

Chapter Four: Progress in Learning About National Park System Natural Resources

In the new strategic plan, the NPS will focus on implementing the measurement of park vital signs, rather than identifying them; this is a direct result of new funding under the Natural Resource Challenge.

This chapter focuses on programs whose accomplishments primarily relate to the National Park Service goal (Ib) that:

The National Park Service contributes to knowledge about natural . . . resources and associated values; management decisions about resources and visitors are based on adequate . . . scientific information.

Descriptions of the accomplishments of the four natural resource programs that received Natural Resource Challenge funding in FY 2003 and contributed to the knowledge goal (Ib) follow:

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

Additional detailed financial information about these programs is located in Chapter Five.

COOPERATIVE ECOSYSTEM STUDIES UNITS (CESUs)

Challenge Activity:

- *Establish Cooperative Ecosystem Studies Units*

Cumulative Challenge Increases:

- *\$1,993,000 (FY 2001 and FY 2003)*

Cooperative Ecosystem Studies Units (CESUs) are multi-agency partnerships with the nation's universities and other institutions, organized around biogeographic areas. Their broad scope includes the biological, physical, social, and cultural sciences needed to address natural and cultural resource and visitor management issues at multiple scales, and in an ecosystem context. A total of 120 universities, including 22 minority institutions, and 24 state, tribal, and non-governmental partners participate in the CESU Network. In FY 2003 four new CESUs were established,

bringing the total number of CESUs to 16. The seventeenth (and final) CESU is on schedule to be established in FY 2004.

Active National Park Service participation in the CESU Network is an essential component of the Challenge. Twelve CESUs now have an NPS Research Coordinator duty stationed at the respective host universities. Funding in FY 2003 resulted in NPS participation in two of the twelve CESUs—the Great Lakes-Northern Forest and Gulf Coast CESUs. National Park Service 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. In addition, through their direct connection with parks to facilitate projects, they have become instrumental in fostering cohesion and enhancing communication among park clusters and among diverse program offices.

While biological and physical science projects continue to dominate, National Park Service coordinators are working to facilitate more projects that meet cultural resources and social science needs. This is particularly significant in the Intermountain Region, where the regional office is supporting Cultural Resource Specialist positions at three CESUs. Several NPS coordinators in border areas are exploring innovative approaches to address management challenges that cross international boundaries. Others are focusing efforts on encouraging and facilitating greater multi-agency activities within the CESU Network.

CESUs play a significant role in conducting and completing the extensive NPS Inventory and Monitoring efforts underway through the Natural Resource Challenge. Connections between NPS participation in

CESUs, the NPS Inventory and Monitoring Program, and Research Learning Centers continue to create highly productive synergy among multiple components of the Challenge. Cooperative Ecosystem Studies Units contribute to the professional development of the NPS workforce through key topical workshops, the development of curricula being used in Servicewide training, and through the contributions of NPS coordinators to training courses. Opportunities for minority students and faculty at participating CESU institutions to become involved in NPS CESU projects continue to be developed, a potential step toward diversifying the NPS.

Use of the CESUs increased from a total of over 380 projects and \$15 million in FY 2002 to 540 projects and \$19 million in FY 2003. In addition to providing academic expertise for collaborative projects, CESUs provide training opportunities and serve as a valuable means to coordinate activities among agencies and academia. Appendix E provides a list of projects carried out through CESUs using Natural Resource Challenge CESU funding. Following are some examples of FY 2003 accomplishments:

- The National Park Service, U.S. Geological Survey, U.S. Fish and Wildlife Service, Army Corps of Engineers, and Pennsylvania State University are collaborating to evaluate the impacts on Potomac River ecology of sediment discharge from the Washington Aqueduct water treatment plant. One study was conducted in response to concern that flocculated aluminum might become toxic to benthic invertebrates living downstream of the discharge point, especially under conditions of anoxia within fine sediments. Researchers from the University of the District of Columbia, through the **Chesapeake Watershed CESU**, are using the Asiatic clam, *Corbicula fluminea*, as a model to study whether aluminum accumulation in estuarine biota is relative to the water treatment discharge point. Results will be used to develop management plans for facility operation to ensure safe drinking water for Washington citizens and protection of natural resources in the river.
- A report produced through the **Colorado Plateau CESU** updated outdoor recreation use values. This report presents updated values per visitor day of outdoor recreation opportunities commonly found at National Park System units, state parks, and national forests. In the report, the term “value” indicates net willingness to pay. Development of credible measures of benefits for outdoor recreation is useful in damage assessment as well as in analysis of current management and policy actions. The investigators updated previous literature reviews on outdoor recreation use valuation, and included recent analyses and estimates. They added 479 new estimates to a previous database, bringing the total to 1,239 benefits estimates obtained from 539 studies. The study provides values for 30 separate outdoor recreation activities, including additions for such values as snorkeling, scuba diving, and bird watching, among others. The average value per day for NPS recreation varies by U.S. Census region; for example, \$22.61 in the Southwestern National Park units and \$89.21 per day for the Pacific Coast states. The overall NPS average was \$43.26 per day.
- During the summer of 2003, a paleontology team excavated several marine vertebrates from the Upper Cretaceous Tropic Shale northeast of Big Water, Utah, at **Glen Canyon National Recreation Area**. The largest and most impressive fossil collected was the partial skeleton of a very large plesiosaur, a marine predator of the Cretaceous Interior Seaway that was the dominant carnivore in the shallow sea covering the North American continent 90 million years ago. This individual is considerably larger than previously collected skeletons of plesiosaurs in the area. During the excavation, Glen Canyon NRA sponsored a one-week open house where the public was invited to observe firsthand the scientific process underway. This was a **Colorado Plateau CESU** project.
- In cooperation with the U.S. Geological Survey Colorado Plateau Field Station and Northern Arizona University, the **Colorado Plateau CESU** developed a website to provide information and tools for invasive plant management in the Southwest (<http://usgs.nau.edu/SWEPIC>).

A high school volunteer eradicates Scotch thistle at Zion National Park. The park has expanded its exotic plant management efforts using volunteers funded by the Natural Resource Challenge. NPS PHOTO



This project was partially funded by Recreational Fee Demonstration funds. The site joins the Southwest Exotic Mapping Program and the Alien Plant Ranking System (APRS) with numerous other direct links to information on invasive plants. Alien Plant Ranking System scores for more than 300 exotic plants in the Southwest are now available. It is hoped that the site will be an essential tool for land managers in Southwest parks and serve as a prototype for regional websites across the country.

- The **Rocky Mountains CESU** joined the Rocky Mountain “wolverine parks” managers with researchers from the U.S. Forest Service and Wildlife Conservation Society to discuss strategies for a landscape-level analysis of wolverine populations in the northern Rockies. Many NPS partners, including the NPS Fire Ecology Program in Boise, Idaho, used the University of Wyoming biostatistician resources for training and education.
- The **Colorado Plateau CESU** developed a prototype course in Integrated Fire and Resource Management Planning in cooperation with NPS Biological Resource Management, Cultural Resources, Training and Development, National Interagency Fire Center, and Northern Arizona University. The course brings to-

gether natural and cultural resource managers from national parks, or groups of parks, with fire managers to encourage integrated fire management planning. The course is designed to contain core sections that do not change with each course offering. As the course is taught throughout the country, the fire ecology and management sections are tailored to the geographic area in which they are offered, using local scientific experts as instructors. The one-week prototype course was presented at the Horace M. Albright Training Center April 28 to May 2. The National Park Service National Fire Program Center will be offering the newly developed course on four to five occasions throughout the country in 2004.

- A project was implemented marking selected ginseng plants at **Shenandoah National Park, Blue Ridge Parkway, and Great Smoky Mountains National Park** with different dyes to determine the uptake and retention of the dye markers in the plants. The intent was to find a dye that persists in suitable amounts in the plants so that identification of poached specimens can be definitive and defensible. Wild ginseng plants are being illegally removed from NPS units in the Appalachian chain to be sold in national and international markets. Identifying poached ginseng once it is removed from

park boundaries is almost impossible and can easily be legally challenged. This project was conducted through the Southern Appalachian Mountains CESU and demonstrated the role of CESUs in assisting law enforcement in the NPS.

INVENTORY AND MONITORING PROGRAM

Challenge Activities:

- *Complete basic inventories, except vegetation mapping*
- *Vegetation mapping cost-share with USGS*
- *Monitor vital signs in networks of parks*
- *FY 2003 Allocation: \$32,385,000*

The Natural Resource Challenge assesses ecosystem health through inventorying and monitoring park vital signs with the help of cutting-edge science. Establishing baseline inventories provides park managers with critical and necessary information that they use when making decisions about the management of their park resources. To coordinate these activities, the National Park Service has organized 270 natural resource parks (see Appendix F) into a system of 32 networks. Parks within the networks are expected to coordinate fieldwork, share staff and equipment, implement smart business practices jointly, and develop resource trend data indicative of the network at large. By doing this, duplication of effort and costs should be reduced, and the integrity of science programs should improve.

Each of the parks involved is to obtain 12 basic inventory products. The 32 networks are charged with developing individually tailored monitoring programs for their parks. These programs are complex and address wildlife, plant life, water and air quality, and landscape ecosystem components. The Park Vital Signs Monitoring component of the Inventory and Monitoring Program is being approached incrementally. Emphasis has been placed on building on the experience gained from early efforts to improve subsequent activities.

This program was designed as a foundational component of the Natural Resource Challenge and reflects the goals of the National Park Service Strategic Plan. The National Park Service target for its inventory goal in FY 2003 was completion of 1,498 (54 percent) of the 2,767 outstanding data sets. The National Park Service met and slightly exceeded this goal by completing an additional 152 data sets in FY 2003, bringing the total to 1,507 (54 percent) of the outstanding data sets. The National Park Service goal for park vital signs was that, by September 30, 2003, 40 percent (108) of 270 parks with significant natural resources would have identified their vital signs for natural resource monitoring. As a direct result of the strategy of organizing parks into 32 vital signs monitoring networks, the goal was exceeded. By the end of FY 2003, 118 parks (43 percent) had identified their vital signs, compared to the annual goal of 108 parks. In the new strategic plan, the NPS will focus

Twelve Basic Natural Resource Inventories

BASIC DATA SETS	UNDERWAY	COMPLETED THROUGH FY 2003
1. Natural Resource Bibliography	0	270
2. Species List	0	270
3. Vegetation Map	45	36
4. Base Cartography Data	1	269
5. Species Occurrence and Distribution	270	0
6. Soils Map	31	58
7. Geology Map	227	17
8. Baseline Water Quality Data	0	270
9. Water Body Location and Classification	0	270
10. Air Quality Data	20	250
11. Air Quality Related Values	270	0
12. Meteorological Data	0	270
TOTALS	864	1980

Note: All numbers represent status as of the end of FY 2003. See Appendix A for a complete list of the status of all basic inventories for the 270 natural resource parks. The National Park Service is working toward implementation of monitoring programs in those 270 natural resource parks.

on implementing the measurement of park vital signs, rather than identifying them; this is a direct result of new funding under the Natural Resource Challenge.

Financial details about the program are included in Chapter Five.

Inventories

Beginning in FY 2000, the Natural Resource Challenge provided substantial increases for inventories, allowing the National Park Service to significantly accelerate providing a core set of 12 basic inventories to all parks with natural resources. As of FY 2003 seven data sets are essentially completed, and the balance are underway. The status of these inventories is shown in the accompanying table.

All networks received significant funding in FY 2003 for completing species occurrence and distribution inventories, or biotic inventories. This funding has allowed parks to obtain the most basic biotic inventory information, primarily for vascular plants and vertebrate animals. Many of the most exciting inventory results are from these efforts and are highlighted in this section.

Vegetation information is a high-priority inventory need for most parks and is arguably the most important piece of information needed for park resource management and protection. Such information is 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. By combining FY 2003 Natural Resource Challenge funding with other funding provided by the U.S. Geological Survey and National Park Service Fire Program, the NPS was able to complete 12 additional vegetation mapping projects (30 total complete), continue 53 ongoing projects, and initiate 26 new park mapping projects. Some vegetation mapping highlights are included in this section.

The Alaska Landcover Mapping Program is separate from the vegetation mapping effort for other parks; the scale of parks there dictates different mapping approaches. The National Park Service has also partnered with a variety of entities to conduct cooperative projects in Alaska, including the U.S. Geological Survey-EROS Field Office, Ducks Unlimited, National Wetlands Inventory, and the University of Alaska. By the end of FY 2003, land cover maps had been completed for six Alaskan park units; field data viewers had been completed for seven park units; and user's guides were completed for six park units. Each of these products is also under development in a number of other Alaska park units. Mapping efforts are expected either to be completed or initiated in all of the Alaskan

Inventory Status and Projected Completion Schedule

	END OF FY 2003		END OF FY 2004	END OF FY 2005	FY 2006-10*
	UNDERWAY	COMPLETED	COMPLETED	COMPLETED	TO BE COMPLETED
BASIC DATA SETS					
1. Natural Resource Bibliography	0	270	270	270	0
2. Species List	0	270	270	270	0
3. Vegetation Map	45	36	52	70	200
4. Base Cartography Data	1	269	270	270	0
5. Species Occurrence and Distribution	270	0	230	270	0
6. Soils Map	31	58	70	95	175
7. Geology Map	227	17	38	70	200
8. Baseline Water Quality Data	0	270	270	270	0
9. Water Body Location and Classification	0	270	270	270	0
10. Air Quality Data	20	250	270	270	0
11. Air Quality Related Values	270	0	50	100	170
12. Meteorological Data	0	270	270	270	0

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

Natural Resource Challenge funding supported a survey in Mount Rainier National Park that revealed the presence of a second park population of the extremely rare fungus, *Bridgeoporus nobilissimus*.

NPS PHOTO



parks by FY 2004. Other inventories that received substantial efforts in FY 2003 included soils mapping that is ongoing in 11 parks and groups of parks, mostly in cooperation with the Natural Resource Conservation Service, and geologic inventories, which are being undertaken in 33 parks.

Highlights of inventory results in FY 2003 include the following:

- An agreement in 2003 with the Seattle City Light Wildlife group added \$19,500 to the **North Cascades National Park Forest Carnivore Inventory**, greatly supplementing the NPS Inventory funding for this project. Biologists conducted the first year of a two-year forest carnivore inventory, documenting carnivores in photographs by placing cameras (38 stations). Fifteen species were documented in 974 animal photographs; the most common of which were marten and spotted skunk. Other species documented included black bear, cougar, coyote, bobcat, and short-tailed weasel. Though not targeted in this effort, northern flying squirrel was one of the more notable species “captured” on film in this productive, but non-invasive inventory project.
- Rare plant surveys at **Mount Rainier National Park** led to the serendipitous discovery of a second park population of extremely rare fungus, *Bridgeoporus nobilissimus*. The worldwide distribution of this very large mushroom, which grows on old-growth fir trees, is limited to 10 known locations in the Pacific Northwest. The new population is located in designated wilderness and appears to be stable, which is important because the other park population is located on a steep slope below a roadway that continues to slough. The newly discovered site is located in a more secure, stable environment. This is an outstanding example of unexpected benefits from NPS inventories; this discovery of an extremely rare fungus was made during surveys looking for an entirely different biological kingdom.
- The presence of a “mesic bur oak forest” was documented at **Homestead National Monument in Nebraska**. According to local experts, it is one of relatively few mesic bur oak forests in good condition in the entire state. This plant community has been identified as critically imperiled in Nebraska and is on The Nature Conservancy’s watch list.
- The Ozark hellbender was documented at six new locations within the **Ozark National Scenic Riverway** during a recent survey. The Ozark hellbender (*Cryptobranchus alleganiensis bishopi*), an

exclusively aquatic giant salamander, was recently listed as a new federal candidate endangered species under the Endangered Species Act.

- The vegetation/fuels mapping effort at **Santa Monica Mountains National Recreation Area** will provide information for park fire management while following NPS national standards and guidelines. Work began in early FY 2002, and the final digital map should be completed by the end of FY 2004. The project is a cooperative effort between the NPS, the California Department of Fish and Game, and several private contractors. Aerial Information Systems (AIS) is completing aerial photo interpretation and map automation. Detailed field-based data are being collected by park staff for the vegetation classification and accuracy assessment. A preliminary classification map was developed during FY 2003. Work will conclude in FY 2004 with a formal accuracy assessment and development of final products.
- At **Bandelier National Monument**, biologists found evidence for the occurrence of up to 37 new small mammal species for which previous documentation was poor or lacking. Because of their precarious isolation from other populations and their limited habitat in the higher elevations of Bandelier National Monument, populations at the park may serve as important indicators of the health of these montane ecosystems in the future. Many of the new species documented represent important records for mammals in New Mexico, including the rock pocket mouse, American pika, mountain cottontail, yellow-bellied marmot, bushy-tailed woodrat, and southern red-backed vole.
- The **Great Lakes Inventory and Monitoring Network** initiated a partnership with Michigan State University to build a “Natural Resources Information Gateway.” The Gateway will be an Internet-based system that will allow National Park Service staff, partners, and the public to search and download natural resource inventory and monitoring information using spatial and tabular queries. The site will contain data on climate, air and water quality, land use change, and human population growth in and around the parks. These regionally important data will be “harvested” from various state and federal agencies. The objective is to bring important data together in a one-stop website for managers of national parks and their partner agencies and researchers. The site will include a public interface that will allow access to nonsensitive natural resource information.
- Observers conducting bird inventories noted a spectacular richness and abundance of bird species in the riparian forest of **Knife River Indian Villages National Historic Site**. They commented that the rich diversity of birds was due to a thick forest with an abundant vertical structure and dead woody debris—habitat features that would be affected by forest thinning. While documenting the presence, abundance, and/or distribution of species occurring in the parks, information on habitat use such as this is also sometimes collected and forwarded to park management. The researchers also observed bird species that likely existed in park units because of fire, such as mountain and eastern bluebirds at **Jewel Cave National Monument**. In burn areas in Jewel Cave National Monument, the black-backed woodpecker counts were twice as high as in any other transect in a burn area outside the park (i.e., on national forest lands). This is probably because of the mature forest that existed in the park before the fire and the absence of salvage logging after the fire.
- Avian and mammalian inventories at two small cultural parks, **Fort Necessity National Battlefield** and **Friendship Hill National Historic Site** in western Pennsylvania, illustrate the importance of protected areas for species of concern. Dr. Rich Yahner, Brad Ross, and other Penn State investigators surveyed bird populations, documenting 127 and 138 bird species at Fort Necessity NB and Friendship Hill NHS, respectively. A total of 27 bird species were of special concern, including five state vulnerable species, two state threatened species, and one federally threatened species.

- Inventories at **Padre Island National Seashore** documented 22 reptile and amphibian species. The survey also identified a frog possibly new to science, according to the investigator, Dr. Mike Duran. The detection of a previously unrecorded species of toad (Woodhouse's toad, *Bufo woodhousii*) in the park is notable. The barrier and consequent genetic isolation imposed by Laguna Madre may have resulted in the toad's distinctive characteristics. Another discovery at Padre Island National Seashore was the Texas scarlet snake (*Cemophora coccinea lineri*), a state endangered species; there are only four specimens of this species in existence.
- The Soil Resource Inventory for **Grand Canyon National Park** was completed in FY 2003. Products included a detailed soil survey report, a set of digital map finished soil survey quad sheets, as well as a soils geospatial database and metadata file which meet National Cooperative Soil Survey Standards. A meeting was conducted with park staff where researchers explained how the soil resource inventory was performed, its limitations for use, and how the geospatial data can be used in a Geographic Information System (GIS). Participants indicated that the park hopes to use the Soil Resources Inventory as a tool to help stratify the park into various ecological zones to address several current and future resource management issues. One result would be a better understanding of the distribution of several threatened and endangered plant species, and the relationship of endemic plant species to various soil and site properties.
- A Coastal Mapping Protocols Workshop at **Canaveral National Seashore** addressed coastal park mapping needs and coastal management issues related to low relief and barrier island coastal systems. Workshop participants identified coastal landform and bathymetric features that should be incorporated into coastal geology mapping products.
- With the increased funding available in 2003, coastal park mapping projects were initiated or continued for seven parks. Leveraging funds with the **U.S. Geologi-**

cal Survey Western Division of Coastal and Marine Geology has made possible the mapping of submerged resources of the three west coast parks on Hawaii and the integration of these maps with on-shore mapping awaiting digitization.

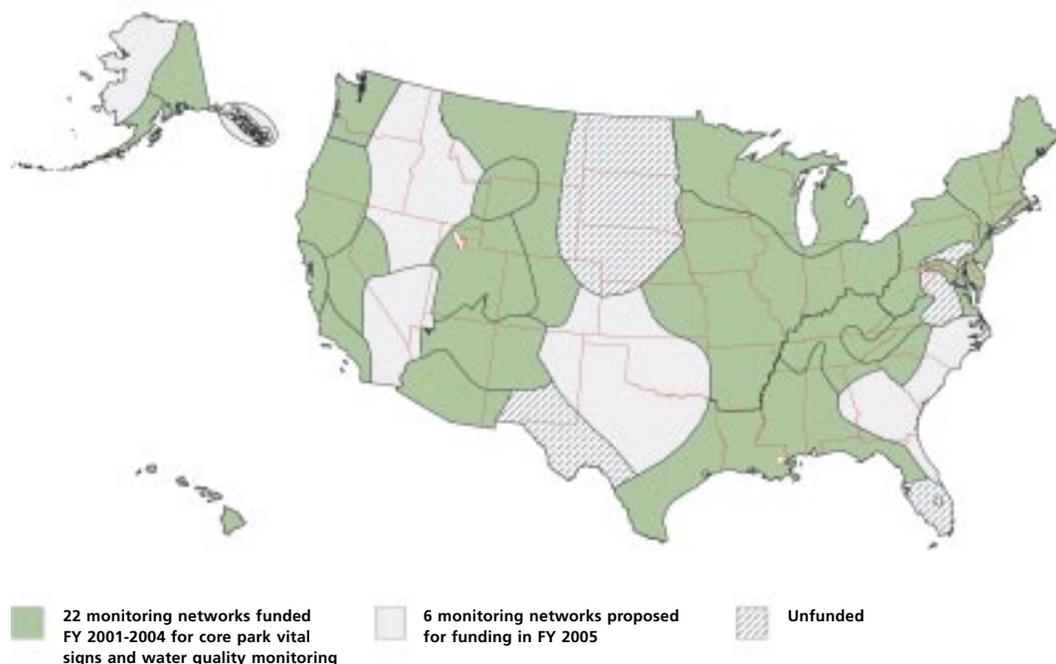
Monitoring

Five additional networks were funded for park vital signs monitoring in FY 2003, bringing the total funded to 17 networks encompassing 153 parks. The 17 networks are involved in a three-phase planning process that is designed to build upon existing information about park ecosystems and maximize the use and relevance of monitoring results for management decision-making, research, and education. Each phase of the design work undergoes peer review and refinement before approval is granted for implementation.

The first twelve networks funded for vital signs monitoring completed Phase Two of their planning and design. This was preceded by the Phase One tasks of compiling and synthesizing existing information, developing conceptual models of ecosystem functioning, and evaluating whether current monitoring efforts that may be ongoing in some parks in each network should be continued and/or expanded as part of the network monitoring program. The networks also identified partnership opportunities with other agencies and academia, and other means of leveraging the monitoring funding. Drawing on this information and understanding, and bringing in experts through scoping meetings and other processes, each network then used a well-documented decision-making process to identify and prioritize park vital signs for monitoring.

Because of funding restrictions, only the highest priority vital signs can be monitored with Natural Resource Challenge funding. However, parks have augmented Challenge funds with personnel and funding from other sources and have established partnerships with numerous agencies and universities. It is often possible to monitor several vital signs and parameters together. For example, a field crew may visit a stream segment and make numerous measurements on the physical and chemical parameters of the water (e.g., channel width, flow rate, pH, dissolved oxygen), as well as measures

National Park Service Vital Signs Monitoring Networks Status, FY 2004



ORDER FUNDED	NETWORK	CODE	NUMBER OF PARKS	REGION
1	North Coast and Cascades Network	NCCN	7	Pacific West
2	Northeast Coastal and Barrier Network	NCBN	8	Northeast
3	Heartland Network	HTLN	15	Midwest
4	Sonoran Desert Network	SODN	11	Intermountain
5	Cumberland/Piedmont Network	CUPN	14	Southeast
6	Central Alaska Network	CAKN	3	Alaska
7	National Capital Region Network	NCRN	11	National Capital
8	Northern Colorado Plateau Network	NCPN	16	Intermountain
9	San Francisco Bay Area Network	SFAN	6	Pacific West
10	Greater Yellowstone Network	GRYN	3	Intermountain
11	Appalachian Highlands Network	APHN	4	Southeast
12	Mediterranean Coast Network	MEDN	3	Pacific West
13	Southwest Alaska Network	SWAN	5	Alaska
14	Northeast Temperate Network	NETN	10	Northeast
15	Southern Colorado Plateau Network	SCPN	19	Intermountain
16	Pacific Island Network	PACN	9	Pacific West
17	Great Lakes Network	GLKN	9	Midwest
18	Gulf Coast Network	GULN	8	Southeast
19	Rocky Mountain Network	ROMN	6	Intermountain
20	Sierra Nevada Network	SIEN	3	Pacific West
21	Eastern Rivers and Mountains Network	ERMN	9	Northeast
22	Klamath Network	KLMN	6	Pacific West
23	Arctic Network	ARCN	5	Alaska
24	Southeast Coast Network	SECN	17	Southeast
25	Upper Columbia Basin Network	UCBN	8	Pacific West
26	Southern Plains Network	SOPN	10	Intermountain
27	Mojave Desert Network	MOJN	6	Pacific West
28	Southeast Alaska Network	SEAN	3	Alaska
29	South Florida/Caribbean Network	SFCN	6	Southeast
30	Mid-Atlantic Network	MIDN	11	Northeast
31	Chihuahuan Desert Network	CHDN	6	Intermountain
32	Northern Great Plains Network	NGPN	13	Midwest

of aquatic macroinvertebrate and fish communities (e.g., species occurrence, relative abundance), using funding from both the core vital signs and water quality monitoring components of the Natural Resource Challenge.

The list of vital signs that will be implemented with Natural Resource Challenge funding by the first 12 networks will not be finalized until completion in 2004 of the protocol design phase and negotiations with partners on options for implementation. To understand the vital signs most likely to be monitored, each of the 12 networks was asked to provide a preliminary list of their parks' three or four highest-priority vital signs. Listed in the accompanying table are some of the most common park vital signs and the number of parks in the first 12 networks that identified them as a top priority.

The following provides the rationale for some specific network selections of vital signs, including those in the accompanying table, and gives an example of a network that listed each vital sign as a top priority.

- **Exotic/Invasive Plant Species Occurrence** – Invasive plant species easily take

over sections of ecosystems, choking out native species and consuming valuable resources. Exotic species can greatly alter ecological processes such as energy flow, nutrient cycling, and succession (e.g., tree mortality because of introduced forest pests). A significant amount of money is spent each year to combat exotics and restore affected habitat. Monitoring exotic species occurrence in a scientifically robust manner could greatly improve efficiency of removal and restoration efforts. (*Greater Yellowstone Network*)

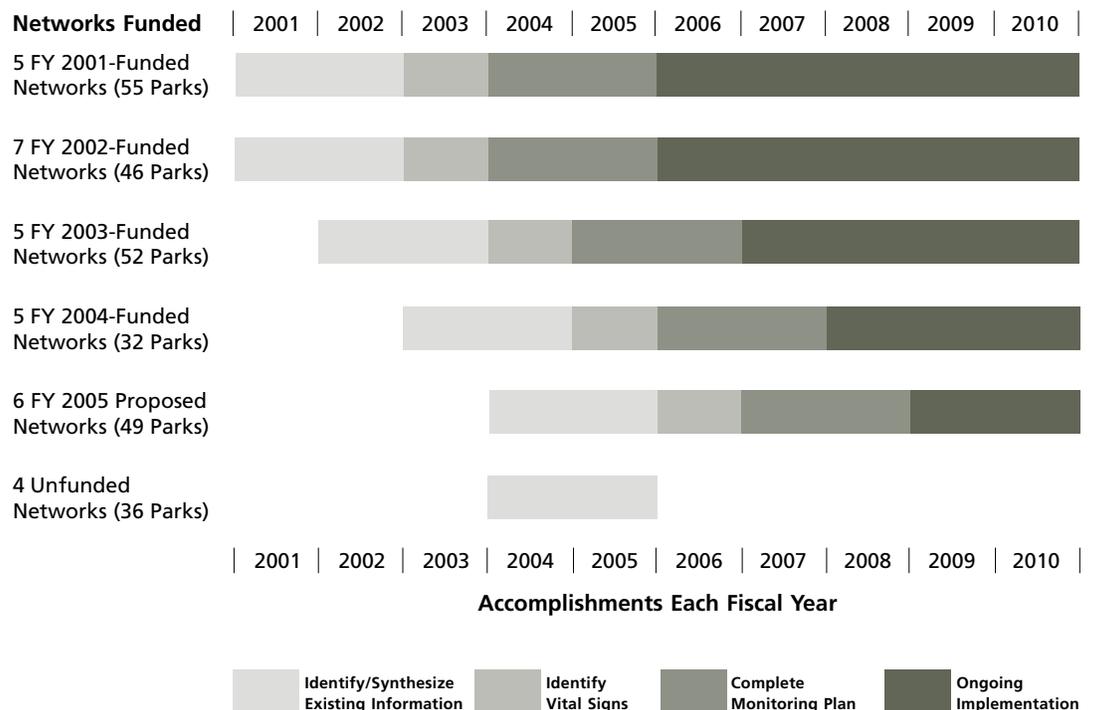
- **Changes in Adjacent Land Use/Land Cover** – Changes in adjacent land cover/land use directly influence park ecosystems in many important areas such as habitat loss, fragmentation, altered nutrient cycles, pollution, invasive species, and hydrologic impacts. Several parks are surrounded completely by urban development, while others exist in rural settings that are rapidly changing. Combining the monitoring of this attribute with key attributes for air quality, water quality, and vegetational changes will provide park managers with early warning for future impacts on park ecosystems. (*Cumberland Piedmont Network*)

Preliminary List of Priority Vital Signs to be Monitored

VITAL SIGN	EXAMPLE MEASURES (VARIES BY NETWORK)	NUMBER OF PARKS
Exotic/Invasive Plants	Distribution, occurrence (presence/absence), area covered by specific species of exotic/invasive plants	79
Land Use/Land Cover Change	Area covered by each land use type; patch size; distance between patches (largely derived from aerial and satellite imagery)	67
Vegetation Community Structure/Composition	Species richness and abundance; percent cover by species; age and size distributions; recruitment (focus on key species and communities)	59
Aquatic Macroinvertebrate Composition Abundance	Species and family richness; abundance of macroinvertebrate indicator species; ratios of observed:expected species	35
Soil Structure and Stability	Presence/absence of erosional features (rills, pedestaled plants, gullies); cover and development of biological soil crust; area of uplands with various soil cover types; patterns of channel aggradation/degradation; channel volume, bedload	20
Fish Community Dynamics	Distribution and abundance of native and exotic species; sex and age structure	15
Land Bird Distribution and Abundance	Distribution and abundance of native and exotic species; age structure	15

- Vegetation Community Structure/Composition** – The herbaceous forest understory provides information regarding important issues of interest to managers (changes in canopy density, deer browse) in addition to reflecting the underlying ecological processes of competition, emigration and immigration, and nutrient cycling. Changes in the tree community may reflect successional trends resulting from management practices or the disruption of historic ecological regimes. (*Heartland Network*)
- Aquatic Macroinvertebrate Composition and Abundance** – Macroinvertebrates are sensitive to changes in the chemical and physical properties of their environment, and certain species require very particular habitat conditions to survive. Data for macroinvertebrates have been used to assess water quality impairment for decades, and are now being used by almost every state agency and numerous county programs across the country for monitoring the biological integrity of our nation’s waters. (*Central Alaska Network*)
- Soil Structure and Stability** – Soil structure and stability (particularly in arid parks) provides a measure of the resilience of a system to recover from disturbance and its resistance to being substantially affected by disturbances. Accelerated soil erosion in uplands is a predictable response to stressors and disturbances such as altered fire regimes, overgrazing by livestock on adjacent lands, and the creation of unauthorized social trails. Soil loss in upland portions of watersheds can result in extreme sedimentation and scour events along streams and other critical surface water sources, and diminished soil productivity can directly impact vegetation and indirectly affect wildlife. (*Northern Colorado Plateau Network*)
- Fish Community Dynamics** – Lake ecosystem processes are greatly affected by the presence and composition of fish communities. In the North Coast and Cascades Network, the status of rare and endemic species are of high concern, as is the effect of exotic species introduction on native fish communities and lake food web structure. In many lakes, native species are subject to recreational harvest. Overharvest can have profound effects on lake food web structure. (*North Coast and Cascades Network*)

National Park Service Vital Signs Monitoring Networks Funding and Accomplishments



- **Land Bird Distribution and Abundance** – The Sonoran Desert lies along a major flyway for migratory birds in North America, and many Sonoran Desert parks contain rare and regionally diminishing habitat (e.g., lowland riparian vegetation) for both migrant and resident land birds. Compared with many other vertebrate taxa, the science of land bird monitoring is well developed, and the community dynamics of land birds provides a useful indicator of overall ecosystem patterns and processes. Simultaneous monitoring of land bird communities and vegetation communities will provide complementary perspectives on ecosystem condition and management effectiveness. (*Sonoran Desert Network*)
- **Glaciers** – In addition to their importance to hydrology, aquatic ecosystems, and vegetation, glaciers are valuable indicators of climatic variability. Annual variations in temperature and precipitation make identification of meaningful changes in climate difficult—glaciers integrate these variations, while they respond continually to temperature and precipitation changes. The climatic change of the late 1940s, which subsequently was found to have caused the advance of glaciers in many parts of the world, was apparently first detected in 1946 and 1947 in the Nisqually Glacier on Mount Rainier. Thus, glacier monitoring is important globally, as well as locally. (*North Coast and Cascades Network*)
- **Shoreline Change** – Monitoring natural shoreline dynamics and retreat of the land in the face of rising sea level is basic to understanding the driving forces behind many Northeast Coastal and Barrier Network park ecosystems. The loss of valuable cultural/historic sites and natural resources (e.g., endangered plover and tern breeding habitat) is of paramount concern to park managers. Understanding shoreline dynamics will assist with these management decisions in the future. For ocean parks such as Cape Cod National Seashore and Assateague Island National Seashore, horizontal position of the shoreline is one of the simplest and most effective means of monitoring shoreline change. (*Northeast Coastal and Barrier Network*)

Highlights of results of ongoing monitoring and planning for monitoring in the first twelve networks include the following:

- A climate/weather workshop was held at the **National Oceanic and Atmospheric Administration (NOAA)** Sandpoint facility in Seattle to (1) integrate and cost-share NPS monitoring with other programs; (2) devise means to economically monitor weather and track climate change for understanding linkages to terrestrial and aquatic systems; and (3) recommend monitoring locations, types of equipment, and appropriate models for extrapolating monitored data. Scientists from NOAA, state and local air regulatory agencies, the National Park Service, regional energy agencies, Natural Resources Conservation Service (NRCS), Washington Department of Transportation, and local universities attended.
- Connections with communities were strengthened at **Olympic National Park** as the park developed its water quality monitoring design. The marine water quality samples required to develop a marine water quality monitoring protocol must be collected in the nearshore environment. “Surfrider” volunteers, members of a nonprofit organization dedicated to protecting oceans, waves, and beaches, collected these water samples in 2003. Their work will continue next year, and the results will help determine how Olympic National Park will monitor ocean water quality on its shores.
- Protocol development for monitoring seagrasses in the **Northeast Coastal and Barrier Network** provided an opportunity for multi-party collaboration. Lead scientists from the U.S. Geological Survey Patuxent Wildlife Research Center invited scientists from Cape Cod National Seashore, NOAA Waquoit Bay National Estuarine Research Reserve, and Massachusetts Department of Environmental Protection to participate in training using **SeagrassNet** protocols. SeagrassNet is a global monitoring project with stations throughout the world oceans. Cofounder Dr. Frederick Short, from the University of New Hampshire, provided on-site training in

SeagrassNet methods. Also assisting with the work was a group of regional high school students participating in a summer science enrichment program under the supervision of a **Cape Cod National Seashore** Student Conservation Association intern.

- In the winter of FY 2003, the **Sonoran Desert Network** joined with the Sonoran Institute, the U.S. Geological Survey-Sonoran Desert Field Station, and the University of Arizona as the lead partners in a regional monitoring framework for the Sonoran Desert Ecoregion. Such cooperation has begun just as Pima County, Arizona (which contains **Organ Pipe Cactus National Monument** and **Saguaro National Park**, the largest parks in the network), is developing an ecological monitoring plan, and the Bureau of Land Management, the U.S. Forest Service, and Mexican agencies are increasingly mandated to conduct sustained, consistent ecological monitoring. These and other entities in the Sonoran region have been very responsive to the network monitoring approach. As network parks comprise less than one percent of the Sonoran Desert, and many of the network resource management issues and threats come from outside park boundaries, a cooperative, regional monitoring approach can provide obvious benefits to network parks. As such, the potential regional and collaborative approaches to monitoring have been considered explicitly during monitoring plan development.
- Results of analyzing five years of bird monitoring data from **Tumacacori National Historical Park**, **Coronado National Memorial**, **Chiricahua National Monument**, **Organ Pipe Cactus National Monument**, **Fort Bowie National Historic Site**, and two nearby preserves in Mexico provided important lessons for future monitoring in the **Sonoran Desert Network**. The data were collected as a part of the national Monitoring Avian Productivity and Survivorship (MAPS) program, but had not been analyzed. Results of the analysis indicated that sample size limitations prevented meaningful trend information for these parks. Another type of monitoring that could be obtained more easily and more economically appears more reliable—relative abundance estimates developed using distance sampling. Results were distributed to network parks and presented at a network meeting. This inexpensive project demonstrated the value and importance of periodic data analysis and careful examination of natural and sampling variance for designing ecological monitoring.
- One of the most feasible and practical ways to monitor long-term changes in permafrost has been identified by the **Central Alaska Network**—the interpretation of aerial photography or other imagery. To explore this option further, a request for proposals has been announced that will evaluate the effectiveness of this method in other settings and delineate limitations and important components of using this technique. One site in each of the network parks will be interpreted as an example of this technique.
- The Kennecott and Nebesna Glaciers in **Wrangell-St. Elias National Park and Preserve** have been identified as suitable for employing the index method of glacier monitoring that was developed by the Denali prototype monitoring program. Site visits were conducted, and descriptions of identified sites will be presented during 2004 to a group of experts. This will establish the groundwork for continued scoping of glacier monitoring ideas during FY 2004.
- Although the 2002-2003 winter was the lowest snowfall winter on record, the overwinter mortality of caribou cows in the **Denali** herd was the highest recorded (19 percent) during this 17-year study. When added to observed summer mortality, an estimated 23 percent of the cows were lost in the last year. The high losses could be attributed to the age structure in the herd, which was biased strongly to older females. A population of approximately 1,130 cows is estimated for September 2003 (15 percent less than September 2002, corroborating the estimate of 16 percent from above). Further estimation of bulls and calves indicates a total herd size of approximately 1,600 caribou. In addition, the fall density of wolves and their mean litter size indicate

some of the lowest measurements ever made for this population. Data indicate a food-stressed wolf population in general; low overall population size, low mean pack size, low pup survival, wolves killing each other, and low capture weights in March. Additionally, two of eight wolves captured in March were in poor physical condition.

Reports identifying the most important vital signs for monitoring are being reviewed for approval. After approval, the vital signs for all 12 networks will be compiled and summarized.

NATURAL RESOURCE DATA AND INFORMATION PROGRAM

Challenge Activity:

- *Make natural resource data useable for management decisions and the public*
- *FY 2003 Allocation: \$1,542*

The Natural Resource Challenge has provided two-thirds of the funding support (above support from the Inventory and Monitoring Program) for the Natural Resource Information Division. This infusion of funds has provided the means to enhance and accelerate the capabilities of the National Park Service to develop information technology (IT) solutions for sharing data and information with others. The capstone of this effort has been the ability to recruit highly competent information technology staff and cooperators as IT system project leaders and application developers. The Division coordinates and maintains various hardware and database systems for all of the natural resource programs, including its web presence. A significant effort was made in FY 2003 to improve the public website, NatureNet, which was completed and introduced in early FY 2004.

The Division maintained and continued refining the NPS Research Permit and Reporting System through ongoing outsourced software design and system support. In FY 2003 the system was used to process and track more than 7,500 electronic records, including applications, permits, and accomplishment reports. Specific software refinements included preparing version 2.0, including an innovative online tutorial-style interface, and an

assortment of functions improving the system confirmation and other auto-messaging capabilities. These refinements resulted in more efficient communication between the NPS and the community of scientific researchers.

The Natural Resource Information Division continued to provide park staff with a software application to help them organize, access, and synthesize data and information pertaining to resource stewardship. Through ongoing university partnerships, park-based data previously available only in hard-copy media was transferred into electronic (digitized) files. Data within a framework of interactive software supporting the "Views of the National Parks Program" were expanded and refined to provide the public with greater knowledge of coastal geology, glaciers, invasive species, and volcanism.

The program implemented several public information efforts in FY 2003. A cooperative venture with the EarthCare radio series was initiated to provide 90-second radio programs on natural resource topics via National Public Radio stations nationwide in 2004. Also developed was an informal partnership with the National Science Teachers Association (NSTA). The first in a planned sequence of two-day National Park Service "tag-on" training sessions was presented in advance of the association's annual meeting, which focused on communicating natural resource stories and issues. In FY 2003 this training focused on NPS geology. As another part of its public outreach effort, the program developed a Research Learning Center website for presenting information to the public about research activities in parks and to help the Research Learning Centers share information among themselves. Additional efforts were made to increase the use of the Internet and other means to make distribution of natural resource publications more efficient.

Update of the Natural Resource Management Assessment Program (NR-MAP) database was completed in FY 2003. This database captures natural resource and natural resource management workload information about parks and helps compare park needs. The NR-MAP database was effectively converted from DBaseIV to MS-Access. The previous client-based NR-

MAP software was successfully migrated to a web-based solution enabling rapid access to core data attributes, including park-specific attributes and National Park Servicewide compilations.

RESEARCH LEARNING CENTERS

Challenge Activity:

- *Establish Learning Centers*

Cumulative Challenge Increases:

- *\$2,698,000 (FY 2001 and FY 2003)*

Thirteen National Park Service Research Learning Centers (RLC) offer infrastructure and other incentives to researchers such as lab space, low-cost housing, access to computer information systems, extensive natural and cultural resource data sets, suggestions for preferred research topics or subject area emphasis, and in some cases, matching funds. With one exception, these RLCs were funded through the Natural Resource Challenge. In addition, RLC education staff members enhance the making of data more useable by identifying expanded methods to access the data, such as through the Internet, through libraries, scheduled public research seminars, or programs with gateway communities. Furthermore, partners are associated with each center in order to help maximize programmatic and financial resources. This ensures that parks and staff possess the current scientific information required to make sound management decisions and maintain an ability to communicate about science in the parks in a relevant way both to community members and area students. An Internet RLC clearinghouse has been developed to provide best practices and RLC case study examples.

Some highlights from FY 2003 follow.

- Through partnerships and consistent communication, the **Pacific Coast Science and Learning Center (PCSLC)** successfully leveraged \$280,000 to conduct high-priority research in **Point Reyes National Seashore** and surrounding community areas. Research outcomes include discovery of an invasive sea squirt that can harm oyster farming and the ecology of the bay. This early detection may allow more effective removal or mitigation. Secondly, subtidal mapping and marine protected area (MPA) modeling will aid with potential MPA plans for the state of California.
- The **Appalachian Highlands Science Learning Center (AHSLC)**, with the help of the Friends of **Great Smoky Mountains National Park**, received a three-year grant (\$165,100) from the Burroughs Wellcome Fund of Research Triangle Park, North Carolina. This grant has allowed the learning center to expand its staff in the summer months with a biological technician, a college intern biological science aid, and 12 high school intern biological science aids (from four local counties). Student intern work in 2003 resulted in the identification of 18 new park-record beetles, five new park-record moths, and more than one dozen new park gall-making flies.
- The director of the **Ocean Alaska Science and Learning Center (OASLC)** holds a faculty position in marine biology through the School of Fisheries and Ocean Sciences, University of Alaska,

National Park Service Research Learning Centers

1. Appalachian Highlands Science Learning Center, Great Smoky Mountains National Park
 2. Atlantic Learning Center, Cape Cod National Seashore
 3. Continental Divide Research Learning Center, Rocky Mountain National Park
 4. Crown of the Continent Research Learning Center, Glacier National Park
 5. Great Lakes Research and Education Center, Indiana Dunes National Lakeshore
 6. Jamaica Bay Institute, Gateway National Recreation Area
 7. North Coast and Cascades Learning Network, Seattle, Washington
 8. Ocean Alaska Science and Learning Center, Kenai Fjords National Park
 9. Old-Growth Bottomland Forest Research and Education Center, Congaree Swamp Nat'l. Monument
 10. Pacific Coast Science and Learning Center, Point Reyes National Seashore
 11. Schoodic Education and Research Center, Acadia National Park
 12. Southern California Coast Research Learning Center, Santa Monica Mountains Nat'l. Recreation Area
 13. Urban Ecology Research and Learning Alliance, Washington, DC
-



A forestry intern with the Casey Tree Foundation (left) uses a laser range finder to measure the height of the oldest and largest trees at the Reflecting Pool on the National Mall as an intern from the University of Maryland (right) provides GPS information for each tree measured.

NPS PHOTO

Fairbanks. This connection strengthens communication between the NPS and the University, resulting in innovative research and partnerships. Since its inception in 2001, the OASLC has funded (through formal requests for proposals) more than \$850,000.00 in coastal and marine research and public education programs.

- A blue-ribbon panel prepared a report on the loss of salt marsh in **Jamaica Bay Wildlife Refuge** within **Gateway National Recreation Area** in New York. In an attempt to reverse the trend, the Jamaica Bay Institute has increased NPS staff awareness about the issues through brown bag lunches and has effectively communicated to gateway communities and implemented a successful beach clean-up program that targets angler's monofilament.
- **The Urban Ecology Research Learning Alliance (UERLA)** has begun an All Taxa Biodiversity Inventory (ATBI) on arthropod species known to be in or from

Rock Creek Park and is sponsoring a study that is assessing visitor harvesting of wild morel mushrooms in **Chesapeake and Ohio Canal National Historical Park** and **Catoctin Mountain Park**.

- **The Great Lakes Research and Education Center (GLREC)** sponsored a Purple Loosestrife Workshop for resource managers, educators, and non-government organization staff. The workshop provided educational tools to teachers and volunteers about the impacts of purple loosestrife on wetland habitats.
- Research scientists at the **Atlantic Learning Center** located in **Cape Cod National Seashore** are working with local teachers to develop student protocols to monitor changes in the park's coastal ecosystem and gather local salt marsh responses to sea level change. Teachers and students are challenged to design salt spray catchers, sand collectors, and "tatter flags" to evaluate wind impact.



A snowy egret contrasts with the dense foliage characteristic of subtropical wilderness in Everglades National Park.

PHOTO © RUSS FINLEY/FINLEY-HOLIDAY FILMS

Chapter Five: Financial Details

Because many of the Challenge funds are indistinguishable from other program funds, financial information is provided for entire program areas receiving Challenge funding, whether they are Challenge-created programs or have been expanded as a result of the Challenge.

The Natural Resource Challenge funding has been requested as a series of discrete requests for a specific set of actions included in the Natural Resource Challenge action plan. Several of the actions represent new directions and new program areas, but many are expansions of existing programs. As a result, 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.

Because many of the Challenge funds are indistinguishable from other program funds, financial information is provided for entire program areas receiving Challenge funding, whether they are Challenge-created programs or have been expanded as a result of the Challenge. These Servicewide programs are identified separately in the National Park Service budget.

Parks receive a single allocation for their operations funding, and neither Challenge

funding nor natural resource management funding are identified separately. For parks, funding is shown for park natural resource programs as reported by the parks.

Narrative descriptions of accomplishments, found in Chapters Two through Four, focus on those parts of the program that have been most affected by Natural Resource Challenge funding. This chapter provides detailed financial information about the affected programs, showing how the program funding changes between FY 2002 and FY 2003 and how the funds were distributed. The accompanying table shows the Natural Resource Stewardship budget, by programs affected by the Natural Resource Challenge, indicating the extent of Challenge contributions to the overall program.

Following are details of funding changes by program between FY 2002 and FY 2003. In addition, where appropriate, additional detail is provided regarding how funding within these programs has been allocated.

Natural Resource Challenge Funding History (dollars in thousands)

CHALLENGE PROGRAM ELEMENT	INCREASE FY 2000	INCREASE FY 2001	INCREASE FY 2002	INCREASE FY 2003	INCREASE FY 2004	REQUEST FY 2005	TOTAL THROUGH FY 2005
Inventory and Monitor Resources							
Basic Inventories (except vegetation mapping)	\$ 7,309	\$ -	\$ -	\$ 1,987	\$ -	\$ -	\$ 9,296
Vegetation Mapping (With USGS)	-	1,746	-	2,235	-	-	3,981
Park Air Emissions Inventory	-	200	-	-	-	-	200
Monitor Vital Signs in Park Networks	-	4,191	4,200	6,855	4,939	4,111	24,296
Monitor Water Quality in Park Networks	-	1,272	-	497	592	528	2,889
Watershed Assessment	-	-	-	3,080	-	-	3,080
Expand Air Quality Monitoring and Related Activities	-	-	2,600	-	-	-	2,600
Make Natural Resources Data Useable	\$ -	\$ 1,098	\$ -	\$ -	\$ -	\$ -	\$ 1,098

(continued on next page)

Mechanical removal of nonnative plants was one phase of restoring the vegetation community at an abandoned ski area in Lassen Volcanic National Park. NPS PHOTO



Natural Resource Challenge Funding History (dollars in thousands) (continued)

CHALLENGE PROGRAM ELEMENT	INCREASE FY 2000	INCREASE FY 2001	INCREASE FY 2002	INCREASE FY 2003	INCREASE FY 2004	INCREASE FY 2005	TOTAL REQUEST THROUGH FY 2005
Fix Critical Problems							
Natural Resource Preservation Program Project Funding	\$ 2,875	\$ -	\$ 4,000	\$ -	\$ -	\$ -	\$ 6,875
Alaska Natural Resource Projects	-	-	-	497	-	-	497
Establish Resource Protection Fund	-	-	300	-	-	-	300
Water Resource Protection and Restoration/Project Funds	-	823	-	-	-	-	823
Water Resource Protection and Restoration/Field Specialists	-	-	1,000	200	-	-	1,200
Native/Non-Native Species Management and Exotic Plant Management Teams	3,449	-	2,400	2,136	-	-	7,985
Implement Resource Protection Act/Restore Resources	-	-	500	-	-	-	500
Protect Geologic Resources	696	-	-	-	-	-	696
Park Invasive Species Control and Threatened and Endangered Species Recovery	\$ -	\$ 3,395	\$ 3,200	\$ -	\$ -	\$ -	\$ 6,595
Attract Scientists							
Establish Learning Centers	\$ -	\$ 898	\$ 1,800	\$ -	\$ -	\$ -	\$ 2,698
Establish Cooperative Ecosystem Studies Units	\$ -	\$ 1,596	\$ -	\$ 397	\$ -	\$ -	\$ 1,993
ANNUAL INCREASE	\$ 14,329	\$ 15,219	\$ 20,000	\$ 17,884	\$ 5,531	\$ 4,639	\$ -
TOTAL ANNUAL FUNDING	\$ 14,329	\$ 29,548	\$ 49,548	\$ 67,432	\$ 72,963	\$ 77,602	\$ 77,602

**Natural Resource Funding of Parks Receiving Natural Resource Challenge (NRC) Program Increases
(dollars in thousands)**

PARK	FY 2001 OR FY 2002 NRC INCREASE	FY 2002 TOTAL NRC FUNDS	FY 2003 NRC TOTAL
Acadia National Park	\$ 345,000	\$ 849,827	\$ 794,395
Antietam National Battlefield	150,000	319,965	316,723
Appalachian National Scenic Trail	142,000	263,638	256,603
Big Cypress National Preserve ¹	399,000	1,033,640	1,010,000
Buck Island Reef National Monument ²	100,000	270,000	216,450
Catoctin Mountain Park*	89,000	254,400	231,900
Channel Islands National Park	498,000	1,406,622	1,406,622
Coronado National Memorial	60,000	94,993	105,231
Curecanti National Recreation Area	141,000	657,500	690,600
Dinosaur National Monument	189,000	501,800	559,375
Gates of the Arctic National Park and Preserve	148,000	362,401	363,039
Great Basin National Park	126,000	331,450	315,756
Great Sand Dunes National Preserve	180,000	291,700	287,500
Great Smoky Mountains National Park	402,000	1,245,100	1,152,700
Haleakala National Park	480,000	1,561,660	1,372,200
Homestead National Monument of America	82,000	104,500	104,500
Hopewell Culture National Historical Park*	105,000	95,000	79,322
Jewel Cave National Monument	50,000	168,500	168,500
John Day Fossil Beds National Monument	95,000	129,000	130,000
Kalaupapa National Historical Park	211,000	549,000	549,000
Lake Clark National Park and Preserve	147,000	321,500	319,810
Little River Canyon National Preserve ³	85,000	182,426	174,027
Mojave National Preserve*	470,000	1,264,000	1,219,073
Monocacy National Battlefield*	118,000	120,000	116,000
Obed Wild and Scenic River	195,000	245,000	193,318
Padre Island National Seashore	95,000	408,000	403,825
Pictured Rocks National Lakeshore	55,000	194,650	207,000
Rock Creek Park*	163,000	436,522	393,168
San Juan Island National Historical Park	95,000	124,600	125,050
Saugus Iron Works National Historic Site	58,000	58,000	58,000
Sequoia and Kings Canyon National Parks* ⁴	112,000	1,446,000	1,424,400
Stones River National Battlefield	132,000	132,000	137,100
Sunset Crater, Walnut Canyon, and Wupatki National Monuments	100,000	166,762	171,227
Theodore Roosevelt National Park	133,000	302,500	292,500
Virgin Islands National Park ⁵	399,000	1,077,234	1,002,726
Zion National Park	246,000	536,300	515,872
TOTAL	\$ 6,595,000	\$ 17,506,190	\$ 16,863,512

* Information provided by parks for FY 2003 report included discrepancies in previously provided information or figures did were not added or subtracted 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 FY 2002 reflect a correction to those reported in FY 2002 report.

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

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

Natural Resource Challenge Funding Changes, FY 2002-2003
Air Resources Program

DESCRIPTION	FUNDING
Funding available in FY 2002	\$ 9,065,000
Across-the-board travel reduction	(26,000)
Pay increase	18,000
Across-the board reduction	(59,000)
TOTAL ALLOCATED IN FY 2003	\$ 8,998,000
Reprogramming of travel reduction to reflect funds that incurred travel, rather than personnel	(1,000)
TOTAL FUNDING AVAILABLE IN FY 2003	\$ 8,997,000
<i>Air Resources Program Funding by Categories</i>	
Air emissions inventory	200,000
Air quality monitoring, analysis, and technical assistance	8,797,000
TOTAL	\$ 8,999,000

Natural Resource Challenge Funding Changes, FY 2002-2003
Biological Resources Management Program

DESCRIPTION	FUNDING
Funding available in FY 2002	\$ 5,846,000
Across-the-board travel reduction	(27,000)
Pay increase	13,000
FY 2003 Natural Resource Challenge increase	2,136,000
Across-the-board reduction	(38,000)
TOTAL ALLOCATED IN FY 2003	\$ 7,930,000
Reprogramming of travel reduction to reflect funds that incurred travel, rather than personnel	(1,000)
TOTAL FUNDING AVAILABLE IN FY 2003	\$ 7,929,000
<i>Biological Resource Management Program Funding by Categories</i>	
Exotic Plant Management Teams	\$ 5,150,000
Ecological Restoration	425,000
Integrated Pest Management Program	515,000
Endangered Species Program	465,000
Wildlife Program	438,800
Biological Resource Projects–National Level Support	935,200
TOTAL	\$ 7,929,000

**Natural Resource Challenge Funding Changes, FY 2002-2003
Cooperative Ecosystem Studies Units**

DESCRIPTION	FUNDING
Funding available in FY 2002 ¹	\$ 46,000
FY 2003 Natural Resource Challenge Increase ²	397,000
TOTAL FUNDING AVAILABLE IN FY 2003	\$ 443,000
FY 2003 transfer to regions	(310,000)
NET AVAILABLE AFTER TRANSFER	\$ 133,000
<i>Cooperative Park Studies Unit Funding Distribution *</i>	
Alaska Region	\$ -
North and West Alaska CESU—no Challenge funding	
Intermountain Region	\$ 465,000
Colorado Plateau CESU (\$155,000)	
Desert Southwest CESU (\$155,000)	
Rocky Mountains CESU (\$155,000)	
Midwest Region	\$ 310,000
Great Plains CESU (\$155,000)	
Great Lakes-Northern Forest CESU (\$155,000)	
Upper and Middle Mississippi Valley CESU—no Challenge funding	
National Capital Region	\$ 155,000
Chesapeake Watershed CESU	
Northeast Region	\$ 155,000
North Atlantic Coast CESU	
Pacific West Region	\$ 310,000
Great Basin CESU (\$155,000)	
Pacific Northwest CESU (\$155,000)	
Californian CESU—no Challenge funding	
Southeast Region	\$ 465,000
South Florida-Caribbean CESU (\$155,000)	
Southern Appalachian Mountains CESU (\$155,000)	
Gulf Coast CESU (\$155,000)	
Piedmont-South Atlantic Coast CESU —no Challenge funding	
Washington Office	\$ 133,000
TOTAL	\$ 1,993,000

¹ \$1,596,000 received in FY 2001; \$1, 550,000 transferred to regions

² Increase amount reflects across-the-board reduction

* Shows distribution with funds previously transmitted to regions, as well as funds received and transferred in FY 2003. A total of \$310,000 was transferred to the Midwest and Southeast Regions, representing new funding to two CESUs in FY 2003.

**Natural Resource Challenge Funding Changes, FY 2002-2003
Geologic Resources Program**

DESCRIPTION	FUNDING
Funding available in FY 2002	\$ 2,700,000
Across-the-board travel reduction	(34,000)
Pay increase	21,000
Across-the-board reduction	(17,000)
TOTAL ALLOCATED IN FY 2003	\$ 2,670,000
Reprogramming of travel reduction to reflect funds that incurred travel, rather than personnel	25,000
TOTAL FUNDING AVAILABLE IN FY 2003	\$ 2,695,000

**Natural Resource Challenge Funding Changes, FY 2002-2003
Inventory and Monitoring Program**

DESCRIPTION	FUNDING
Funding available in FY 2002	\$ 21,757,000
Transfer to prototype park	(189,000)
Across-the-board travel reduction	(126,000)
Pay increase	5,000
Across-the-board reduction	(139,000)
Natural Resource Challenge Increases in FY 2003	
Accelerate basic inventories	1,987,000
Vegetation mapping cost-share with USGS	2,235,000
Park Vital Signs Monitoring	6,855,000
TOTAL FUNDING AVAILABLE IN FY 2003	\$ 32,385,000

Inventory and Monitoring Program Funding by Categories

Resource Inventory Projects	\$ 13,794,500
Vital Signs Monitoring	13,578,900
Prototype Monitoring	1,231,300
Monitoring Projects	286,365
Database Development	1,404,335
Regional Coordinators	640,000
Program Administration	1,191,600
Reprogrammed	258,000

TOTAL \$ 32,385,000

Allocation of Funding Among Basic Natural Resource Inventories in FY 2003

Species Lists	\$ 25,000
Base Cartography Data	35,000
Biological Inventories	5,908,500
Vegetation Mapping	
Alaska	500,000
Outside of Alaska	4,000,000
Water Resource Data	620,000
Soil Surveys	986,000
Geology Inventories	1,395,000
Air Quality Related Values	325,000

TOTAL \$ 13,794,500

Allocation of Park Vital Signs Monitoring Funding Among Networks in FY 2003

North Coast and Cascades	\$ 345,100
Northeast Coastal and Barrier	776,500
Heartland	684,400
Sonoran Desert	670,000
Cumberland/Piedmont	476,700
Central Alaska	730,100
National Capital	747,000
Northern Colorado Plateau	535,500
San Francisco Bay Area	742,800
Greater Yellowstone	742,700
Appalachian Highland	416,400
Mediterranean Coast	302,000
Southwest Alaska	974,700
Northeast Temperate	481,200
Southern Colorado Plateau	815,200
Pacific Island	1,095,100
Great Lakes	811,500
Gulf Coast	150,000
Rocky Mountain	150,000
Sierra Nevada	150,000
Eastern Rivers and Mountains	150,000
Klamath	150,000
Arctic	\$ 150,000

(continued on next page)

**Natural Resource Challenge Funding Changes, FY 2002-2003
Inventory and Monitoring Program (continued)**

DESCRIPTION	FUNDING
<i>Allocation of Funding Among Basic Natural Resource Inventories in FY 2003</i>	
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
TOTAL	\$ 13,578,900

**Natural Resource Challenge Funding Changes, FY 2002-2003
Inventory and Monitoring Program (continued)**

CATEGORY	UNIVERSITIES	OTHER NON-FED	USGS	OTHER FED
<i>Inventory and Monitoring Expenditures by Non-NPS Categories</i>				
Inventories				
Biological Inventories	\$ 2,312,300	\$ 1,411,200	\$ 557,900	\$ 339,500
Vegetation Mapping	812,400	910,600	0	44,800
Water Resources	335,600	0	239,400	0
Air Quality-Related Values	322,000	0	0	0
Soils	0	0	0	940,000
Geology	215,000	0	0	0
Base Cartography	0	0	15,000	0
Miscellaneous	0	0	0	25,000
Monitoring	4,472,400	4,759,000	649,900	608,100
TOTALS	\$ 8,469,700	\$ 7,080,800	\$ 1,462,200	\$ 1,957,400

**Natural Resource Challenge Funding Changes, FY 2002-2003
Natural Resource Data and Information Program**

DESCRIPTION	FUNDING
Funding available in FY 2002	\$ 1,553,000
Across-the-board travel reduction	(13,000)
Pay increase	12,000
Across-the-board reduction	(10,000)
TOTAL ALLOCATION IN FY 2003	\$ 1,542,000
Reprogramming of travel reduction to reflect funds that incurred travel, rather than personnel	(1,000)
TOTAL FUNDING AVAILABLE IN FY 2003	\$ 1,541,000

Natural Resource Challenge Funding Changes, FY 2002-2003
Natural Resource Preservation Program (NRPP)

DESCRIPTION	FUNDING
Funding available in FY 2002	\$ 12,289,000
Across-the-board travel reduction	13,000
Across-the-board reduction	80,000
Challenge increase	497,000
TOTAL ALLOCATED IN FY 2003	\$ 12,693,000
Reprogramming of travel reduction to reflect funds that incurred travel, rather than personnel	(15,000)
TOTAL FUNDING AVAILABLE IN FY 2003	\$ 12,678,000

Natural Resource Challenge Funding Changes, FY 2002-2003
Natural Resource Preservation Program (NRPP)

CATEGORY	ALLOCATION	NO. PROJECTS
<i>Allocation of NRPP Among Project Categories and Projects Funded</i>		
Natural Resource Management	\$ 6,287,700	70
Threatened & Endangered Species	532,000	14
Disturbed Lands Restoration	850,000	12
Small Park	999,800	69
Regional Block Allocation	1,400,000	81
Alaska Projects	497,000	unknown
USGS/BRD Technical Assistance	255,000	30
Servicewide	934,000	16
Reprogrammed	922,500	
TOTAL	\$ 12,678,000	

Natural Resource Challenge Funding Changes, FY 2002-2003
Research Learning Centers

LOCATION	RESEARCH LEARNING CENTER	FUNDING FY 2001	FIRST REC'D FY 2002
Acadia National Park	Acadia Center for the Environment		X
Cape Cod National Seashore	Atlantic Learning Center	X	
Gateway National Recreation Area	Jamaica Bay Learning Center for Applied Research on Urban Ecology		X
Glacier National Park	Crown of the Continent Learning Center		X
Great Smoky Mountains National Park	Purchase Knob Learning Center	X	
Indiana Dunes National Lakeshore	Great Lakes Research and Education Center		X
National Capital Region	Urban Ecology Learning Alliance		X
North Cascades, Mount Rainier, and Olympic National Parks	North Coast and Cascades Learning Center		X
Point Reyes National Seashore	Pacific Coast Learning Center	X	
Rocky Mountain National Park	Continental Divide Research and Learning Center	X	
Santa Monica Mountains National Recreation Area	Center for Teaching New America		X
Seward, Alaska Sealife Center	Ocean Alaska Science and Learning Center	X*	

Except as noted, each of these Research Learning Centers received \$225,000 in Challenge funding the year that they were funded. 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.

* Did not receive Natural Resource Challenge funding, but was developed in response to the Challenge.

Maryland educators working on a project with the National Capital Parks Urban Ecology Research Learning Alliance identify and record plants along transects in Dyke Marsh at George Washington Memorial Parkway. NPS PHOTO



**Natural Resource Challenge Funding Changes, FY 2002-2003
Resource Damage Assessment and Recovery Program**

DESCRIPTION	FUNDING
Funding available in FY 2002 ¹	\$ 1,394,000
Transfer of function/position ²	(95,000)
Across-the-board travel reduction	(20,000)
Pay increase	5,000
Across-the-board reduction	(8,000)
TOTAL AVAILABLE IN FY 2003	\$ 1,276,000

¹ Combines two former line items: Oil Pollution Act and Resource Protection Act

² Response position transferred to another program area

**Natural Resource Challenge Funding Changes, FY 2002-2003
Resource Protection Fund**

DESCRIPTION	FUNDING
Funding available in FY 2002	\$ 300,000
Across-the-board reduction	(2,000)
TOTAL AVAILABLE IN FY 2003	\$ 298,000

Natural Resource Challenge Funding Changes, FY 2002-2003
Water Resources Program

DESCRIPTION	FUNDING
Funding available in FY 2002	\$ 7,905,000
Across-the-board travel reduction	(41,000)
Pay increase	26,000
Natural Resource Challenge increases in FY 2003	
Monitor water quality	497,000
Watershed assessment	3,080,000
Expand water resource protection and restoration	200,000
Across-the-board reduction	(53,000)
TOTAL ALLOCATED IN THE FY 2003	\$ 11,614,000
Reprogramming of travel reduction to reflect funds that incurred travel, rather than personnel	(1,000)
TOTAL FUNDING AVAILABLE IN FY 2003	\$ 11,613,000
<i>Water Resources Program Funding by Categories</i>	
Water Resources Projects	
Water Resource Protection	\$ 1,329,000
Competitive Projects	380,300
Other Projects	15,000
Water Quality Monitoring	1,775,000
Water Resource Protection–Aquatic Resource Professionals	1,170,100
Watershed Condition Assessment Program	1,263,000
Competitive Projects	1,102,700
Critical Projects	500,000
Water Resource Technical Assistance Reprogrammed	3,711,500 366,400
TOTAL	\$ 11,613,000
<i>Allocation of Water Quality Monitoring Funding</i>	
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
Servicewide Data Management	237,000
TOTAL	\$ 1,775,000



Extensive prairie grasslands of Badlands National Park support diverse wildlife including bison, bighorn sheep, pronghorn, swift fox, and black-footed ferrets.

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