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# Natural Resources Programs



## HIGHLIGHTS OF NATURAL RESOURCES MANAGEMENT • 1986

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## ABOUT THIS REPORT

The natural resources management projects and activities described in this report represent the proverbial "tip of the iceberg." Although these articles convey some sense of the diversity of natural resources and the range of resources management activities being taken to preserve and protect park resources, what is here represents only a small portion of the total research and resources management activities of the National Park Service. Because we could include only some of those things we knew of or had been told about, we undoubtedly have left out many highlights that should have been included. Nevertheless, we think it is a good sampling and hope readers will find the report interesting.

We are deeply grateful to and want to thank the many people who shared information and expertise with us. We encourage others to let us know about activities, projects, ideas, and quotations that would be of interest (or inspiration) in a 1987 highlights report.

This publication is dedicated to the memory of Thomas W. Lucke--a vibrant, caring, energetic man whose joy in nature, in life, and in his fellow human beings was so generously shared and so untimely lost.

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RESEARCH AND TECHNOLOGY

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Sound research has always been an essential component, and continues to be the cornerstone, of the National Park Service (NPS) natural resources management programs. The nature and range of NPS research is both interesting and impressive. An exciting, relatively new partner in resources management is technology. The many diverse and sophisticated applications of technologies are greatly enhancing our capabilities in managing natural resources. This section presents some of the research projects and examples of how technology is being used in research and resources management.

### Counting Bats-on-the-Wing

In 1986, the Southwest Regional Office completed software design and bench testing of an innovative computer system designed specifically to count bats. Basically, the system consists of two parts. The first part is a portable low-light television camera, a portable video cassette recorder, and a miniature television monitor. This portion of the system is used to photograph and record objects on videotape. The second part of the system consists of a bench model video cassette player, a computer monitor, and an IBM computer with a specially designed freeze-frame board.

A video recording of a bat flight is played into the computer and each videotape frame is "frozen" as the computer counts the objects in the frame. Such objects must be counted in three consecutive frames to be recorded.

To date, only bats have been counted with this system but the specifications on the contract call for the ability to count as many as 16 million objects in two hours, and well over 90 percent accuracy has been achieved thus far.

Although the system was designed to determine bat numbers, a great deal of interest has been shown in the possibility of counting fish in a weir, migrating waterfowl, migrating caribou, and a variety of other wildlife for which baseline and monitoring data are needed. The system will be extensively field tested during summer 1987, and applications for other agencies should be available by fall 1987.

### 1986 Science Conference

The role that science should and can play in the understanding, managing, and preserving of park resources was the focus of the fourth Conference on Science in the National Parks, July 13-18, 1986, sponsored by the National Park Service and the George Wright Society.

Regional science programs were presented, and research and resources management projects were displayed.

Approximately 400 people attended the conference. NPS personnel included the directorate, superintendents, researchers (natural, cultural, and social sciences), resource managers, and interpreters. Research personnel from universities and other agencies, staff from Park Services of six foreign countries, and members of the public also attended and participated in the conference.

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There is just one hope of repulsing the tyrannical ambition of civilization to conquer every niche on the whole earth. That hope is the organization of spirited people who will fight for the freedom of the wilderness.

Robert Marshall  
"The Problem of the Wilderness"  
Scientific Monthly 1930

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General Sherman and other sequoias tower above man, Sequoia National Park.

## Ozone Injures Pines in Sequoia

The Air Quality Division continued studies in 1986 to determine the effects of air pollution, particularly ozone, on sensitive plant species native to Sequoia National Park.

Air pollution effects are monitored using a variety of research techniques. These studies determine the types of visible symptoms, the extent and degree of injury over large areas, and the impacts on growth, physiology, foliage retention, mineral cycling, mortality, gene pools, and accumulations of toxic elements.

As early as the mid-1970s, ozone injury was detected on Jeffrey and ponderosa pines, species sensitive to pollutants. Ozone injury has since been observed on hundreds of these pine trees along the western side of the park.

Ozone injures pines by entering leaves during the normal gas exchange process and affects the permeability of cell walls. Photosynthetic cells are destroyed, and needles are dropped prematurely. The vigor of the tree is lowered, making it more susceptible to other pathogens. Ozone-injured trees are sparsely foliated with many yellow needles.

Since 1983 permanent field plots show that injury to pines has increased along the western border of the park but injury to oaks has remained relatively low and unchanged.

A 1986 extensive survey of Jeffrey and ponderosa pines showed that injury was most severe in drainages bordering the San Joaquin Valley. Injury was recorded on 39 percent of the 1,470 trees surveyed throughout the park.

Perhaps the debilitating effects of ozone on pines can best be understood when one sees tall, mature ponderosa or Jeffrey pines with only a few whorls of yellow



needles. These trees have survived centuries of summer drought, winter snows, and numerous fungal and insect predators but are defenseless against the chlorophyll bleaching effect of ozone.

Ozone may also be affecting the giant sequoia, either directly through injury to the tree, or indirectly through degradation of other ecosystem species. Fumigation work to date shows that sequoia seedlings are relatively sensitive to ozone. Of the millions of seedlings sprouted each spring following a previous year's fire, only a few dozen become mature sequoias. Ozone may change the growth of sequoia seedlings, altering natural selection processes. Giant sequoias have survived as a species for 100,000,000 years. Now this unique species may be affected by polluted air.

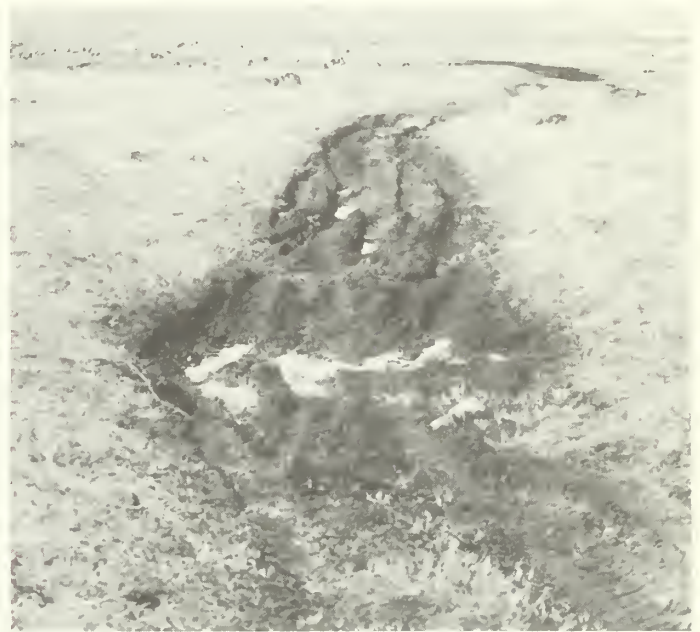
### **Dispersed ATV Use Studied In Gates of the Arctic**

A pilot study was initiated during the summer 1986 on the effects of all-terrain vehicle (ATV) use on lands in the vicinity of Anaktuvuk Pass, Alaska, a village that lies within Gates of the Arctic National Park.

Village residents use ATVs for access to traditional subsistence resources in the park. ATV use has increased over the past few years. Vehicles have become more numerous in the area and ATV effects on vegetation and soils have become increasingly evident.

Using ATVs on park lands is generally prohibited; however, several ATV access easements exist on nonwilderness park lands to allow village residents access to traditional subsistence resources.

Many residents are not satisfied with the easements. They have asked for unrestricted ATV use within the valleys through which the easements run and in certain



ATV trail near village of Anaktuvuk Pass,  
Gates of the Arctic National Park and Preserve.

nearby portions of wilderness areas. They claim that by dispersing ATV use over these lands no long-term adverse effects will occur.

Research was conducted to determine and document the effects of dispersed ATV use in areas where restrictions on such use were eased or lifted. Conditions at the beginning of the summer were documented using low-level aerial photography. This procedure will be repeated after a year of dispersed use. The effects of a known number of ATV passes (determined using time-lapse photography) on established, new, and closed segments of trails were quantified throughout the summer by measuring changes in terrain surface profiles and plant cover.

The study is scheduled to continue for two more years. Managers will use results of the research to provide the access required in ways that minimize impacts.

## Wolves and Moose Studied at Isle Royale for 29 Years

A long-term monitoring and research study of wolves and moose at Isle Royale has provided invaluable scientific data and has captured the attention of the international scientific community. The length of the study, the fact that the research has been conducted in a controlled island environment, and the nature of the data collected have not only provided important scientific information but have also proven to be a magnet for attracting other researchers to Isle Royale.

This Isle Royale study has now been sufficiently long enough to provide a proper appreciation of the variability that is possible in wolf-prey relationships--a cycle period of about 30 years. Extensive data from this study have been important in validating conceptual models and theories in population ecology. In addition, Isle Royale supports one of only two remaining wolf populations in the lower 48 states, and a strong public mandate exists to carefully monitor this endangered species.

In the short-term, the wolf-moose study has provided Isle Royale managers with the necessary data to protect the endangered eastern timber wolf, which is a major park objective. Study information is used annually to manage the distribution of backcountry visitors and for interpretive purposes.

Most national parks have lost all large carnivores, and managing large ungulates and exotics in the absence of natural predators is a continuing problem requiring expensive and controversial management actions. Managers with a better understanding of wolf predation should be able to assess more adequately the natural ecological role of ungulates in parks, and the implications of predator absence.

As man's consumptive use of prey such as moose increases, as it has in some areas of Alaska and Canada, quantitative data on wolf predation of the type gathered on Isle Royale will become even more valuable. As management programs for moose become more extensive, additional attention will be paid to the importance of sex and age structure on productivity and population well-being. Baseline data on natural mortality patterns in the Isle Royale moose population are quite relevant in this regard and comprise the unequalled body of data that is practically unobtainable anywhere else in the world.



Wolves at Isle Royale National Park.

\*\*\* Congress established Great Basin National Park in October 1986. \*\*\*





Time exposure of night sky in southern Utah (Phil Wondra).

### Effects of Light Pollution on Night Sky Evaluated

In 1986, the Air Quality Division developed a model to estimate the effects of light pollution on the night sky. The model was initially applied in Canyonlands National Park to evaluate light pollution from night operation of a proposed nuclear waste repository near the park boundary.

Estimates of human perception on the effects were made in order to evaluate the changes in the night sky as perceived by an observer. The results of the study revealed that the predicted potential light pollution from the proposed facility would be perceptible in both a clean atmosphere with visibility greater than 200 miles, and a polluted atmosphere with visibility near 20

miles. The closer an observer is to the light source, the greater influence the light pollution from the source has in diminishing the beauty of the night sky to the observer.

The computer model is currently being applied at Bryce Canyon National Park to assess the effects of man-made lighting from a proposed surface mining operation on visitors viewing the night sky.

Many national parks are prime areas for viewing the night sky. Yovimpa and Rainbow points in Bryce Canyon have been praised by professional astronomers for their spectacular night sky views. Wheeler Peak, in the new Great Basin National Park, Nevada, has been recommended by the National Science Foundation for locating a new

astronomical observatory because of its high elevation, clear air, and minimum man-made light pollution.

The beauty of the night sky is particularly spectacular in high terrain areas above air pollution and away from sources of man-made light that reduce the ability to see the fainter celestial objects.

Air pollution intensifies the effect of ambient light by reducing visibility both during the day and at night. Although satellite imagery and computer-generated maps show that light pollution brightens the sky across much of the United States, especially in large urban areas, large regions of the western United States are still excellent areas for viewing the beauty of the night sky.

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Environmental concerns are no longer the private preserve of the birdwatchers: the same bell tolls for us all.

Frank M. Potter, Jr.

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### **Peregrine Falcon Increase In Zion Will it Last?**

Peregrine falcon monitoring in Zion National Park in 1986 revealed that eyrie locations are evenly spaced throughout the park. By projecting this distance into areas that had not been surveyed, two new territories were located, and a third area suspected of being active was confirmed. The number of active territories in Zion is now eight. Although this measurement system has been successful in predicting what habitat areas should be investigated, this method is probably only usable in Zion because of the excellent habitat available.

Peregrine falcons obviously find the steep-walled canyons of Zion an ideal place to

nest. The density of this population is probably one of the highest in the continental United States.

The number of juveniles fledged has generally been at the minimum level necessary to maintain the current population. Unfortunately, eggshell fragments recovered in 1985 revealed a thinning problem. The Zion falcons are laying eggs 21 percent thinner than normal. Because of the thinning problem and the continued use of pesticides in suspected wintering areas, predictions for the continued survival of this population are not optimistic. Careful monitoring of the population is continuing and any decline in reproduction will be detected.

### **COMMON Database Goes On-Line**

The National Park Service COMMON database became operational in June 1986. This NPS database is a resourceful computerized information system that contains a variety of topics for each park unit. For the first time, this compendium of multidisciplinary information--such as park directory, resource, budget, personnel, visitation, and planning--is available on a servicewide basis through one system.

One application of COMMON for natural resources management illustrates how the system supports NPS activities. Using COMMON's PESTS module, the Southwest and National Capital regions are transmitting and processing their park pesticide use requests. They anticipate a significant reduction in the time required to compile this information.

Using COMMON increases opportunities for parks to share information and to benefit from the experiences and results of other parks with similar resources and resource problems.

COMMON also includes information on park threatened, endangered, and exotic species;

park ecological classifications; park resource types; resource threats; and park special designations.

The system is being expanded in 1987 to include modules on park flora and a servicewide natural resources personnel directory.

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There once were men capable of inhabiting a river without disrupting the harmony of its life.

Aldo Leopold  
"Song of Gavilan" 1940

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### **Water Modeling at Voyageurs Applicable to all River Systems**

To provide information to park managers on a key park resource of Voyageurs National Park, the Water Resources Division developed a simple three-reservoir network model which represents the major hydrologic drainage system of Voyageurs. This network model, when used with historical flow records, provides a useful tool for estimating lake levels and discharges when structures such as dams control lake levels.

The utility of the water network model rests in its ability to generate results rapidly from numerous alternative operating schemes. The model can provide quantitative data for managers to assess what operating changes are appropriate for protecting the park's natural resources. The network simulation at Voyageurs evaluates what lake levels are needed to enhance wild rice propagation and walleye pike reproduction and to reestablish seasonal lake levels.

Network modeling is widely applicable to all river systems. Specific configurations

and constraints are mathematically formulated to characterize features that may be of particular interest to the Park Service. This modeling tool can be tailored to any river system and provide results without altering the physical system and without waiting months or years to evaluate the impacts of any changes.

### **NPS Automates Air Quality Monitoring Network**

Because data processing and data validation are both time-consuming and subject to operator error, the Air Quality Division (AQD) is gradually phasing in automated data acquisition systems throughout the air quality monitoring network. As of December 1986, 17 stations in 13 units had been automated. Automating 11 existing stations and 10 new stations will be completed by summer 1987.

Before 1986, the National Park Service relied on manual data reduction from strip chart recorders to obtain hourly concentrations of monitored components. Field personnel manually performed data validation checks, such as instrument calibration checks and data precision checks. By adding data acquisition systems, these functions can now be performed automatically or remotely activated. Adding telephone lines to some sites allows for the nightly transfer of data to the AQD computers in Denver, where the data are routinely checked for completeness and validity.

The Park Service monitors levels of selected pollutants within parks (1) to facilitate research on air pollution effects on natural resources; (2) to establish baseline concentrations and long-term trends; (3) to evaluate the effects of new industrial growth near park units; and (4) to support NPS research on air quality modeling.



## Fire Research Conducted in Alaska

A fire research project to study fire and its effects in the Alaska parks continued in 1986. During the last four summers, four field teams gathered fire-related data at Denali, Lake Clark, Wrangell-St. Elias, Gates of the Arctic, Katmai, Kobuk Valley, Yukon-Charley Rivers, Noatak, Bering Land Bridge, and Cape Krusenstern.

Most trees of the boreal forest in Alaska are not fire resistant and are usually killed by fire. The resulting snags create "ghost" forests which may persist for years.

Some idea of the historical role of fire in forested parks is obtained by cross dating tree-ring samples from snags with dated local tree-ring width chronologies to determine the last year of growth for the fire-killed trees. The burned area can often be determined from the vegetation mosaics apparent in aerial photographs and satellite imagery.

Plant composition on similar habitats within and adjacent to burned areas was sampled to learn more about vegetation dynamics following fire. The density, age, and mean annual radial growth for all tree species present were determined by size classes, and all plant species were sampled.

When analyzed, these data will determine the various successional patterns and stages present and permit inferences to be made concerning the intensity of a historical fire.

In addition, ground coverage and fuel inventory data were collected from numerous sites. These data will be used to derive the landcover analysis from satellite thematic mapper data which will form a basic layer in the GIS database being developed for each park.

The teams also gathered fire behavior and weather information from ongoing natural fires in the parks. These data, along with the fuel inventory information, will be used to refine models for predicting fire behavior in Alaskan fuel types.

Information from this study will be used in developing comprehensive fire management plans for each park.

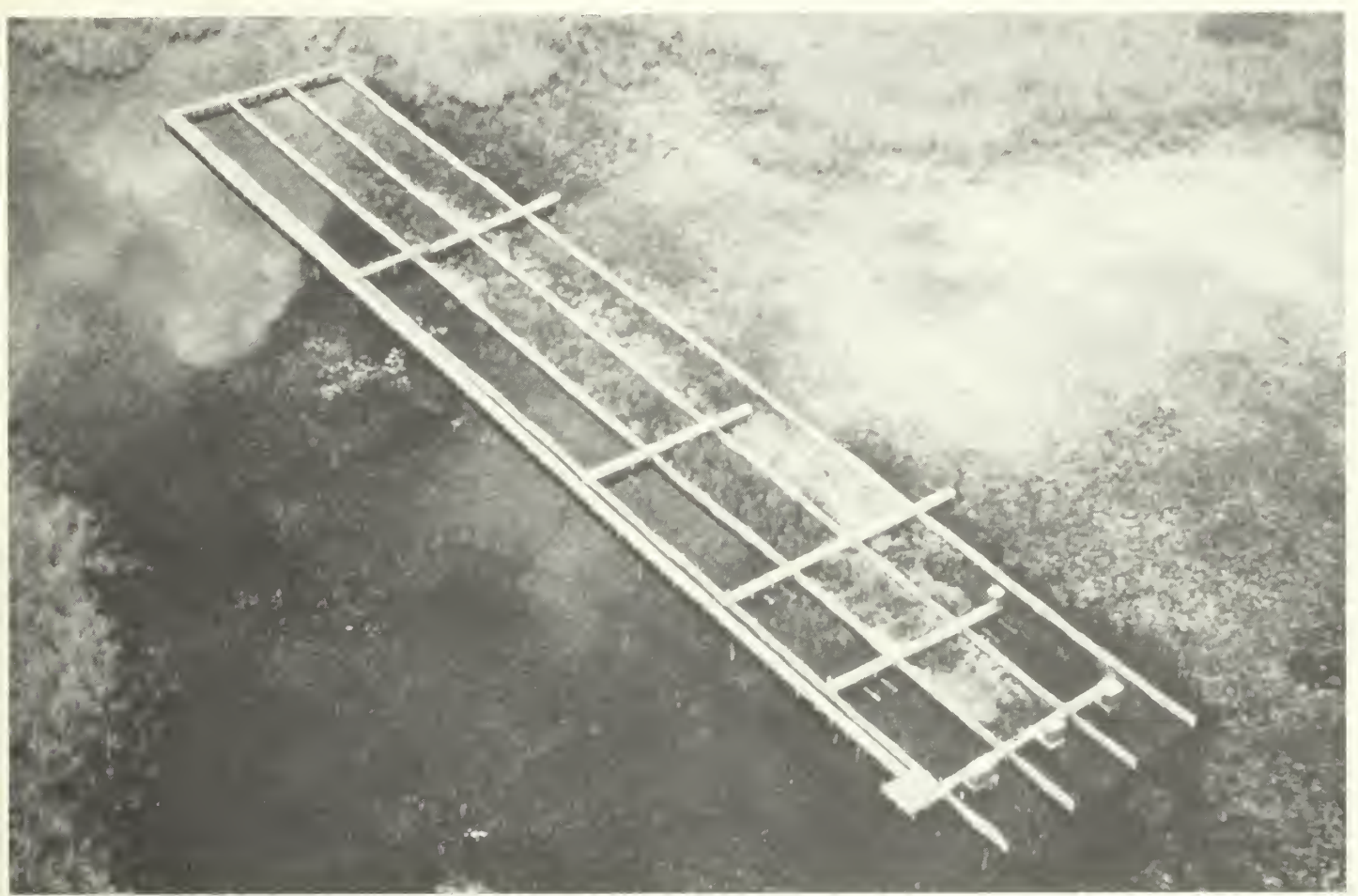


Sampling vegetation in a "ghost" forest, Denali National Park and Preserve.

## Glacier Bighorn Monitored by Satellite

Satellite telemetry is being used to monitor bighorn sheep in Glacier National Park. The satellite tracking will assist Kim Keating, a seasonal wildlife biologist, in genetic research on bighorns in isolated populations.





Nutrient experimental site in Shark River Slough, Everglades National Park.

### **Nutrients Alter Marsh Community Structure in Everglades**

The South Florida Research Center, Everglades National Park, recently completed an 18-month field study in which increased phosphorus and nitrogen nutrients were continuously added to experimental channels in the Shark River Slough. The purpose of the experiment was to evaluate the potential effects of increased nutrients coming to the park.

An analysis of the data indicates that while the marsh system has an ability to rapidly assimilate additional nutrients,

even slight increases in phosphorus or nitrogen altered algae biomass and community structure. Algae serve as the basis of marsh aquatic food webs and are important in marsh water chemistry processes. In addition, species composition of the natural higher plant community was altered, and great increases in the rate of bacterial decomposition were documented. All of these changes, in turn, may potentially alter higher levels of marsh ecosystem organization.

Everglades National Park lies downstream of one of the most intensively managed water systems in the United States. Various

water management strategies throughout recent years have adversely affected the park. Excessive nutrient problems in Lake Okeechobee, and proposed solutions, may increase nutrients coming to the park. The state of Florida is considering alternatives for water quality management upstream of the park.

Data from this study will assist park managers in assessing water quality standards for water delivered to Everglades National Park.

\*\*\* Dr. Dominic Dottavio became regional chief scientist in 1986 for the Southeast Region. \*\*\*

### GIS Provides Key Tool for Alaska Parks

During 1986, the Geographic Information Systems (GIS) Division continued to work with the Alaska Regional Office in developing the GIS database for all the Alaska parks. The millions of acres, the diversity of park resources, and the complex management issues in Alaska dictate using state-of-the-art technology such as a geographic information system to efficiently manage and analyze the enormous amount of information. This computerized technology creates, manages, analyzes, and displays mapped information on park resources entered into the database.

Initially the database was constructed from satellite data and digital topographic data (elevation, slope, aspect) for information on vegetation, landcover, and fire fuel models. The database was expanded to assist in the minerals management planning and impact assessment activities for Denali and Wrangell-St. Elias. This phase of the overall GIS program is being carried out in cooperation with the Denver Service Center.

The Alaska experience once again points out the flexibility and multifaceted capabilities of GIS databases. Even though a GIS database may initially be developed for one set of applications, that database (with or without adding new information) usually has value for other applications as well.

By early summer 1987, all components of the GIS program (computer hardware, software, and database) will be available at the Alaska Regional Office, as well as at the Geographic Information Systems Division in Denver, Colorado. Locating the GIS components in Alaska places this powerful tool in the hands of those who will need it for day-to-day decision making.

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Nature never breaks her own laws.

Leonardo da Vinci

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### Bioindicators. A New Monitoring Technique

The Water Resources Division has begun new research to develop biological indicators (bioindicators) for assessing environmental impacts. These bioindicators use attributes of single species populations, communities, and ecosystems to summarize a complex array of data into simpler, more interpretable indices. These simpler indices can be used to determine environmental health and degrees of environmental stress. For example, these indicators consider such things as (1) the population structures, (2) the number of species and distribution of individuals composing communities, (3) the similarity of impacted and pristine communities, and (4) the overall metabolism of the entire ecosystem.

Research projects using bioindicators are in operation at Acadia, Olympic, Capitol Reef, and Zion national parks and St. Croix National Scenic Riverway.

## ACTIONS AND INITIATIVES

The NPS natural resources management programs are a mixture of activities conducted by various units and offices throughout the Park Service. These activities include the numerous individual resources management actions at the park level, the research projects at the regional level, which includes Cooperative Park Study Units, and the servicewide programs at the national level. This section describes only a few of the many many resources management actions and initiatives taken in 1986 to protect and preserve park natural resources and values.

### Natural Resources Interpretation

The Western Region organized two major natural resources interpretative workshops in 1986, one on desert ecosystems and another on Pacific mountain parks. Interpreters, park managers, resource managers, and scientists from both the Washington Office and the field participated in the workshops.

The region is planning workshops on island ecosystems, large animal management, and coastal barrier islands for 1987.

Dick Cunningham, Western Region, Chief, Interpretation Division, initially tested the workshop approach in 1985 with a pilot workshop on coastal parks. Cunningham is developing recommendations for improving interpretation of natural resources issues based on the three workshops he has chaired to date.

Several other developments in natural resources interpretation occurred in 1986. The Western and Rocky Mountain regions began incorporating plans for interpreting resource management projects into their resource management plans. The Air Quality Division developed and distributed air quality materials to over 60 park units for use in park interpretive programs and activities. Major exhibits have been

constructed for several parks, including Bryce Canyon, Grand Canyon, and Great Smoky Mountains. These exhibits focus on how air pollution is transported into parks and what effect it has on park resources.

The Interpretation Division developed and distributed generic interpretive materials on fire management. Two workshops are proposed for 1987, one on acid rain issues and the other on criteria natural resources issues. Also planned are generic interpretive materials on exotic and extirpated species, acid rain, and biological diversity.

\*\*\* A NPS outreach task force met in Washington in December 9-11, 1986, to develop a servicewide program of interpretative and environmental education initiatives. \*\*\*

### Cuyahoga Valley and Mammoth Cave Plug Wells

Cuyahoga Valley National Recreation Area and Mammoth Cave National Park continued their programs in 1986 to plug abandoned oil and gas wells within park boundaries.

Both parks are working closely with the Energy, Mining and Minerals Division's petroleum engineer, Leslie Vaculik, and their respective state oil and gas commissions to plan and complete the plugging work. Cuyahoga Valley has plugged 12 wells and plans to complete 12 more when funds become available. The Mammoth Cave work started in 1985 when 2 wells were plugged. The park plugged 3 more natural gas wells in 1986 and is planning to complete 4 wells in 1987.

The programs are part of an ongoing effort to properly plug abandoned wells that are posing a threat to park resources and visitor safety.



## Pigs Controlled at Hawaii Volcanoes

Resource managers at Hawaii Volcanoes National Park began the fourth year, and at Haleakala the second year, of their intensive nonnative pig control program. Feral pigs devastate the forests of the parks so rapidly that, in unmanaged areas, park managers saw widespread ecosystem changes in 1986 alone.

The pigs at Hawaii Volcanoes are affecting the park in ways that are typical of nonnative species. Their rooting, digging, and wallowing activities that turn the soil have disrupted native vegetation and wildlife species. These activities over time have changed forest ecosystems so much that these ecosystems are highly susceptible to invasions by nonnative species of plants and animals. Some of the damage that has already occurred is irreversible. In Haleakala, for example, the vegetation and bird life of the Valley Koa ecosystem have been irreversibly altered.

The resource management staffs are concentrating on saving specific areas in the park that are of special ecological importance and areas where the likelihood of success is highest. The program involves fencing, removing the pigs from fenced areas, revegetating the most severely disturbed areas, and monitoring the treated areas to assess results and identify needs for follow-up activities.

The staffs use professional hunters, dogs, cages, traps, snares, and even infrared scopes to find the pigs. They must be thorough because in good pig habitat any remnant pig population can double every six months.

Most of the pigs probably will be removed from the park over the next 10-15 years, but it will be necessary indefinitely to maintain the fences, remove any newly discovered pigs from the park, and assist the recovery of park vegetation and fauna from the effects of the pigs.

When we speak of nature's arteries, it would be natural to think of rivers.

John H. Storer  
The Web of Life 1953

## NPS Protects Water Resources

During the last year the National Park Service initiated an aggressive program to protect park water rights. Although most water rights are decided by state water courts, some states are entering into negotiations with the federal government to reach mutual agreements regarding water usage. In 1986, the Park Service negotiated with the Montana Reserved Water Rights Compact Commission to determine reserved water rights for park units in Montana. Negotiations continue, but already the commission has acknowledged the need to recognize the quantity of water required for maintaining the water-dependent environment of the Flathead River system on the west side of Glacier National Park.

Also in Montana, the Park Service has entered into settlement discussions with other water users to divide the waters of Reese Creek (a stream flowing through Yellowstone National Park) for park (instream) uses and agricultural and domestic uses of adjacent landowners. Reese Creek is unique because it flows entirely within Yellowstone National Park and parallels the adjacent Royal Teton Ranch (also known as the Church Universal and Triumphant). The stream is the only watercourse in the park where adjacent landowners have entitlement to part of the flow for irrigation and other uses. Adjacent landowners have used the entire flow of Reese Creek in past summers. Although it is not clear what the water rights are for each party, the Park Service feels it is entitled to some of the available flow to maintain park purposes, including riparian vegetation, wildlife, and the cutthroat trout fishery. The



Service is committed to protecting these values.

Obtaining and protecting water rights through state courts are not easy tasks. For example, in early 1986, the Park Service suffered a setback for its reserved water rights claim for Dinosaur National Monument. In 1974, water rights were claimed to maintain water levels in the Yampa River necessary for rafting, to sustain endangered fishes, and to protect the river's ecosystem. In 1982, the Colorado Supreme Court ruled that the recreational and fish habitat uses were not specified as purposes of establishing the monument so the Park Service could not claim reserved water rights for those purposes. The Colorado Supreme Court referred the case back to the Colorado water court, and that court denied the Park Service the federal reserved water rights for water to maintain the ecological system and recreational uses of the Yampa River. The Park Service is evaluating alternatives to obtain water needed to fulfill its purposes at Dinosaur.

Currently, the Park Service is a party in Utah's basinwide adjudication of water rights in the Virgin River involving private parties and federal enclaves including Zion National Park. Because the park is located midway in the basin, potential for upstream development exists. The Service is particularly concerned with changes in water flow that might affect the river's fish population, the nature and extent of vegetation along the river bank, and the river's scenic and aesthetic qualities. Consequently, staff from the Water Resources Division and park are inventorying Zion's water resources and carefully assessing needs at the park so a comprehensive water rights claim can be filed in the adjudication.



Virgin River in Zion National Park.

There is an eagle in me and a mockingbird...the eagle flies among the Rocky Mountains of my dreams...the mockingbird warbles in the early forenoon before the dew is gone, warbles in the underbrush of my Chattanooga of hope, gushes over the Ozark foothills of my wishes--and I got the eagle and the mockingbird from the wilderness.

Carl Sandburg

### **NPS Adopts Wilderness Management Recommendations**

The National Park Service adopted the findings and recommendations of a task force as general guidance for a NPS initiative in wilderness management. Specific steps already have been taken by some parks and regional offices, and additional steps will be taken in 1987.

The task force developed six recommendations and a five-year plan of proposed implementation. Recommendations were (1) that wilderness representatives be designated in the Washington, regional, and, as appropriate, park offices; (2) that NPS techniques for managing wilderness be reassessed; (3) that wilderness use be restricted to those uses which remain within the limits of the wilderness condition and that management of such use be guided by a computer-based system; (4) that encouragement, education, and information be provided to NPS personnel for understanding wilderness ethics, philosophy, and techniques; (5) that efforts be made to increase public understanding of wilderness management needs; and (6) that an interagency national wilderness group composed of managing agency representatives be formed.

Wilderness specialists from the National Park Service, the Bureau of Land Management, the U.S. Forest Service, the U.S. Fish and Wildlife Service, the Office of the Solicitor, the National Parks and Conservation Association, the Conservation

Foundation, and the Audubon Society made up the task force. These wilderness specialists reviewed wilderness management policies and issues, the intent of the Wilderness Act of 1964 as applied to the overall NPS mission, and wilderness management programs of other federal members of the national wilderness preservation system.

\*\*\* Director Mott has designated 1988 the "Year of Clean Air" as the theme for servicewide interpretation. \*\*\*

### **NPS Increases Use of Prescribed Fires**

The National Park Service is increasingly using prescribed burning as an essential natural resources management tool. Prescribed fires are useful in replicating the natural cycle and role of fire and in preventing major uncontrolled fires that might have disastrous consequences. Using fire as a tool, however, poses difficulties for resource managers, such as the need for a good research information base to develop a fire program.

In addition to the fire research being conducted in Alaska, new research was done at Pipestone National Monument, and fuel reduction programs are beginning at Crater Lake National Park as the first step toward reestablishing a more natural role for fire. Research in fire history and fire effects is being conducted at Big Cypress in saw grass and at Redwood National Park in oak woodlands, prairie, and conifer forest. A fire database is in an early stage of development at Santa Monica Mountains for chaparral. Prospects for using fire in some of the smaller northeastern areas, including battlefields, are also being evaluated.

Clearly fire has played a natural role in most vegetation systems, but using prescribed fire must be carefully evaluated. In some areas, such as at Hawaii Volcanoes, fire benefits exotic plants at the expense of natives. Natural fire regimes within a vegetation type may vary greatly, requiring a variety of prescriptions.

The increasing use of prescribed fire is not without its costs. In the Western Region, a comprehensive training program for prescribed fire managers has resulted in the need for well-trained personnel. In Rocky Mountain National Park, moving from a full suppression fire policy toward a prescribed fire program has required a substantial reinvestment in planning, coordination, and public involvement.



Prescribed burning at Pipestone National Monument.

\*\*\* The second class of natural resource specialist trainees "graduated" on September 25, 1986, receiving their completion certificates from Director Mott. \*\*\*

### **NPS Expands Natural Resources Training**

The National Park Service made a substantial commitment in 1986 to expand natural resources management training. Service-wide training opportunities were increased, and the natural resource specialist trainee program was continued with a third class of trainees. Priorities in subject areas, specifically in wildlife and vegetation management, were redirected to meet the needs of field personnel.

In response to a 1986 survey of servicewide training needs, the regions requested over 1,500 training slots for natural resources staff. Identified training needs were for courses in general natural resources management and for courses beyond the basic skills level.

The Park Service plans to address some of these needs in 1987. For the first time, the Service has decided to offer intermediate-level training courses in vegetation and wildlife management and in computer applications for natural resources management. Also for the first time, the Park Service will schedule more specialized subject area courses in wilderness management, natural resources law, air quality monitoring, and fisheries and aquatic habitat management.





Terry McEneaney adding nest material to a floating nest platform at Yellowstone National Park.

### **Trumpeter Swan Nesting in Yellowstone More Successful**

Management biologist, Terry McEneaney, at Yellowstone reports that although 1986 was a record year for flooding in the park, a total of 12 young trumpeter swans managed to reach the fledgling stage.

Although still too early to be sure, a three-year experiment involving artificial floating nests and refurbishing nest substrate techniques may be enhancing the trumpeter swan population. Trumpeter swans laid eggs on one of the three artificial floating nests and managed to hatch three young swans.

The trumpeter swan population in the Greater Yellowstone Ecosystem reached its peak in the 1960s but since that time a dramatic decline has occurred. In the last six years, the resident trumpeter swan population has dropped 28 percent. This decline was due mainly to lead poisoning from duck hunters' shots and fishermen's sinkers and nest flooding resulting from adverse weather conditions.

The trumpeter swan is considered a rare bird in North America. By the early 1900s the population was so low that some scientists believed it was headed for extinction. Yellowstone National Park and Red Rock Lakes National Wildlife Refuge have played a leading role in the conservation efforts to protect this species.



Each grass-covered hillside is a page on which is written the history of the past, conditions of the present, and predictions of the future. Some see without understanding; but let us look closely and understandingly, and act wisely.

Dr. J.E. Weaver  
North American Prairie 1954

## Videotapes on Natural Resources Are Available

Under the auspices of the servicewide training program, several videotapes were produced in 1986 on a variety of natural resources topics.

The Energy, Mining and Minerals Division produced a videotape that presents an overview of mineral issues in park units. Most audiences have been surprised by the scale of mineral activity and the resulting environmental consequences.

The Air Quality Division produced a videotape that focuses on air quality issues affecting park resources and how these issues are being addressed by park managers.

The Science Support Staff produced two new videos on integrated pest management techniques, one on pesticide applicator safety, the other on termite biology.

A videotape on GIS applications and an introductory integrated pest management videotape continue to be in demand.

## Prairies Surveyed in Great Plains

The Midwest, Southwest, and Rocky Mountain regions completed a survey in 1986 of prairies in national parks within the Great Plains. The principal investigator for the project was Dr. James Stubbendieck, professor of range ecology at the University of Nebraska-Lincoln.

The survey produced a list of parks with prairie and the type, acreage, and condition of prairies within these parks. The survey also identified and consolidated known information on prairie management into references and guidelines for park resource managers.

Initial results of the survey showed that within the Great Plains area 32 parks have prairie totaling approximately 274,000 acres. This is only a small percentage of the original midcontinent prairie ecosystem, and 10 of the 32 parks have restored prairie.

For each of the 32 parks surveyed, additional information was collected on current vegetation, past management, and adjacent land use.

There are no islands any more.

Edna St. Vincent Millay

### Resource Threat Resolution Drafted

In 1986, the Department of the Interior drafted a policy statement on "Resolution of Resource Threats" and added the statement to the departmental policy manual. The new policy directs the Park Service and other Interior land and resource managing agencies to anticipate, avoid, and resolve resource threats by using existing agency and interagency structures and processes and enhancing them where necessary.

The policy statement summarized the recommendations of a park protection group. This task force learned more about the nature of park protection issues and determined what measures the Interior agencies could take to address the issues.

The Park Service drafted a joint memorandum of understanding with the Bureau of Land Management as part of the effort to support the new policy. The agreement extends to all planning and program activities of the two agencies that relate to administrative and management activities. These activities include land use and resource management planning, environmental protection, visitor and information services, training, and research.

### Revised Mineral Regulations Eliminate Confusion

Last year when the Bureau of Land Management revised the regulations for federal mineral leasing, the Energy, Mining and Minerals Division worked with the Bureau to increase protection of units in the national park system by removing language that was subject to misinterpretation.

The previous regulations stated that the leasing of federal minerals was prohibited in "national parks" and "monuments." A literal interpretation of this provision in the old regulations sometimes was read to mean that the Bureau could issue federal mineral leases in units other than those called parks and monuments.

The new BLM regulations state that federal mineral leasing is prohibited on "lands within the boundary of any unit of the national park system, except as authorized in law." The revised regulations eliminate any possible confusion.

## COOPERATIVE ACTIVITIES

The parks do not exist in an ecological vacuum, and the Park Service does not exist in a managerial one. It is, therefore, imperative that the Service continues to increase cooperative activities with park neighbors and with others whose expertise can be of assistance. This section illustrates the diversity of those cooperative activities and some of the benefits.

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We travel together, passengers on a little space ship, dependent on its vulnerable resources of air and soil; all committed for our safety to its security and peace; preserved from annihilation only by the work, the care and, I will say, the love we give our fragile craft.

Adlai Stevenson

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### NPS Joins Space Program

In October 1986, NPS resource managers, scientists, and interpreters met in Yosemite to form a steering committee for planning an interagency NPS/NASA workshop.

Dr. Paul Sebesta, research scientist with the NASA Ames Research Center, Ecosystem and Technology Branch, assumed the leadership to organize and find funding for a workshop with NASA and NPS researchers, scientists, and interpreters.

In preparing for the proposed workshop, NASA plans to conduct two interagency cooperative demonstration research projects, one at Golden Gate and one at Yosemite. These projects will serve as prototypes on which future interagency projects can be carried out on a national basis. At the same time, funding requests to support the workshop are under consideration at NASA, and the steering committee is working on a final agenda.

Don Scott, a private citizen and former California State park ranger, was convinced that NASA and the National Park Service should develop interagency cooperative projects. He felt that NASA research and work in space exploration was parallel to NPS work and that the two agencies shared similar goals.

Don contacted Len McKenzie, Chief of Interpretation at Yosemite National Park, and Marti Leicester, Chief of Interpretation at Golden Gate National Recreation Area, and the three of them began working with NASA.

Don's vision for interagency cooperation included the following areas: (1) NASA remote sensing technology could be used by NPS researchers and land managers. (2) The technology developed by NASA to explore the available resources of space could be used to explore and research the resources of parks. (3) From a sociological perspective, living in isolated park areas has many similarities to the isolation of life in a space station or on a spaceship. Research in these areas might benefit both NASA and the Park Service. (4) Both agencies share the common goal to improve interpretive and educational activities and communications with the media that would foster public understanding of the research programs of each agency, the technology, and the results.

\*\*\* In September 1986, Dr. Christine Schonewald-Cox, University of California-Davis, headed a NPS task force on conserving gene pools. The task force has since proposed NPS biological diversity action plan. \*\*\*



## Bison Research in Badlands Has Wide-Ranging Implications

Bison research in Badlands National Park is an example of cooperative efforts between the National Park Service and other institutions. The Smithsonian Institution and the National Geographic Society are providing research funding, and the Park Service is providing logistical support and housing for the research team.

The bison of Badlands are currently the subject of a study on ungulate reproductive ecology. Dr. Joel Berger, University of Nevada-Reno, began research in 1985 using bison as a model to better understand the genetic consequences of population size and inbreeding on large mammals in isolated reserves.

Berger and his associates have collected data on age, sex, size, home range, fecundity, and habitat use of individual bison during thousands of hours of field observation and during the park's bison roundups. A roundup in September 1986 allowed researchers and park rangers to immobilize 28 bison and gather blood samples for genetic analysis.

The Badlands bison herd, which currently numbers about 450, comes mostly from animals reintroduced from Theodore Roosevelt National Park in 1963, but also includes some animals brought from Colorado National Monument in 1983.

The tagged and identifiable Colorado bison, which are highly inbred, offer an important opportunity to contrast growth rates and reproductive success between the park's two founding populations.

In the next two years, researchers will continue to examine the genetic aspects of the present herd. Berger, who has previously worked with the National Zoological Park, Smithsonian Institution's Conservation and Research Center, believes that information about ungulates in parks may

help conserve large mammals elsewhere in the world, such as the wisent, an endangered European bison.

Recommendations from the study may cause park managers to revise their strategies for bison management in Badlands. Results will also be of interest to managers of other island-like reserves.



Bison in chute before being measured and sampled, Badlands National Park.

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The Nation behaves well if it treats its natural resources as assets which it must turn over to the next generation increased and not impaired in value.

Theodore Roosevelt

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## International Commission Investigates Cabin Creek Mine

As part of the International Joint Commission's ongoing investigation of the proposed Cabin Creek coal mine in Canada, north of Glacier National Park, the Water Resources Division continues to participate in the analysis of potential impacts of the mine on water quality and quantity, fisheries, water uses, and the implications of special designations applicable to the North Fork of the Flathead River.

Since 1985, the National Park Service has participated on the Flathead River International Study Board. Dan Kimball, Water Resources Division, is a member of the board representing the United States. The study board is composed of six members, three from Canada and three from the United States. Glacier National Park staff and other NPS personnel serve on three of the technical committees.

Potential environmental impacts to Glacier National Park as a result of the proposed mine include possible adverse impacts to water quality and quantity, air quality, aquatic and terrestrial wildlife, and increased human use in wilderness areas.

Sage Creek Coal Ltd., proposes to construct and operate a surface coal mine, the Cabin Creek mine, in southeastern British Columbia, Canada. The proposed mine is located approximately 6 miles upstream of the international boundary on the North Fork of the Flathead River. This river comprises the western boundary of Glacier National Park, which is part of a Biosphere Reserve and has been nominated as a World Heritage Site. The North Fork of the Flathead River has also been designated by the United States as a Wild and Scenic River.

## Anglers Not Affecting Rainbow Trout in Katmai

Through a cooperative agreement with the Alaska Department of Fish and Game and an interagency agreement with the U.S. Fish and Wildlife Service, the Alaska Regional Office conducted rainbow trout studies in the Naknek River Drainage, Katmai National Park, Alaska, during 1983-86. Ross Kavanagh, fishery biologist, administered both agreements.

The studies focused on determining rainbow trout sport harvests; angler effort and distribution; fish population parameters such as age, length, and growth; spawning areas; stock identification and separation; fish distribution; and intrasystem movements.

Present sport-fishing levels are not adversely affecting the size, age composition, or numbers of available trout throughout the Naknek River system. Spawning surveys indicated sufficient numbers of spawners to perpetuate populations and to provide quality sportfishing. A growing "catch and release" philosophy contributes to relatively few rainbow trout retained by anglers. Radio tagging of 46 rainbow trout defined two largely separate locally adapted populations, Brooks River and Naknek River fish, which do not share habitat to a significant degree.

The Naknek River Drainage is approximately 3,700 square miles and is composed of seven large lakes interconnected by rivers.

To inquire into the intricacies of a distant landscape, then, is to provoke thoughts about one's own interior landscape, and the familiar landscapes of memory. The land urges us to come around to an understanding of ourselves.

Barry Lopez  
Arctic Dreams 1986

### **Utah Takes First Step To Protect Scenic Views**

In January 1987, a Utah Citizen's Advisory Committee recommended identifying and protecting the integral vistas associated with Utah national parks. The committee said:

"We believe that the visibility and ability to see the great scenic vistas in Southern Utah is a rare and unique treasure. We believe that it should be preserved, both for the benefit and pleasure of Utah residents, and to support our large tourist industry. To protect it, we believe that industries that emit [visibility-degrading] pollutants should be required to locate only where their emissions will not measurably damage these vistas."

Utah's Governor Bangerter appointed the committee to study the question of visibility protection in scenic vistas and to make recommendations to Utah decision makers.

Utah park managers took a proactive stance on the issue. They attended committee meetings and hosted visits to the parks so that committee members could become familiar with the resources. They also called on technical experts from the Air Quality Division to brief committee members on various subjects.

The committee's recommendation was far from inevitable. Many people interested in developing the rich energy reserves that lie near the national parks in Utah had opposed protecting scenic views.

When presenting the preliminary recommendation to the Utah Air Conservation Committee in November 1986, the chairman began by saying that most people on the committee had gone into the process with their minds made up, but that all of them had changed their minds in the end.

In April 1987, Utah held public meetings to get feedback on the committee's recommendation. A proposed regulation will be developed by July, and a final decision made in August.

The Clean Air Act established a national goal of remedying and preventing visibility impairment in large national parks and wilderness areas. The only way the Park Service can ensure protection of scenic views extending outside park boundaries is to work cooperatively with states and industry.



Integral vista of LaSal Mountains from Arches National Park (John Christiano).





A young ram measured after being captured in Canyonlands National Park.

### **Canyonlands Bighorn Sheep Find New Home in Arches**

In 1986, at the Island-in-the-Sky District, Canyonlands National Park, 42 desert bighorn sheep were captured, measured, and weighed, and ewes were tested for pregnancy before transplanting the sheep to new homes.

The sheep were captured using either tangle nets or a net gun fired from a helicopter. NPS rangers and Utah Division of Wildlife Resources game biologists measured and

weighed the sheep and drew blood samples for laboratory tests. Ultrasound testing checked ewes for pregnancy; 7 of 8 tested were pregnant.

Half of the transplanted sheep went to Arches National Park, and under the direction of the Utah Division of Wildlife Resources, the other half went to BLM lands.

The bighorn sheep in Arches are reoccupying former habitat throughout the park, and now visitors to the park have the opportunity

to watch the sheep in its natural habitat. The desert bighorn sheep were a major component of the ecosystem before man's intrusion extirpated the animal from most of its habitat in southern Utah.

A total of 168 sheep have been transplanted over a five-year period from the Island-in-the-Sky District to Capitol Reef National Park, Glen Canyon National Recreation Area, BLM lands, and the Maze District of Canyonlands.



Sow with cub at Yellowstone National Park.

\*\*\* The National Park Service issued a final rule September 19, 1986, that prohibits trapping in parks except where specifically approved by Congress. \*\*\*

No one who has ever seen a grizzly will dispute its title; shambling, rooting, or frozen against a hillside, fur roughened by the wind, it stirs the heart.

Peter Matthiessen  
Wildlife in America 1959

### Grizzly Bears Increase at Yellowstone--43 Cubs Born

Yellowstone National Park reported an increase in sightings of new grizzly bear cubs in 1986. Observers recorded 23 grizzly sows with 43 newborn cubs, as many unduplicated sightings of sows with cubs as have ever been observed in a single season. This year also recorded the youngest reproducing female ever in Yellowstone (4 1/2 years old).

Combining the increased number of newborn sightings with a female reproducing at such an early age is cause for cautious optimism. One year does not make a trend, however, and it is premature to draw long-range conclusions.

The survival of the park's grizzly population has been the focus of research since 1959. Efforts of the Interagency Grizzly Bear Committee continue to improve our knowledge of bears and to enhance our monitoring of the status of bear populations. Data collection, monitoring, and innovative land management strategies to prevent grizzly bear populations from declining continue to be coordinated among several federal agencies--National Park Service, U.S. Forest Service, U.S. Fish and Wildlife Service, and Bureau of Land Management--and agencies from the states of Idaho, Montana, Washington, and Wyoming.

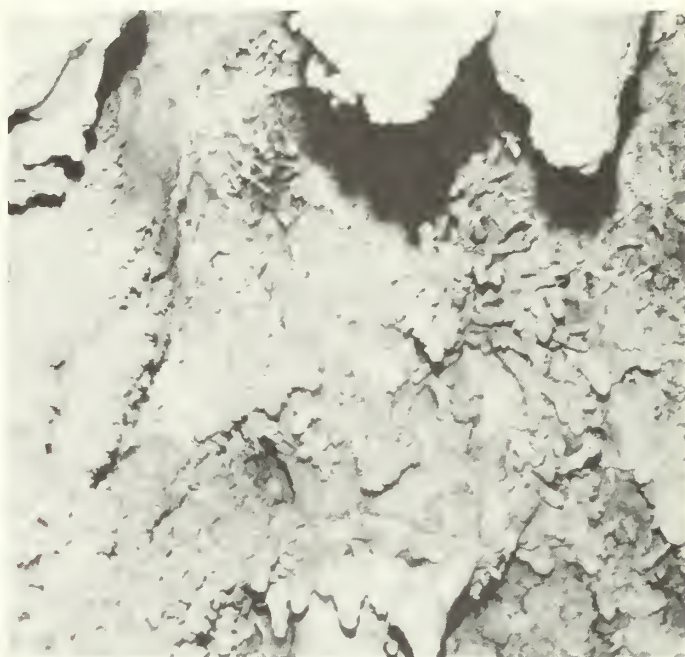
## Timpanogos Grotto Monitors Caves With Photos

Timpanogos Cave National Monument and the Timpanogos Grotto members, National Speleological Society, started a cooperative five-year photo monitoring project in 1986.

Over the next five years, the Timpanogos Grotto members will spend over 2,000 hours in the caves and take more than 10,000 individual photos to fully document the present cave conditions. This is a long-term project, and noticeable change will probably not occur in the lifetime of the participants. This project will establish baseline data against which it will be possible to monitor cave formation growth in the future and to detect any damage that may be occurring due to human use of the caves.

The Timpanogos cave system contains thousands of small, fragile formations. Many are so delicate that any attempt to physically measure them would risk destroying the feature. Photo monitoring is an excellent means of recording much of the needed information without risking damage to the cave features.

\*\*\* The Park Service entered into an agreement with the Cave Research Foundation in 1986 to conduct studies of cave and karst features within the national park system. \*\*\*



A portion of a photo monitoring sheet from Coral Garden room, Middle Cave, Timpanogos Cave system.



## **Multiagency Water Quality Monitoring at Curecanti**

Resource managers at Curecanti National Recreation Area continued cooperative efforts with other researchers in monitoring water quality and fisheries resources at Blue Mesa Reservoir.

In working with other researchers from the Water Resources Division, local water laboratories, Western State College, the Bureau of Reclamation, Colorado Division of Wildlife, and the U.S. Fish and Wildlife Service, Curecanti has established baseline data and determined parameters to monitor the well-being of the water and fisheries resources. Sampling, analysis, and studies are ongoing to test waters and fish for signs of pollution and heavy metals.

The areas upstream of and surrounding the Blue Mesa Reservoir continue to be affected by hardrock mining of heavy metals, uranium tailings dumps, increased human waste, and extensive cattle and sheep grazing. New residential and commercial developments are planned for various land areas around the reservoir. A new sewage waste disposal facility using ultraviolet radiation is scheduled to go on-line just upstream of Blue Mesa, and a uranium residual plume associated with a uranium tailings pile has been discovered to be approaching groundwater supplies.

Blue Mesa Reservoir, the largest of three reservoirs within Curecanti, is 20 miles long and the largest lake in Colorado. Over a million fish are stocked each year, with annual catch levels of over 300,000 trout and salmon. The lake and its surrounding land provide a wintering area for bald eagles, bighorn sheep, and elk and mule deer populations. Over 400,000 fishermen, boaters, windsurfers, and water-

skiers use the water resources. The reservoir also serves as a direct water source for the headquarters complex, park residences, and a major campground.

## EMERGING CONCERNS

This section highlights a few issues that seem destined to be of growing concern to the National Park Service. Some of these issues will be park specific; many will not. Over the next 20 years, many of the problems that will have the most impact on park resources are likely to be environmental concerns originating on a regional or national scale and affecting more than one park unit. In addition to those concerns described, other concerns include acid precipitation, biological diversity, and light pollution of the night sky--all mentioned elsewhere in this publication. These concerns are some of the challenges that must be dealt with if we are to maintain park natural resources "unimpaired for future generations."

### Parks Too Quiet To Measure

Natural sound levels in parks that have been studied are generally very low, often too low for state-of-the-art equipment to measure. Sound levels at Bryce Canyon, for example, have been compared to a high-quality sound studio.

Parks are beginning to address the intrusion of noise on the natural quiet. In the last several years, studies have been made at Bryce Canyon and Zion to determine the noise impacts on visitors from proposed coal mines adjacent to the parks; at Canyonlands to calculate noise impacts on visitors from constructing a nuclear waste repository; and at Glacier National Park to determine impacts of human-made noise on bear populations.

Through these studies the Park Service has determined that visitors are most affected by noise when its decibel level varies greatly from the natural quiet. Further, visitors easily distinguish between existing natural sounds and those introduced from industrial development.

The Park Service estimates that a proposed coal mine adjacent to Zion would result in decibel levels ranging from 43 to 86 in the park. Of concern to the Park Service is that these levels represent a 23 to 66 fold increase over existing sound levels in the park.

No absolute standards define unacceptable levels, duration, or qualities of environmental noise. The U.S. Forest Service has established subjective audibility guidelines to assess noise impacts for various recreational opportunities. These guidelines suggest that acceptable levels of noise intrusion in pristine or wilderness-like areas of park units are 0-10 decibels above background.

With increased development pressures near national parks, and increased aircraft traffic over parks, the effects of noise on the natural quiet of parks will continue to be evaluated.

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Keep these bits of primitive America for those who seek peace and rest in the silent places.

Horace M. Albright, 1933

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## Resource Recovery Facilities Pollute Parks

During 1986, the Air Quality Division reviewed more than 40 permitting actions that had the potential to affect park units. Of these, 7 permit applications were for municipal solid waste resource recovery facilities. All of these facilities are proposing to locate in the eastern United States; however, because of their increasing popularity, these facilities can be expected to be built near densely populated urban areas around the country.

Pollutants from resource recovery facilities are of major concern; more than 15 different pollutants can potentially affect park resources. The pollutants posing the greatest threat are nitrogen dioxide and volatile organic compounds (ozone precursors), sulfur dioxide, sulfuric acid, cadmium, fluoride, hydrogen chloride, and dioxins.

Household garbage contains many combustibles (paper, cardboard, plastic, yard-waste) that create harmful air emissions when burned at high temperatures. Pollutants from municipal incinerators are dependent on the composition of the refuse being burned.

The impacts of these pollutants include ozone damage to major vegetative species (white pine, ponderosa pine), elevated concentrations of sulfur and lead found in lichens, and elevated levels of fluorides in the bones and teeth of deer. Also, heavy metals can affect wildlife resources in many different ways. For example, cadmium is a known teratogen (causes congenital abnormalities), carcinogen (causes cancer), and a probable mutagen (rearranges genetic material), which has been implicated as a cause of several deleterious effects on fish and wildlife.

One pollutant not previously an air quality concern until reviewing resource recovery facilities is dioxin. Out of 75 dioxin isomers, one is the most toxic synthetic compound ever tested under laboratory conditions.

## Minerals Database Uncovers "Sleeping Giant"

The Energy, Mining and Minerals Division completed a servicewide minerals database in 1986 on nonfederal mineral ownership and activity in and around park units.

The database shows that approximately 225 parks contain state or private mineral ownership within their boundaries. Of these parks, about 100 units contain non-NPS mineral rights with a probability of development. The Park Service must either purchase valid nonfederal mineral rights or allow the minerals to be developed. Currently, 550 mineral development operations are present in 40 park units servicewide. Mineral development activity is present in or adjacent to about 150 parks.

In the course of the research, some surprising facts surfaced. Unauthorized federal mineral leases existed in Carlsbad Caverns National Park, Chiricahua National Monument, Golden Spike National Historical Site, Natchez Trace Parkway, and Theodore Roosevelt National Park. Most of these leases have now been eliminated.

In inventorying unpatented mining claims, some 180 claims have been eliminated because they were either located in error or the claimants did not meet all the filing requirements. Approximately 525 unpatented claims remain in parks in the lower 48 states--280 in the new Great Basin National Park. About 1,500 unpatented claims remain in Alaska. The Park Service is performing validity examinations on these unpatented claims in an attempt to eliminate improperly located claims.





Bill Nagle, Energy, Mining and Minerals Division, inspecting mine opening on Mary Draper Ingles trail, New River Gorge National River.

### Abandoned Mines Riddle Parks

Hundreds of abandoned mine sites are found within numerous park units. Open mine shafts and adits, unmarked and unfenced highwalls and exploration trenches, dilapidated and crumbling mining structures, rusted twisted equipment, sharp waste metal, and unexploded blasting caps and explosives are just a few of the hazards that face visitors and employees in many national parks.

Abandoned mines can also affect natural resources from possible heavy metal, PCB, and acid mine drainage contamination of waters; unstable hill slopes; subsidence; and escaping toxic and noxious gases.

The National Park Service has addressed this problem to some extent with active programs to identify, characterize, and mitigate abandoned mine sites.

Organ Pipe National Monument has fenced or gated all of the mine openings in the park and may start a program to blast some of them for a more permanent closure. Big Thicket National Preserve has conducted studies to inventory and characterize abandoned oil wells throughout the park and to determine their impact on park resources. A similar effort is ongoing at Lake Meredith. Death Valley National Monument has devised an inexpensive way of netting mine openings to prevent entry. Capitol Reef National Park has investigated

methods of sealing or backfilling abandoned uranium mine openings. Grand Canyon is in the process of developing a reclamation plan for an abandoned uranium mine on the lip of the canyon. New River Gorge National River is conducting a study to inventory and characterize its abandoned mine sites. A park trail passes through the Kaymoor mine site and past open mine adits, crumbling buildings, and other dangerous mining structures.

Because the Park Service has limited resources to deal with the problems associated with past mining, an interagency agreement is being sought with the Office of Surface Mining, which would provide the Park Service with possible funding and expertise in dealing with the effects of past coal mining sites. Parks initially targeted for work under this program, if approved, are New River Gorge National River, Friendship Hill National Historic Site, and Big South Fork National River and Recreation Area.

### **Search Continues for Nuclear Waste Repository Sites**

On May 28, 1986, the Secretary of the Department of Energy announced that two proposed sites near Canyonlands National Park had not been chosen for intensive testing in the continuing search for the nation's first high-level nuclear waste repository. However, the sites that were selected include the Yucca Mountain, Nevada, site which presents a new set of concerns for the National Park Service because of its proximity to Death Valley National Monument (25 miles). The Department of Energy has pointed out that the ultimate discharge point for any groundwater released from the site would be within the monument. The potential for effects to Death Valley would be significant.

The issue of nuclear waste disposal will continue to be one of major concern for the country and the Park Service well into the future.

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If we are going to succeed in preserving the greatness of the national parks, they must be held inviolate. They represent the last great stands of primitive America. If we are going to whittle away at them, we should recognize at the very beginning that such whittlings are cumulative, and the end result will be mediocrity.

Newton Drury  
NPS Director, 1940-1951

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### **Cumulative Impacts Difficult to Assess**

A major problem facing all land managers is their inability to assess cumulative impacts, the composite effect of multiple actions. The science of assessing the direct impacts of existing or proposed developments is well-defined and rather straightforward. Assessing impacts that are indirect, synergistic, or minor, but collectively significant, however, is quite difficult.

The incremental effect of an action could be, of itself, benign, or of minimal impact, but looked at in concert with other actions affecting the park it could be seriously harmful. In order to avoid being "incrementalized to death," it will be increasingly important to better assess the cumulative impacts of actions on park resources.

NPS D-291





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