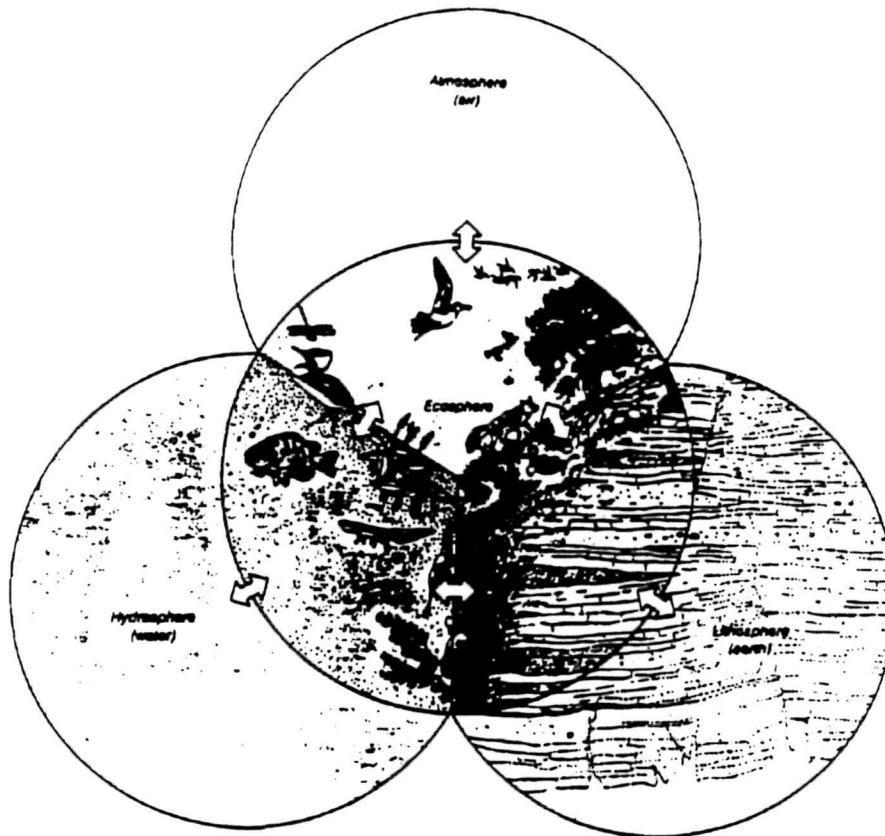


NPS INVENTORY and MONITORING PROGRAM

ANNUAL ADMINISTRATIVE REPORT

Fiscal Year 1993



U.S. Department of the Interior - National Park Service



EXECUTIVE SUMMARY

This report summarizes the activities performed by the National Park Service's Inventory and Monitoring Program during Fiscal Year 1993 (FY 93) under the authorities of the Organic Act of 1916 and other applicable Federal statutes. The I&M Program coordinates natural resource inventories and monitoring throughout the national park system to enhance the development of information on the status of park ecosystems and how they are influenced by human activities. Four prototype monitoring programs were funded during FY 93. Also in 1993, an additional 17 parks in seven biogeographical regions were selected to participate in the I&M Program. Various projects of the overall program were carried out by research scientists and resource managers of the NPS, other government agencies, and private contractors.

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1.0 THE NATIONAL PARK SERVICE PROGRAM

1.1 Introduction

The National Park Service (NPS) occupies a unique and critical position in American, indeed worldwide, natural resource conservation. Probably no ecosystem on earth today remains totally unaffected by modern human activities. But, in a world where natural places have become so few and precious, knowledge of the composition and function of relatively unaltered places is critical. The units of the NPS by in large represent such places. This fact has led some to state that preserving the natural resources (and natural processes) in national parks may be the most important legacy the Park Service can provide American conservation.

1.2 Legislative Authority

Realization of the unique value of NPS units to American conservation is reflected in agency policy. National Park Service policy requires park managers to know the condition and status of natural resources under their stewardship, have the means to detect changes in those resources, and understand the forces driving the changes in order to fulfill the NPS mission of conserving parks in an unimpaired condition. Specifically, the NPS policy with respect to natural resource inventory and monitoring is enunciated in its Management Policies (Chapter 4:4, 1988):

"The National Park Service will assemble baseline inventory data describing the natural resources under its stewardship and will monitor those resources at regular intervals to detect or predict changes. The resulting information will be analyzed to detect changes that may require intervention and to provide reference points for comparison with other, more altered environments."

Further, the National Park Service recognizes that natural resources and ecosystems found in parks commonly extend beyond park boundaries, as do pollution sources and other conditions that may threaten park resources. Accordingly, National Park Service policy directs that resource inventory will be conducted in a regional context and states:

"The National Park Service is committed to working cooperatively with federal, state, and local agencies, native American authorities, users' groups, adjacent landowners, and others in the management of natural resources and will seek to establish formal and informal lines of communication and consultation in order to better achieve park management objectives."
(Management Policies, Chapter 4:1, 1988)

1.3 Background

In 1989, a Task Force was established by the Associate Director for Natural Resources and charged with developing a plan for carrying out inventory and monitoring of natural resources on a programmatic basis in the NPS. The Task Force recommended implementation of a Servicewide Inventory and Monitoring (I&M) Program structured around two phases. During Phase I (the first 10 years), the Task Force recommended that the Servicewide program complete basic natural resource inventories in approximately 250 park units containing significant natural resources. The Task Force also recommended that a network of 8-10 prototype monitoring programs be established during Phase I to gain experience and expertise in park-wide, ecosystem monitoring. During Phase II, the Task Force recommended long-term monitoring programs be set up in all natural resource park units.

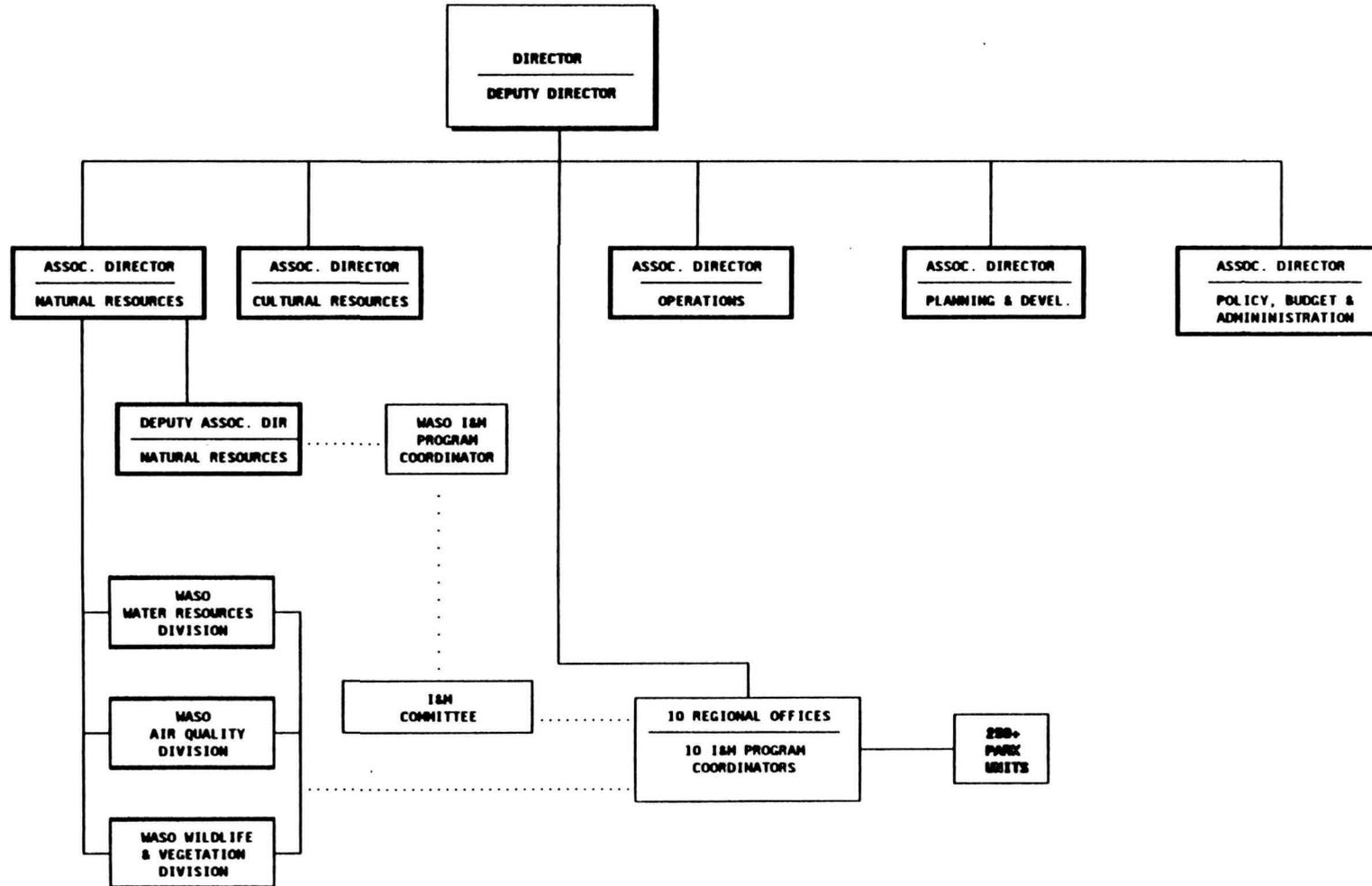
Five strategic goals, detailed in NPS-75 Natural Resource Inventory and Monitoring Guideline, were subsequently established for Phase I of the Servicewide I&M Program. These goals included:

- 1. Inventory the natural resources and park ecosystems under National Park Service stewardship to determine their nature and status.**
- 2. Monitor park ecosystems to better understand their dynamic nature and condition and to provide reference points for comparisons with other, altered environments.**
- 3. Integrate natural resources inventory and monitoring information into National Park Service planning, management, and decision making.**
- 4. Establish natural resource inventory and monitoring as a standard practice throughout the National Park Service which transcends traditional program, activity, and funding boundaries.**
- 5. Share National Park Service accomplishments and information with other natural resource organizations and form partnerships for attaining common goals and objectives.**

1.4 Program Organization

The Director of the National Park Service is responsible for the conservation and preservation of all natural resources under the agency's stewardship (**Figure 1**). The Inventory and Monitoring Program Office, a staff office of the Associate Director for Natural Resources, is responsible for formulating guidelines, and protocols as they relate to the planning and coordination of natural resource activities Servicewide. The Washington I&M Program Coordinator provides program administration at the national level. An I&M Committee comprising various administrators, managers, and scientists, advise and assist the Washington Coordinator on all aspects of program planning and development.

Figure 1. ORGANIZATIONAL CHART - NPS Washington Office/I&M Program



2.0 PROGRAM IMPLEMENTATION/ ACCOMPLISHMENTS

2.1 Servicewide Accomplishments

2.1.1 Vegetation Mapping

Beginning in 1994, NPS and the National Biological Survey (NBS) will begin the development of vegetation maps for approximately 235 NPS units. A vegetation mapping contract was developed to map the estimated 235 natural resource park units to the series level and to provide information urgently needed by the NPS Washington Office and by a growing list of regional and international land management and conservation institutions. Eventually, these data sets will be integrated with other land ownerships to provide continent-scale information that will allow tracking of such global phenomena as pollution effects or responses to climate change.

The NPS recommended to NBS that the first region to be mapped should be in the midwest grassland park areas. It is expected that this mapping effort will require adjustments as the work proceeds.

2.1.2 Water Resources

In 1993, a cooperative endeavor was initiated by the NPS Servicewide I&M Program and the NPS Water Resources Division, the NPS baseline Water Quality Inventory and Analysis Project is a three year effort designed to characterize baseline water quality at all units of the National Park System containing significant natural resources.

Every participating park unit will receive a detailed analog report and several hydrographic digital databases, including all water quality parameter data, surface-water quality monitoring station locations, stream gage locations, National Point Discharge Elimination System permit locations and drinking water intake locations.

2.1.3 Species Lists/Biodiversity

In 1993, a major inventory effort was undertaken to compile a faunal database. This effort resulted in the completion of the NPFAUNA.PC databases compiled by the University of California. NPFAUNA.PC databases provide checklists of mammal, bird, fish, and plant species found in approximately 190 NPS units. Although the databases reflect only currently compiled information and are not a complete species inventory, they will be useful in the planning and implementation of future cost-effective species inventories.

2.1.4 Bibliography

The NPS has recently chosen PROCITE as its standard bibliographic software program. During 1993, a draft proposal was completed by the CPSU at the University of Idaho addressing Servicewide bibliographic database conversion.

To facilitate the conversion process, in 1994 the Washington office will contract to:

- Produce a report describing the process for converting files in a dBASE format to a PROCITE format.
- Provide a PROCITE bibliographic resource database for every park in the region in a reasonable compatible format.
- Compose an outline on methods of maintaining the currency of bibliographic databases.

Additionally, in 1994 bibliographies will be developed for many individual parks. These bibliographies will include all descriptive documents and scientific studies pertaining to park natural resources, including extended searches for published and unpublished documents outside the park. Each park data set will be incorporated into a computer-based storage and retrieval program (PROCITE) along with procedures for updating the information as necessary.

2.1.5 Digital Cartographic Data

During 1993, a 50:50 cost sharing agreement was setup with U.S. Geological Survey that will provide several of the basic data layers needed for park-based GIS. Standard products available through this cooperative agreement are topographic maps, digital line graphs, digital elevation models, and digital ortho products. In addition to obtaining important spatial data sets to support park management, research, and planning, the effort will accelerate completion of the National Digital Cartographic Data.

In total \$1.07 million of the funds were made available in 1993 to acquire cartographic data sets for 40 park units in nine NPS regions.

2.1.6 Newly Selected Prototype Programs

During May 1993 the NPS Washington Office issued a Call for Proposals from which they would eventually, through competition, select Prototype Monitoring Programs for seven biogeographic biomes not currently represented in the Servicewide I&M program. An Interagency Evaluation Panel was convened on November 2-5, 1993 to evaluate the submittals and develop implementation recommendations. The proposals and their biogeographic region are indicated below. These new programs along with those selected previously will complete the Phase I Servicewide Prototype Monitoring Program Network.

- ▶ **Caves** - Mammoth Cave National Park

- ▶ **Arid Lands** - Northern Colorado Plateau Cluster
 - Arches NM
 - Canyonlands NP
 - Capital Reef NP
 - Dinosaur NM
 - Natural Bridges NM

- ▶ **Grasslands/Prairies** - Great Plains Prairie Cluster
 - Effigy Mounds NM
 - Homestead NM
 - Scotts Bluff NM
 - Agate Fossil Beds NM
 - Wilson's Creek NB

- ▶ **Coniferous Forest** - Olympic National Park

- ▶ **Lakes and Rivers** - North Cascades National Park

- ▶ **Atlantic/Gulf Coast** - Cape Cod National Seashore

- ▶ **Tropical/Subtropical** - Virgin Islands Cluster
 - Virgin Islands NP
 - Buck Island NM
 - Dry Tortugas NP

2.2 Prototype Parks

In 1991, the NPS initiated a Servicewide program to provide park managers with information needed to preserve and protect park ecosystems and natural resources. As part of this program the Service has established a network of experimental programs to evaluate a variety of monitoring protocols and methodologies. Four parks were selected to participate in this program.

The goal of prototype monitoring is to develop sampling designs and strategies to detect changes and quantify trends in critical ecosystems components and processes over time. Standard methods and procedures, or protocols, are developed and tested during the design phase. Quality assurance and control factors are developed in conjunction with the protocols to insure high standards of data acquisition and management. Complete monitoring protocols are peer reviewed and stand as transferable technology. Interim synthesis products assure the timely dissemination of results, findings, and information from federally supported research, development, and monitoring programs.

The prototype approaches to long-term monitoring vary widely with respect to the detail in which the function and structure of park ecosystems are studied. However, they share many common features such as examining trends in species abundance, population dynamics, watershed ecology, and other indicators of environmental change.

It is important that managers understand the relationships between research, monitoring, and resource management for prototype monitoring parks. It is also important to differentiate between protocol development and implementation phases of program development. The prototype park model is premised on three main concepts.

- Protocol development is a research function.
- Implementation of peer-reviewed monitoring protocols will be by resource managers.
- Implementation will require minimal technical oversight (e.g., changes in protocol or assistance in analysis).

Subsequently, the progression from research to resource management functions has important implications for program administration, including staffing and other uses of I&M funding.

The National Park Service envisions a national network of monitoring sites with 10 operational prototype parks by the year 2000. As envisioned, the network would include various biogeographic regions or land unit designations including: Subarctic/Arctic, Eastern Deciduous Forests, Pacific Coast, Arid Land, Coniferous Forest, Atlantic-Gulf Coast, Rivers and Lakes, Caves, Tropical-Subtropical, and Grasslands and Prairies.

Four prototype parks were selected in 1991 for long-term monitoring under the I&M Program. Prototype selection criteria included evaluations of the status of existing inventory information, ongoing research and monitoring, biogeographical representation of the park, scientific personnel and park infrastructure, and technical and cost proposals. The four prototype parks originally selected were:

- ◆ Denali National Park and Preserve (DENA)
- ◆ Great Smoky Mountain National Park (GRSM)
- ◆ Shenandoah National Park (SHEN)
- ◆ Channel Islands National Park (CHIS)

In 1992, the WASO I&M Program appropriated nearly one million dollars for these four prototype parks. An additional \$700,000 was contributed to the overall monitoring programs through regional and operational base sources. These monies were utilized for protocol development, monitoring, program administration, logistics support, and information management. In 1993, the WASO I&M Program appropriated approximately \$1.5 million for the four prototype parks. An additional \$686,000 was contributed to the prototype monitoring programs through regional and park base sources (**Table 1**).

TABLE 1. FY 93 FUNDING SOURCES

FUNDING SOURCE/PARK	DENA	GRSM	SHEN	CHIS
NPS - WASO I&M	\$275,000.00	\$393,000.00	\$368,000.00	\$501,000.00
NPS - REGION	\$40,000.00		\$194,310.00	
NPS - PARK BASE	\$5,000.00	\$58,500.00	\$111,592.00	\$170,000.00
OTHER FEDERAL AGENCY				\$65,000.00
NPS - WASO AIR QUALITY			\$36,700.00	
OTHER STATE AGENCY				
NON-PROFIT INSTITUTION				
PERSONAL /VIP				
TOTAL NPS FUNDING	\$320,000.00	\$451,500.00	\$710,602.00	\$736,000.00

Table 2 presents a summary of each of the four prototype parks environmental monitoring program. The following is a description of funded inventory and monitoring projects that have been initiated in 1993 by each prototype park.

SHENANDOAH NATIONAL PARK	
Issue:	Exotic Forest Insect Defoliation and Effects on Brook Trout
Approach:	Air and Water Quality Species Trends and Population Dynamics Aquatic, Meadow, and Forest Communities Landscape Monitoring
CHANNEL ISLANDS NATIONAL PARK	
Issue:	Enabling Legislation Mandate for Research and Monitoring
Approach:	Trends in Species Abundance Population Dynamics Island and Coastal Communities Marine Debris
GREAT SMOKY MOUNTAINS NATIONAL PARK	
Issue:	Air Pollution and Acid Rain Effects
Approach:	Air and Water Quality Indicators Trends in Species Abundance Forest and Cave Communities Aquatic Ecosystems Landscape Processes
DENALI NATIONAL PARK AND PRESERVE	
Issue:	Test Watersheds as Representative Ecological Units
Approach:	Air and Water Quality Glaciers and Permafrost Species Trends and Population Dynamics Aquatic, Forest, Treeline, and Tundra Communities Watershed Ecosystems and Landscape Processes

TABLE 2. Description of Monitoring Programs in Prototype Parks

2.2.1 Denali National Park and Preserve (DENA)

Background

Research to develop long-term monitoring protocols for Alaska's *Arctic and Subarctic* national parks was initiated in 1992. The park chose a systems approach in the design of their monitoring program with an emphasis on:

- ◆ **Watersheds as a Potential Monitoring Unit for Ecosystem Management of *Arctic/Subarctic* systems.**

In 1993, this research was continued in Rock Creek, DENA, as part of the Inventory and Monitoring program. The research goal of this project was to develop an integrated monitoring design that, when implemented, will promote management of protected areas in an ecosystem context. In Denali, the monitoring protocols are being developed at the watershed scale of spatial resolution. Since watersheds have definable boundaries, they are conceptually attractive in an ecosystem context. The park's continuing research has expanded upon the traditional watershed approach (eg., hydrology, atmospheric deposition) by including other ecological measures linking key aquatic and terrestrial system components and processes within defined watershed habitats.

The multiple watershed approach stratifies the park's 2.4 million hectares into five manageable ecological units. This research design embraces principles of the hydrological cycle, hypotheses surrounding global climate change, and biological interactions of organisms occupying intermediate components of taiga ecosystems.

When completed, the integrated program design will include peer-reviewed monitoring protocols describing standardized methods for the detection and tracking of environmental change over time. This core measurement program will be transferable to other Alaskan environments in the *Arctic/Subarctic* biogeographic association.

Currently, the park's inventory and monitoring efforts are focused primarily on one watershed area - Rock Creek. As part of the overall monitoring plan, the park is planning to expand their research efforts to other watersheds in the upcoming years. Specifically, prototype monitoring projects for each of the following resources are ongoing or being initiated in Denali National Park and Preserve.

- A. Glaciers**
- B. Climate and Meteorology**
- C. Soils and Landscape Mapping**
- D. Hydrology and Water Quality**
- E. Decomposers**
- F. Invertebrates**

- G. Vegetation Structure and Dynamics*
- H. Avifauna Census*
- I. Small Mammal Inventory*
- J. Macroinvertebrate Populations*

Budget

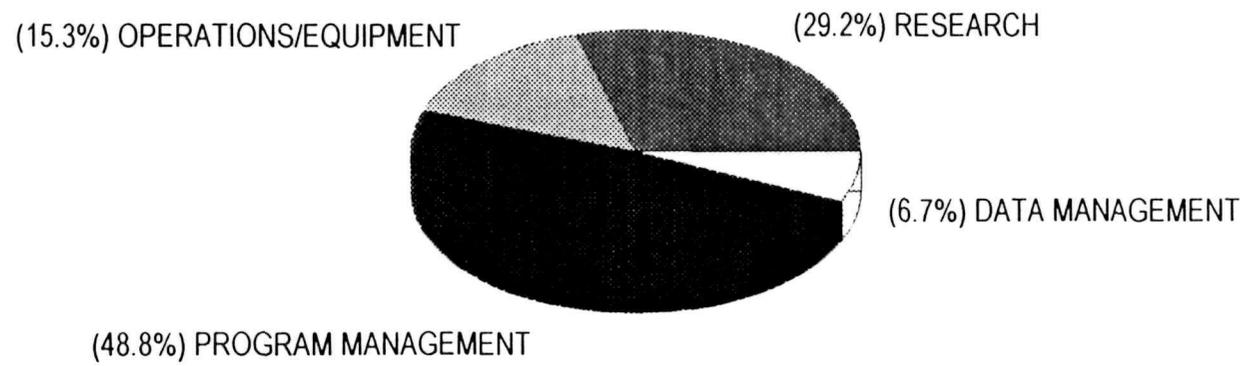
Total NPS funding for Denali's prototype monitoring program in 1992 was \$300,000 and \$326,000 in 1993. Of that, \$275,000 was funding from the WASO Inventory and Monitoring Program. An additional \$40,000 was contributed by the Alaska Regional Office and \$11,000 from the park base budget. Approximately 4.5 FTEs participated in the research program during 1993. **Table 3** and **Figure 2** present a breakdown of the monitoring budget by program element.

TABLE 2. DENALI NATIONAL PARK - FY 93 FUNDING AND EXPENDITURES

FUNDING SOURCE	NPS (WASO I&M)	REGION	DENALI BASE
RESEARCH	\$93,513.00		
OPERATIONS/EQUIPMENT	\$48,800.00		
PROGRAM MANAGEMENT	\$111,180.00	\$40,000.00	\$5,000.00
DATA MANAGEMENT	\$21,507.00		
TOTAL	\$275,000.00	\$40,000.00	\$5,000.00

FIGURE 2. FY 93 EXPENDITURES BY PROGRAM ELEMENT

DENALI NATIONAL PARK
Total Funding FY 93: \$320K



2.2.2 Great Smoky Mountain National Park (GRSM)

Background

GRSM was selected and funded as one of four prototype inventory and monitoring parks in the NPS representing the *Eastern Deciduous Forest* Ecosystem. The park developed a hierarchical approach in the design of their monitoring program, with an emphasis on:

- ◆ **Air Pollution and Acid Deposition Effects on *Deciduous Forest* Resources.**

GRSM completed its Long-Term Ecological Monitoring Plan in February 1993. This plan identifies the status of the park's natural resource inventories, provides for a five year implementation strategy, and discusses the objectives of various methodological approaches. Peer review of protocols used in each long-term monitoring component was completed in FY 93. In 1993, Prototype monitoring projects were initiated or ongoing for the following resource components.

- A. Large Stream Water Quality**
- B. Black Bear Population**
- C. White-Tailed Deer Population**
- D. Rare Plant**
- E. Exotic Forest Insect and Disease**
- F. Fisheries**
 - 1. Brook Trout
 - 2. Large Stream Fisheries
 - 3. Reintroduced Threatened and Endangered Fish Populations
- G. Large Stream Macroinvertebrates**
- H. Aquatic Biota**

Budget

Total NPS funding for GRSM's prototype monitoring in 1992 was \$400,000 and \$354,900 for 1993. In 1993, the WASO I&M Program allocated \$393,000 to the GRSM monitoring program. Other funding sources, including park base and regional monies, totalled approximately \$58,500. **Table 4** presents a summary of GRSM's expenditures on monitoring by individual component.

TABLE 3. GREAT SMOKY MOUNTAIN NATIONAL PARK - FY 93 FUNDING AND EXPENDITURES

PROGRAM ELEMENT/FUNDING SOURCES	WASO I&M	OTHER	TOTAL
CAVE MONITORING			
VEGETATION MONITORING			
BLACK BEAR MONITORING	\$31,400.00	\$900.00	\$32,300.00
CADES COVE DEER MONITORING	\$10,000.00	\$3,800.00	13800
RARE PLANT MONITORING	\$43,000.00	\$10,000.00	\$53,000.00
BROOK TROUT MONITORING	\$33,000.00	\$10,000.00	\$43,000.00
LARGE STREAM FISHERIES MONITORING	\$19,000.00	\$12,500.00	\$31,500.00
RARE FISH MONITORING	\$7,000.00	\$3,500.00	\$10,500.00
LARGE STREAM MACROINVERTEBRATES	\$30,000.00	\$3,100.00	\$33,100.00
WATER QUALITY MONITORING	\$6,000.00	\$5,700.00	\$11,700.00
WATERSHED AQUATIC BIOTA MONITORING	\$20,000.00	\$3,000.00	\$23,000.00
WATERSHED HYDROLOGY/NUTRIENT CYCLING	\$96,600.00		\$96,600.00
EXOTIC FOREST/INSECT/DISEASE MONITORING	\$22,000.00	\$6,000.00	\$28,000.00
DATA MANAGEMENT	\$75,000.00		\$75,000.00
TOTAL	\$393,000.00	\$58,500.00	\$451,500.00

Note: Other includes Park Base, and Region Funding

2.3.3 Shenandoah National Park (SHEN)

Background

Selected in 1991 to serve as one of the prototype long-term monitoring sites, Shenandoah National Park representing the *Eastern Deciduous Forest* ecosystem chose a multi-disciplinary approach in the design of the park's monitoring program with an emphasis on:

- ◆ **Changes Occurring in *Eastern Deciduous Forest* and Aquatic Ecosystems Due to Natural Succession, Exotic Pests and Air Pollution.**

As a prototype monitoring park, Shenandoah is building on previous research and monitoring efforts to develop a coordinated, multi-disciplinary program that identifies environmental changes and resultant responses in populations, communities, or defined ecological processes. A Geographical Information System (GIS) supports the monitoring program through the development of mapping products and spatial analysis of mapped information. In 1993, Prototype monitoring projects were initiated or ongoing for the following resource components:

- A. *Water Quality***
- B. *Air Quality***
- C. *Meteorology***
- D. *Long-term Ecological Monitoring of Forest Plant Communities***
- E. *Rare, Threatened, and Endangered plants***
- F. *Black Bear Population***
- G. *Avifauna***
- H. *Fish***
- I. *Amphibians***
- J. *Aquatic Macroinvertebrate/Habitat***

Budget

Total funding for prototype monitoring from NPS sources was approximately \$488,000 for 1992 and \$710,602. In 1993, The WASO I&M Program allocated \$368,000 to the SHEN monitoring program. Other funding sources in FY 93, including Region, SHEN base, and WASO Air Quality Division totalled \$342,602.93. **Table 5** and **Figure 3** present SHEN's annual expenditures by program element in 1993.

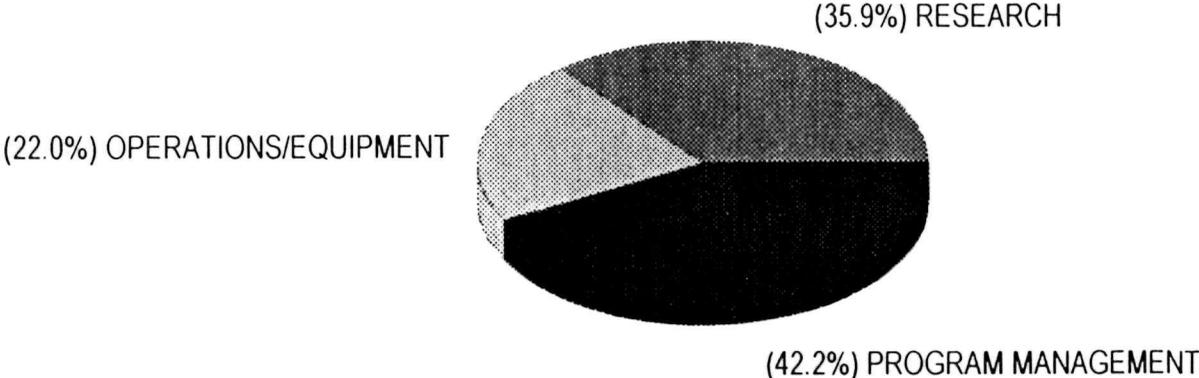
TABLE 4. SHENANDOAH NATIONAL PARK - FY 93 FUNDING AND EXPENDITURE REPORT

PROJECT PURPOSE/FUNDING SOURCES	SHEN BASE	REGION	WASO - AQD
RESEARCH	\$61,349.00	\$193,500.00	
OPERATIONS/EQUIPMENT	\$155,179.00	\$810.00	
PROGRAM MANAGEMENT	\$263,064.00		\$36,700.00
DATA MANAGEMENT			
TOTAL	\$479,592.00	\$194,310.00	\$36,700.00

Note: SHEN Base includes \$368,000 from WASO I&M Program

FIGURE 3. FY 93 EXPENDITURES BY PROGRAM ELEMENT

SHENANDOAH NATIONAL PARK
Total Funding FY 93: 710K



2.2.4 Channel Islands National Park (CHIS)

Background

Shortly after the passage of the 1980 legislation designating Channel Islands as a national park, the designing of a long-term monitoring program for natural resources was inaugurated. In 1992, CHIS was selected as a prototype park under the NPS Inventory and Monitoring Program. In designing the park's monitoring program, a population dynamics approach was chosen with an emphasis on:

- ◆ **Status and Dynamics of Terrestrial and Marine *Pacific* Indicator Species**

In 1993, the park began development of monitoring protocols for water quality and the island foxes on Santa Cruz Island.

As of the end of 1993 the park has implemented, all or in part, protocols for the following resource components:

- A. *Meteorological***
- B. *Water Quality***
- C. *Vertebrate Populations***
- D. *Landbirds***
- E. *Vegetation***
- F. *Kelp Forest***
- G. *Rocky Intertidal***
- H. *Marine Debris***
- I. *Seabirds***
- J. *Pinnipeds***

Budget

Total funding for prototype monitoring from NPS sources was approximately \$300,000 in 1992 and \$622,657 in 1993. In 1993, the WASO I&M program allocated \$464,000. These funds augmented \$150,000 already in the park's base funding for marine monitoring. An additional \$20,000 in special projects money also supported in the monitoring effort. Shown in **Table 6** and **Figure 4** is a summary of FY 93 expenditures for CHIS's monitoring program.

TABLE 5. CHANNEL ISLANDS NATIONAL PARK - FY 93 FUNDING AND EXPENDITURE REPORT

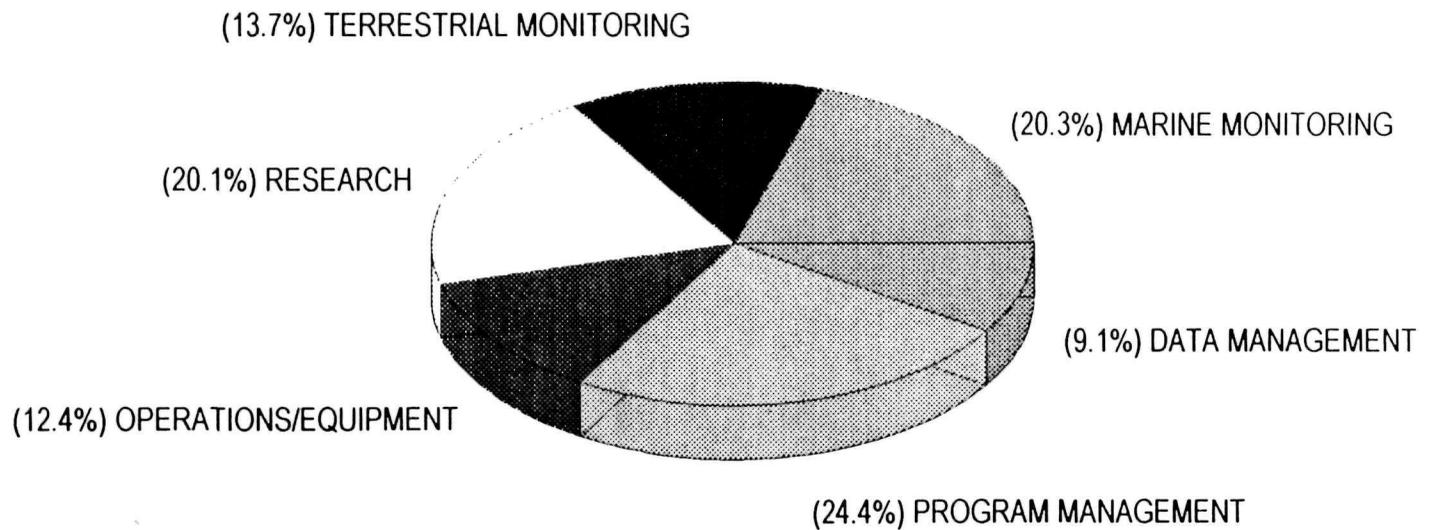
PROJECT PURPOSE/FUNDING SOURCES	WASO - I&M	CHIS BASE	OTHER
PROGRAM MANAGEMENT	\$31,049.00		
TERRESTRIAL MONITORING	\$174,460.00		
MARINE MONITORING	\$62,290.00	\$150,000.00	\$45,000.00
DATA MANAGEMENT	\$115,750.00		
OPERATIONS/EQUIPMENT	\$117,451.00	\$20,000.00	\$20,000.00
TOTAL	\$501,000.00	\$170,000.00	\$65,000.00

Note: Other includes Water Quality, Challenge Cost Share, and NRPP funding.

FIGURE 4. FY 93 EXPENDITURES BY PROGRAM ELEMENT

CHANNEL ISLANDS NATIONAL PARK

Total Funding FY 93: 736K



3.0 DATA AND INFORMATION MANAGEMENT

Background

Design of effective data management protocols is critical to the implementation of the Inventory and Monitoring program. This has been recognized at both the Servicewide and individual park levels. To address these issues, in 1993 the Inventory and Monitoring Program accomplished a multitude of important tasks and the prototype parks began development of individual data management protocols.

3.1 Servicewide

Internet Connectivity Within the NPS

Internet is a packet-switched network which exists as a collection of networks, centered in North America but extending world-wide. Communications across the Internet occur in the form of electronic mail to tens of millions of people, remote access to user logins at over a million computer hosts, and file transfers between millions of computers. Currently, the Internet supports more than 100 countries, 39,000 unique networks with their own unique addresses, at least 5 million fully functional users and well over 25 million users with at least electronic mail functionality. Internet exists to promote the sharing of resources among participating organizations. Participating organizations include government agencies, educational institutions, and private corporations.

To facilitate access to this extensive network, the Inventory and Monitoring Program funded a study paper in 1993 to present an analysis of alternatives for implementing Internet in the National Park Service. This paper was completed and presents detailed information concerning the best approach for to establish Internet connectivity within the NPS environment.

Biodiversity Database Management

Many federal, state, and non-governmental agencies are investing in the inventory and monitoring of biological diversity. There would be substantial benefit from standardizing a core set of databases that are derived from this effort. There is a clear and urgent need within the NPS to design an integrated system of databases that will allow for the efficient flow of information among programs and across the organizational levels of the agency.

In response to this urgent need, in 1993, the Inventory and Monitoring Program coordinated the formation of a Biodiversity Database Working Group. A workshop was held to address these database issues. Thirty-seven government and non-government researchers and resource managers met for a workshop in North Carolina to discuss databases needed by the NPS to support one of the agency's most basic missions, the conservation of biological diversity in National Parks.

Other workshops will be held in 1994 to finalize criteria for a national biodiversity database.

Hardware and Software

The I&M Program Office purchased 200 copies of PROCITE which will be sent to selected parks. Procurement of this software, along with planned basic inventories in 1994, should enhance each park's ability to manage and utilize their large bibliographic databases.

Additionally, 14,400 baud modems were purchased by the I&M Program and furnished to select parks. These high speed modems will allow parks to access and download large databases including spatial data in a quick and efficient manner.

3.2 Data Management in Prototype Parks

Denali National Park

A draft data management protocol was developed during 1993. The protocol establishes some very basic guidelines for database structures and formats; field data collection, entry, and testing; and appropriate storage and maintenance procedures.

During 1993, Denali NP&P received a GIS position as part of the NPS professionalization initiative. This position will be filled in fiscal year 1995 and should be of great assistance in the design, assessment, and integration aspects of the monitoring. In the short-term, Autocad mapping is being employed for mapping of Rock Creek activities. During 1993, a digitizing table was purchased to assist immediate GIS needs.

Great Smoky Mountains National Park

The Natural Resources Database (NRDB) program, which the park is developing, is planned as a common front end to the data from the separate components of the I&M program. NRDB is intended to be a comprehensive easy-to-use PC-based information system that permits a user to browse through natural resources data using a graphical interface centered around a map of the park. Much of the base data is taken from the park's GIS. To date, vegetation, old growth, disturbance history, geology layers, watershed, and stream segment vector layers have been transferred from the GIS and customized for use in NRDB.

Shenandoah National Park

An Ecologist/Database Manager joined the I&M staff in February 1993. Data management and computer support needs have become a significant workload for the I&M program staff.

The data manager has dramatically improved the efficiency of data reduction tasks and quality assurance checks which has allowed staff specialists to focus on their individual projects without becoming distracted by computer hardware and software problems. Data integration between projects has also been better planned.

A preliminary draft of the I&M Data Management Plan was completed in July, 1993, and received very favorable comments with a limited circulation. A more comprehensive outline was finished in September, 1993, and a final version should be completed and undergo outside review by the end of FY 94.

During the summer of 1993, hand-held data recorders were used for the first time in the field. To test their efficiency and ease-of-use, they were used concurrently with our standard paper forms to collect tree data. Feedback from the field crews was implemented overnight into adjustments to the data entry module, resulting in virtually error-free use by mid-season. Additional routines were developed that automated downloading and formatted printing of the data within minutes of returning from the field, and thus allowed the staff to check the data for errors while still fresh in mind. Following that success, plans are in place to expand the use of the Polycorders in 1994 to other projects.

Channel Islands National Park

During 1993, data management was largely focused on relocating the resources management staff and their associated files, maps, and equipment in a rented building approximately 1/2 mile from park headquarters. A Local Area Network (LAN) was set up in the "annex" building and connected via microwave to the LAN at the headquarters building.

The park funded digitizing of the eleven quad maps to provide the basic GIS data layer for the entire park. This project was completed and the data received in December. Digital Orthophoto quads were ordered from USGS in December. The park Data Manager continues to oversee acquisition of data layers to complete a base GIS map for the park. A GIS Specialist left mid-year, leaving a vacancy that is yet to be filled.

4.0 PUBLICATIONS

Each prototype park submitted an Annual Administrative Report for FY 1993 to the Washington Office. These reports should be consulted for more detailed accounts about technical aspects of this facet of the I&M Program. Copies of these annual reports are available by written request to the I&M Program Coordinator, Washington Office. A bibliography of reports generated from the I&M Program may be obtained from the individual parks.