrels at SBI and 1 at Scorpion Rock were recaptured. Researchers radio-marked 15 Ashy Storm-petrel at SBI, and 28 at SCI. Between 23 July and 23 August 2004, 16 aerial tracking surveys were flewn with support from the U.S. Navy and covered >72,000 km2 of ocean. The surveys found storm-petrels (90 valid locations for 34 individuals) were aggregated over the continental shelfbreak from Pt. Conception to Pt Reyes, within the Santa Barbara Channel, and within Monterey

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PROJECTS AWARDED IN FY 2004, RECEIVED FY 2004 FUNDS (continued)

Title of Project	FY 2004 Report
	Bay, CA. FY 2004 study results will be presented at the annual Pacific Seabird Group meeting in Portland, Oregon. FY 2005 plans include continuing capture-recapture efforts, radio-telemetry, diet collections, analysis of sex-specific capture, and a power analysis to evaluate trends in Standardized Catch Per Unit Effort. Final results will be presented to park staff and submitted for journal publication. These data augment the Channel Islands NP seabird monitoring program and will contribute toward assessing population size and trends, and population-specific foraging habitats—both aspects are required for effective adaptive management.
Does food availability impede bird restoration in Hawaii Volcanoes National Park?	This study assesses whether availability of arthropod prey affects abundance and distribution of Hawaiian forest birds and whether arthropod abundance may limit bird recovery efforts. In FY 2004 researchers established six study sites within relatively dry ohia (*Metrosideros polymorpha*) forests of Hawaii Volcanoes NP, performed the first of four semi-annual surveys of arthropod abundance on bird foraging substrates within each site, and conducted the first of four variable circular plot counts of all birds within each site. In FY 2005 researchers will continue sampling to determine arthropod and bird abundances and will begin surveys of potential competitors of birds (ants and parasitic wasps), identification and enumeration of arthropods, and analyses of data.
The role of hybridization in cattail (Typha spp.) invasions of freshwater wetlands in Great Lakes National Parks	The rapid and ongoing spread of cattails (*Typha spp.*) in national parks of the Great Lakes Region seriously threatens biodiversity and ecosystem function. One potential explanation for this invasion is an expansion of ecological tolerances through hybridization between *Typha latifolia* and a European invader, *T. angustifolia*. This study is designed to verify through genetic analysis the presence of hybrids in three Great Lakes national park units (Indiana Dunes NL, St. Croix NSR, and Voyageurs NP), and to determine if hybrids are capable of outgrowing their parental species under a variety of environmental conditions. In FY 2004, researchers collected field data on 150 cattails from each of 5 sites within these parks, and harvested leaf tissue for genetic analysis. During FY 2005, researchers will develop genetic fingerprints and will correlate hybridity with invasiveness. Depending on the purity of the *T. latifolia*- and *T. angustifolia*-type specimens collected, other populations may also need to be sought to identify species-diagnostic DNA markers.
Importance of small wetlands to the diversity of amphibian assemblages in the Delaware Water Gap Recreation Area	Although often overlooked, small and ephemeral wetlands contribute to the maintenance of landscape-level biodiversity. This study will determine the importance of small wetlands to amphibian species diversity in Delaware Water Gap NRA. Using samples of amphibian assemblages in the park, researchers will develop spatial models to describe amphibian diversity as a function of the size and distribution on the landscape of wetlands of various hydroperiods. The study will use the models to predict consequences of wetland protection measures or of natural or human-induced changes in the park landscape on wetlands and wetland communities. Sampling for this study will begin November 2004.

Appendix G: Summary of Fully-Funded Water Resources Division Competitive Projects—FY 2004

Title of Project	FY 2004 Report
Management of Dune Slack Wetlands in Cape Cod National Seashore	As municipal wells and wastewater treatment facilities are installed adjacent to Cape Cod National Seashore (CACO) boundaries, serious concerns have arisen over the possibility of groundwater withdrawal/ water table modifications affecting dune slack wetlands. This study identified and mapped 340 dune slack wetlands within the boundaries of CACO. Site specific abiotic and biotic data was collected at 15 sites. Preliminary results indicate that a total of 105 wetland plant species were identified, although no State- or Federally-listed species were found. Results of analyses of hydrology, vegetation, and other variables will be used to improve dune slack conceptual models and to assess the severity of threats from water table modifications or other stressors. A final completion report is expected in 2005.
Characterization of Macroinvertebrate Community and Drift in a Tributary of the Buffalo National River, Prior to Damming	The U.S. Army Corps of Engineers has granted a Clean Water Act Section 404 permit to dam Bear Creek, a large tributary to the Buffalo National River. This project collected macroinvertebrate samples at 3 sites in order to document baseline conditions within Bear Creek. A total of 412 macroinvertebrate samples were collected and are currently being processed. A taxa list has been developed from the identifications and voucher specimens. Data analysis is currently underway and a final completion report is expected in 2005.
Develop a Water Resources Management Plan for Mammoth Cave National Park	As south-central Kentucky's population and industry continue to grow, the potential for pollution of the surface and ground waters of Mammoth Cave National Park can also be expected to increase. The development of a Water Resources Management Plan is currently underway to identify and address the current and near-future potential threats to the park's aquatic resources. A scoping session and public forum was conducted in 2004 in order to identify water resource issues, assess current conditions, begin development of desired conditions of park waters and to assess potential strategies to protect aquatic-related park resources. A final WRMP is expected to be published in 2005.
Stream and Riparian Characterization & Analysis at Petrified Forest National Park	Petrified Forest National Park management has identified a need to develop a more complete understanding of the ecological potential of riparian areas throughout the park to support native plants and animals. This is being accomplished by examining the water-shed scale interactions of precipitation, streamflow, groundwater and vegetation along a gradient of drainage basin area. Data is currently being collected at 17 study sites throughout the park. Data will be collected through the end of 2004, then analyzed with a final report expected in late 2005. The final report will contain: 1) the natural riparian community potential for each study stream; 2) identification of park riparian systems where restoration needs exist; and 3) recommendations for defining and establishing a long-term hydrological monitoring program for the park.
Assess and Plan for Restoring Wetland and Riparian Habitats in Rodeo Lagoon Watershed, Golden Gate National Recreation Area, Marin County, CA	The objective of this study is to identify historic aquatic, wetland, and riparian habitats within the Rodeo Valley with high potential for restoration and to develop a conceptual restoration plan for high priority sites. A step-wise process was implemented to: 1) map historic features; 2) map existing conditions; and 3) to conduct a field evaluation of the restoration potential of historic aquatic, wetland, and riparian habitats. Historic wetland assessment work was completed and published in 2004 by the San Francisco Estuary Institute. Field evaluations and conceptual design work for potential restoration activities are currently underway by the University of California, Berkeley and is scheduled for completion in May, 2005.

Overview of the upper Kijik River, Lake Clark National Park & Preserve, Alaska. One of four water quality monitoring sites in the park, the Kijik River flows into Lake Clark.

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Evaluate Stream Temperature Regimes for Juvenile Coho in Redwood Creek, Redwood National Park, CA	The purpose of this project was to evaluate whether summer stream temperatures are a limiting factor for juvenile coho salmon in Redwood Creek. This project is related to the Government Performance and Results Act Ia4 Water Quality Objective. In 2003, the parks contracted for thermal infrared imaging of Redwood Creek. Thermal images were used to measure the surface water temperature along the main channel of Redwood Creek and identify warm versus cool reaches. On July 29, 2003, about sixty miles (90 % of the stream length) of Redwood Creek were photographed in about 1½ hours. About 2,500 overlapping thermal images were acquired. A digital video of Redwood Creek was also acquired and provided good coverage of the channel and riparian zones. The final report and data were received in March 2004. Thermal images captured stream temperature during the warmest time of the day and on the hottest day of the summer. The water temperature profile of Redwood Creek showed quite a bit of variability with large changes of stream temperature over relatively short distances. For example, changes in water temperature greater than 1 degree C occurred in less than a half-mile and many were associated with the inflow of tributaries or springs. Based on the temperature data, Redwood Creek can generally be divided into four main reaches that showed similar temperature characteristics.
Enhanced Wetlands Mapping for Tomales Bay Watershed, Point Reyes National Seashore, CA	As a coastal park, Point Reyes National Seashore supports many different kinds of wetlands including fresh, brackish, and saltwater systems, a diminishing resource in coastal California. The park has identified the need for an enhanced inventory of these wetlands to better understand and protect this important resource. This current study has identified and mapped 717 polygons of wetlands comprising more than 1500 acres within the Tomales Bay watershed of the National Seashore. During visits to these sites, wetlands were delineated, classified, and assessed in order to evaluate their condition and functionality. A final report on this work is expected in 2005.
Assess and Remove Alien Marine Alga (A. spicifera) from Kaloko Fishpond at Kaloko-Honokohau National Historic Park, HI	*Acanthophora spicifera*, an invasive, exotic marine alga has been identified in the historic 11-acre Kaloko fishpond at Kaloko-Honokohau National Historic Park. Funds were received in late FY 2004, and the University of Hawaii was selected to serve as principle investigator for this project. An initial field assessment is scheduled for January, 2005.
Nelson Slough Wetland Restoration Design and Implementation, Klondike Gold Rush National Historical Park, AK	For many decades, Klondike Gold Rush NHP (KLGO) visitors and local residents drove off-road vehicles and automobiles through Nelson Slough, a small tidal wetland, in order to access the Taiya River Delta and tidal mudflats. While motorized vehicle traffic was restricted in the late 1990s, horse access was not eliminated until 2002. It is a current objective of park management to attempt to restore the natural bank structure and native vegetation of this currently degraded area and to improve its functionality as anadromous fish habitat. In FY 2004 necessary permits for this restoration work were acquired from the U.S. Army Corps of Engineers and the Alaska Department of Natural Resources. A local contractor Streamcraft, Inc. produced a restoration plan, site reconstruction was completed and native plant materials were collected from nearby locations and transplanted. Follow-up work in FY 2005 will include sowing of native plant seed collected in FY 2004, on-going monitoring, and the removal of exotics. It is also the plan of the park to develop an interpretive program focusing upon this restoration effort.
Investigate Limnological Conditions in Tanada Lake Affecting Sockeye Salmon Production	Wrangell-St. Elias National Park/Preserve is responsible for managing subsistence salmon fisheries to maintain natural and healthy salmon populations. Unfortunately, we do not have an adequate understanding of our lake systems to determine if the harvest of 1.5 million sockeye salmon in Copper River fisheries annually is limiting the production of juvenile sockeye salmon within Park/Preserve waters. While the effects of artificial fertilization to lake productivity are well documented, the more subtle effects of fluctuating natural delivery

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	of marine derived nutrients to lake ecosystems through varying escapements are not. Although establishing this relationship will likely take several years, this project seeks to develop a protocol for examining the role of natural lake fertilization (salmon carcasses) within this ecosystem over a two year timeframe. If we are successful in developing a useful protocol, we intend to seek additional funding from other sources to continue collecting data and ultimately establish an escapement range.
Water Quality Impacts to the Snake River from Landslides	This project is recommended and discussed in Hagerman Fossil Beds National Monuments's (HAFO) 1999 Interim Water Resources Scoping Report and was submitted under FY 2000 and 2001 Unified Calls but was not funded. Through a renewed partnership between the NPS and USGS, a short-term (two-year) water chemistry analysis about aquatic conditions of both surface and groundwater systems that flow into the Snake River. The river is an EPA listed 303d impaired water body and subject to specific water quality regulations that this project will investigate. Landslides caused by both surface and groundwater sources are contributing massive amounts of sediment and other water quality parameters into the Snake River. This information will provide the first data of its type, as well as baseline, for future comparisons and analysis. The project will help mitigate and resolve the landslide issue by identifying aquifer recharge areas with groundwater that is causing slope failures and help HAFO comply with state regulations for discharges into the Snake River. The project will also help resolve the landslide issue at HAFO by identifying recharge source areas of aquifers that are causing landslides that will enable efficient application of mitigative treatments.
Identify Restoration, Reservations and Minimum Flows and Levels Targets for Biscayne National Park	The state of Florida is revising its water resource rules. Consumptive use permits for water supply will change from 5-year permits to 20-year permits in the year 2004. Prior to 2004, BISC and the state must agree on minimum flows and levels to prevent further harm to the system. More importantly they must decide on levels to be reserved for restoration and preservation of the Park. A means to approach this problem is to use continuous recording salinity equipment and isotopic relationships to develop a salinity envelope related to freshwater inflow. We propose to use continuous recording salinity equipment placed along the western shoreline of the Park and work with Dr. Peter Swart of the University of Miami on stable isotope chemistry to develop these relationships. This will be used to participate in the process to set water reservations for the Park.
Ground and Surface Water Interactions of the Buffalo National River	Buffalo National River is located in karst terrain in northwestern Arkansas and is visited by over one million people each year who take part in hiking, swimming, canoeing, caving, and other recreational activities. Agricultural development (primarily hogs, cattle, and poultry) and forest clearing has increased nonpoint source pollution and represents the most significant long-term threat to the Buffalo River. The movement of water between ground water and surface water in karst terrains provides a major pathway for contaminant transfer between terrestrial and aquatic systems. To better understand the ecological implications of nonpoint source discharges within the Buffalo River basin, location of streamflow gain and loss and relations between water-quality characteristics and base flow of the stream must be defined. Identification of locations along the Buffalo River where ground water significantly contributes to streamflow is needed so sources of pathogens and fate and transport of contaminants can be better monitored and used to assess human health risks related to recreational activities. This synoptic study will evaluate the ground-water and surface-water interactions and assess base-flow water quality and quantity within the Buffalo River watershed.

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Title of Project	FY 2004 Report
Determine Groundwater Impacts to the St. Croix National Scenic Riverway	The St. Croix National Scenic Riverway, one of the original eight rivers designated under the Wild and Scenic River System, was included in the system for its outstanding scenic and recreational values and its diverse biota and clean water. Many of the values of the Riverway are related to its water quality, which is under constant threat from activities in its tributary watersheds. Several studies have been implemented to assess surface water quality in those tributaries, but very little is known about the groundwater hydrology and its influence on surface water quality in the St. Croix Basin. Groundwater sustains the flow in the St. Croix during dry periods of the year. Farming in the St. Croix Basin has been going on for over a century, with pesticides and fertilizers being applied for nearly half that time. Manure spreading on fields, septic systems, wastewater seepage ponds, and industry all has the potential to contaminate groundwater that eventually discharges into stream systems in the watershed. Changing land use (most notedly development extending from the St. Paul/Minneapolis Metro Area) has the potential to change the groundwater recharge and baseflow in the St.Croix. This study will provide a groundwater flow model that is greatly needed to improve the understanding of the hydrology of the St. Croix Basin. The sources and amount of baseflow contribution to the St. Croix River from its sub-basins will be more accurately known and understood, and water-resource managers can use the model as a tool to assess groundwater contamination susceptibility and the affects of hydrologic stress (e.g., development and land-use changes) on water resources of the Riverway. The model will provide a basis to interpret new and existing water-quality data and will provide a regional framework for more site-specific studies in the future.
Capture and Assess Stream Health in Highly Fragmented Parks	Parks in the National Capital Region (NCR) lack basic information on water resource conditions. This project provides NPS with detailed information on water quality (chemistry, physical habitat, biological assemblages) and aquatic health in these parks by: 1) determining the current status of water resources in six parks using an integrated monitoring approach; 2) establishing a rigorous physical, chemical, and biological baseline for detecting changes in conditions; and 3) providing a comprehensive assessment of water quality in the parks relative to regional reference sites, allowing prioritization of streams for protection and/or restoration. The project will analyze water chemistry (e.g., nitrate), physical habitat (e.g., embeddedness), and biotic assemblages (benthos, fishes) at a minimum of 55 randomly-selected sites along an urban to rural gradient and calculate indices of biotic integrity to assess health. This study complements a fish inventory of the NCR Inventory and Monitoring Program.
Assess Hydrocarbon Pollution Threats to Park Waters	Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous contaminants of freshwater and marine ecosystems, and in an island park like Isle Royale are transported there via atmospheric deposition, through motorboat engine exhaust, and in fuel spills. PAH presence at Isle Royale is known but unstudied. This project proposes to assess the ecological impact of PAHs on the park's aquatic communities (which are highly significant features on the park landscape) through analysis of sediments, benthic community structure, and sediment toxicity. The project fulfills commitments made by the park in response to public comment made on the park's recently completed General Management Plan.
Data Collection & Analysis of Required Water Quality Parameters; Outstanding Waters Designation	Preliminary water quality data collected from sites within Black Canyon of the Gunnison National Park and Curecanti National Recreation Area have shown that some constituents are better than standards dictated by the Clean Water Act and enacted by the State of Colorado. Recent explosive and potential future growth surrounding Black Canyon and Curecanti has necessitated an investigation into the feasibility of an antidegradation designation known as Outstanding Waters. This designation will protect the waters of Black Canyon National Park and Curecanti National Recreation Area beyond

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	current standards, consistent with Service-wide and park guidelines. The minimal schedule of constituents collected as part of the baseline water quality program does not meet those required by the State for Outstanding Waters designation. Therefore, high quality collection and analysis of required data will be required in the next two years in order to petition and defend this designation to the State Water Quality Control Commission.
Data Collection and Analysis of Required Water Quality Parameters; Outstanding Waters Designation	Water is one of the most important resources for Buffalo National River. Preserving the water quality requires an understanding of water sources to the river. This is particularly important to the Buffalo since much of its water comes from springs during baseflow and there has never been a complete spring inventory conducted in Buffalo's watershed. In karst geology like that of the Buffalo, underground drainage networks are interconnected so that groundwater recharge from outside the topographic watershed can influence the Buffalo. This proposal focuses on documenting two major sources of water that feed the Buffalo, springs and perennial streams. Along with locating and mapping these features, water quality measurements will be taken for each spring and stream. The results will allow park managers to isolate problem areas and evaluate springs that may be receiving groundwater from outside basins, and will be shared with agencies and researchers doing work involving springs.
Regional Point-Source Management to Support Special Protection Water Quality Regulations	The overall goal of the proposed project is the development of a point source management plan for the states and municipalities that abut and impact the park. The area defining the boundary of the plan includes the 8-mile section of the Delaware River between two national park units (Delaware Water Gap National Recreation Area (DEWA) and Upper Delaware Scenic and Recreational River (UPDE)) and borders New York, New Jersey and Pennsylvania. Wastewater facilities are allowed to discharge treated effluent directly into this segment of the river, which is immediately adjacent to the upstream boundary of the DEWA. Although the Delaware River Basin Commission will lead plan development, the DEWA must strive to meet requirements set forth in the enabling legislation and management goals. This project will address concerns about growth in affected communities as well as park development proposals. This "pro-active" approach to addressing common needs with states and municipalities will preserve and protect the designated Special Protection Waters of the Middle Delaware Scenic and Recreational River.
Hydrodynamic Assessment of Estuarine Restoration of Pilgrim Lake and Salt Meadow, Truro	Tidal flow into this 200 ha (500-acre) back-barrier coastal lagoon and salt marsh system has been blocked by railroad and highway grades since 1867; original shallow-water estuarine environments have been replaced by brackish-to-fresh surface waters, and original salt marsh invaded by Typha, Phragmites and freshwater wetland shrubs. Water quality within the impounded lake is poor with high ammonium and phosphorus concentrations and dense cyanobacterial blooms (Mozgala 1974, Redfield & Emery 1977, Applebaum & Brenninkmeyer 1988); the limited aquatic fauna are dominated by introduced carp (*Cyprinus carpio*) and chironomid midges. Eutrophic conditions may be caused by nutrient loading from road runoff and septic leachate; in fact, both highway traffic and residential development on this coastal systems barrier beach just outside Cape Cod National Seashore boundaries, Beach Point, is increasing rapidly. Eutrophication is exacerbated by the artificial restriction of tidal flushing that allows nutrients to accumulate. Because nearly all of the flood plain is within the park, restored tidal ranges and salinities should not affect adjacent properties. Nevertheless, all options for restored tidal flow require restoration of an inlet, or large culverts, through private lands and under town and state roads on the barrier beach but outside of Park boundaries. Hydrodynamic assessment is a necessary first step toward the cooperative restoration process

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Determine Source of E. coli Contamination at Central Avenue Beach, Indiana Dunes National Lakeshore	The majority of visits to Indiana Dunes National Lakeshore are associated with beach recreation. Visitors enjoy the numerous beaches spread along the Lake Michigan shoreline, with numbers of visitors reaching into the millions every summer. In recent years, Central Avenue Beach has experienced an increase in beach closures associated with elevated levels of E. coli bacteria. Park personnel seek to protect public health by preventing visitors from swimming when E. coli levels are high. The reason for the recent increase in the number of beach closures is unclear. Investigations into the sources of bacteria and the factors influencing their abundance and persistence will be conducted. These inquiries will include bacterial analysis of the beach and the tributaries to the east and west of Central Avenue Beach.

The National Park Service is conducting coastal watershed assessments of ocean park resouces like this salt marsh at Cumberland Island National Seashore, Georgia. The Park Service is developing an ocean park stewardship plan in response to the President's U.S. Ocean Action Plan.

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