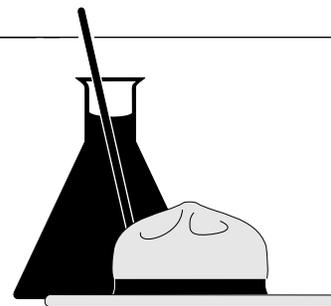


# PARK SCIENCE

Integrating Research and Resource Management



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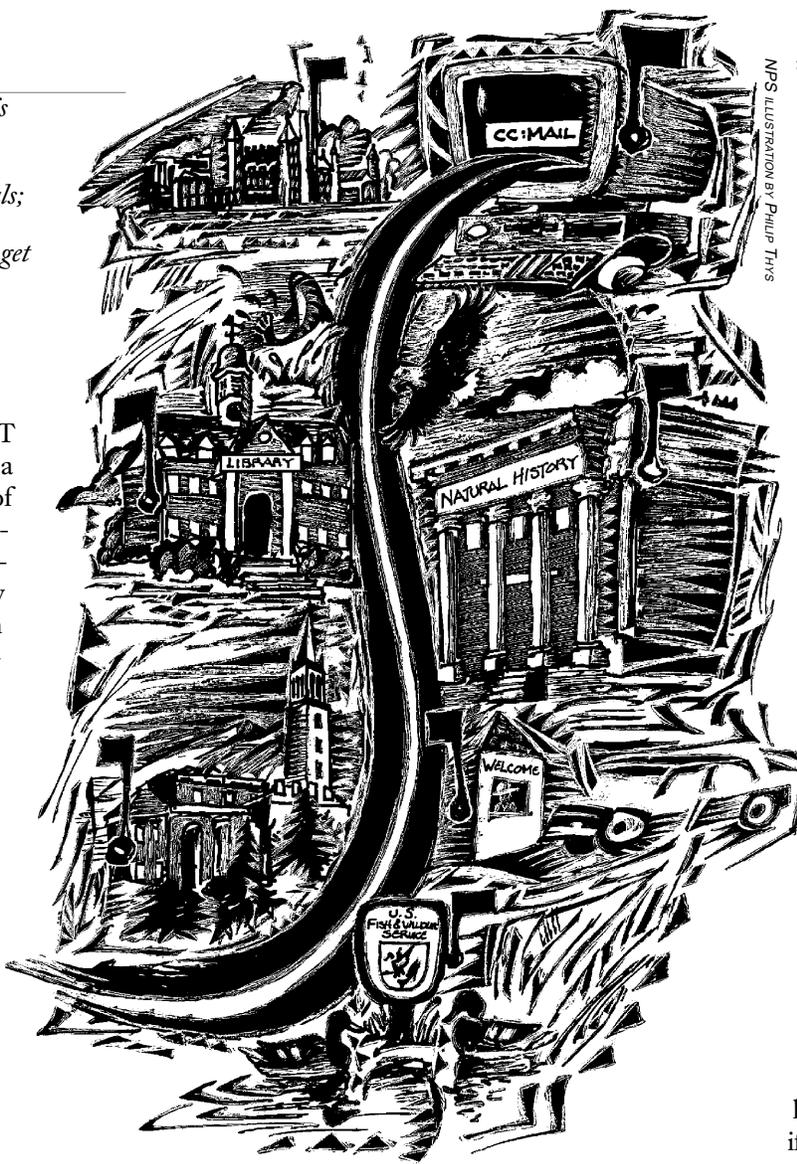
## RETRIEVING BIOLOGICAL INFORMATION OVER THE INTERNET

A Primer for Resource Professionals Using cc:Mail

By STEPHEN FETTIG

*Editor's Note: This article is limited to examples for biologists, ecologists, and natural resource professionals; however, the same e-mail access routes can be used to get legal, law enforcement, geological, cultural resource, and other information over the Internet.*

**T**HE INTERNET has fast become a common part of our lives. Electronic mail (e-mail) addresses are now given out routinely in magazines and on television and radio shows allowing viewers and listeners to ask questions or send comments. Some program hosts and commercial enterprises even point computer users to multimedia World Wide Web pages—the newest and perhaps most popular way of exploring the Internet—for further information. Many state and federal government agencies also have Web pages (including the National Park Service),



NPS ILLUSTRATION BY PHILIP THYS

along with most universities and research centers around the world. Many of these Internet sites provide a great deal of interesting and useful biological information. While some NPS staff already have access to the World Wide Web and its multitude of biological resources, most park employees only have access to cc:Mail, the NPS e-mail software.

To many people it may come as a surprise that most Internet information is available to park personnel right now, with nothing more than our current cc:Mail system. Everyone with access to cc:Mail has access to the Internet. In reality, everyone with e-mail is already part of the Internet, although in a limited way (see side bar on page 16 explaining levels of connectivity). No new hardware, software, or computer equipment is needed to get information from computers from all over the world. Don't get your hopes up too high, however, if the only connection you have to the non-NPS world of com-

*The information superhighway is fast connecting land managers with universities, libraries, the Smithsonian Institution, and museums.*

*Continued on page 16*



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## IN THE NEXT ISSUE

*Look for the articles that were promised for this issue on landslide assessment at Hagerman Fossil Beds and a look back at the first class of natural resource management trainees in 1984. Also, economic assessment of parks in Virginia, rare aster surveys in Alaska, and the pitfalls of pseudoreplication, where ecology research findings can be mistakenly applied too broadly.*

## 1995 AT A GLANCE

TO HISTORIANS, THE INDEXES ON PAGES 29-31 OF ARTICLES published in *Park Science* during 1995 are more than just tools to find information. They also constitute a barometer, indicating the events we considered to be significant enough to document. At a glance, they share advances and declines in the state of the art of research and its application in park resource management. They also reflect the dedication and morale of the professionals that make the connection between research and its use in park management on a daily basis. A snapshot in time, these indexes reveal trends that help us assess where we are and where we are going.

In reviewing the approximately 45 features published last year, several themes are evident. Many focused on projects that could not have been accomplished without the help of partners. As these articles detailed, we do not stand alone in our work, and must reach out to cooperators who can provide funds, staff, equipment, or expertise to help us achieve our goals. Population and landscape ecology articles also appeared, indicating that while we are just beginning to explore ecosystem management, the resources we care for clearly interact in a world that extends far beyond park boundaries.

Restoration activities triumphed in 1995. While the articles probably told only the most successful stories, they showed that with adequate planning, research, funding, and public support, we can bring threatened, endangered, or displaced resources back into areas where they once occurred. Once again we also seem to be making progress, in the post-Yellowstone fires era, in incorporating prescribed natural fire into the scheme of our resource management activities.

Where *Park Science* usually reports techniques, we also delved into analyzing the effects of government reinvention on our work. In this issue, the article on page 24 continues this trend and looks into many of the ramifications of restructuring on resource management.

What will prevail in 1996? Our cover story on retrieving biological information over the Internet may foretell of what is to come. The information age is bringing us greater opportunities to find information easily, even in remote settings, and these opportunities are sure to expand.

*Park Science* will even take the plunge into cyberspace this spring by appearing regularly on the World Wide Web. Printed copies will continue to be circulated and the publication will continue to be edited for core readership, but this electronic medium will help us reach a larger audience and generate stronger interest and support for research and resource management programs. Perhaps historians will remember 1996 as the year that we began to use computers more frequently than printed journals to learn about advances in our fields?



## Dear Editor,

On page 13 in the Highlights section of the Fall 1995 issue you noted that "NPS officials are able to support delisting the peregrine falcon from endangered to threatened status." The U.S. Fish and Wildlife Service (FWS) published a notice that they are considering removing the species from protection under the Endangered Species Act entirely, *not* downlisting the species to "threatened status" (Federal Register. 1995 Jun 30. 60(126):34406-34409). The Fish and Wildlife Service has not yet proposed funding a scientifically credible peregrine falcon monitoring program; rather they will "describe" a monitoring plan in the proposed rule to delist the species. It is extremely doubtful, given recent cuts to the FWS endangered species budgets, that they will fund a scientifically credible monitoring program once the species is delisted.

Mike Britten

Wildlife Biologist

NPS Colorado Plateau SSO

## Dear Editor,

I am a university scientist who has worked on a number of NPS research projects and have received *Park Science* for some time. For us "outsiders," an article on the NPS reorganization would be very helpful, particularly how it affects the NPS research efforts... What has transpired in the reorganization is very much a mystery to me.

Jim Gregory

Department of Forestry

North Carolina State University

**Editor's Note:** The article beginning on page 24 addresses some consequences of the NPS reorganization on research.

## Parks designated world heritage sites

What do the Taj Mahal, the cliff dwellings of Mesa Verde, the Great Barrier Reef in Australia, and the Egyptian Pyramids have in common with Glacier, Waterton Lakes, and Carlsbad Caverns National Parks? They are all world heritage sites. The world heritage site designation recognizes both natural and cultural sites that have been deemed to be of outstanding universal value to all citizens of the world. The honor was bestowed on the parks at a December meeting of the World Heritage Committee in Berlin, Germany.

The World Heritage Convention, an international treaty ratified by 147 nations, governs the designation and preservation of world heritage sites. To be inscribed a world heritage site, nominees must meet several criteria that define "outstanding universal value." For example, natural site nominees must exhibit major stages of earth's natural history or its ongoing geological, ecological, or biological processes, among other criteria. Conditions of integrity must also be met that include size and legal protection. To carry out the field evaluations, the committee contracts the independent organizations IUCN (International Union for the Conservation of Nature) and ICOMOS (the International Committee on Monuments and Other Sites).

Nominated for world heritage site status in 1994, Carlsbad Caverns now joins Chaco Culture National Historical Park and Taos Pueblo as New Mexico world heritage sites. One of the deciding factors in the

Continued on page 4

*Continued*

Carlsbad addition to the list was Lechuguilla Cave and the many scientific discoveries made there since 1986. Also contributing to the designation were other park geological and biological features, park size, beauty, and the significance of its most famous cave, Carlsbad Cavern.

Glacier National Park was first nominated for the distinction in 1984; however, consideration was deferred until 1993 when Glacier and Waterton Lakes were nominated jointly. The Waterton-Glacier International Peace Park was recognized for its biological diversity and natural beauty. The two parks sustain exceptionally diverse and productive habitats, reflected by the natural populations of large mammals and carnivores, including wolves, grizzly bears, and mountain lions. Glacier plans to use the designation to amplify its role in achieving and maintaining an international ecological complex.

The three newly designated parks join the list of 360 world heritage sites occurring in 83 countries that includes the Great Wall of China; Sagarmatha (Mt. Everest) National Park; Kilimanjaro National Park, Tanzania; the Galapagos Islands; the Statue of Liberty; Grand Canyon, Hawaii Volcanoes, Mammoth Cave, Mesa Verde, Everglades, and Yellowstone National Parks; Independence Hall; and the old city of Jerusalem among others. The United Nations Educational, Scientific, and Cultural Organization oversees both the World Heritage Site and Biosphere Reserve Programs.

## Kimball honored

National Park Service Water Resources Division Chief Dan Kimball received the prestigious 1995 Stephen Tyng Mather Award for national park resource conservation at the annual Association of National Park Rangers Ranger Rendezvous in St. Paul, Minnesota, last



*NPS Water Resources Chief Dan Kimball*

November. Named for the first NPS director, the award is given annually by the National Parks and Conservation Association to a federal employee for exemplary efforts to protect national park resources. Kimball was recognized for his many significant protections that have been won for national park resources, especially water resources, in large part due to his fine ability to bring into agreement opposing views in controversial issues.

Since he became branch chief for planning and evaluation in the NPS Water Resources Division in 1983, Kimball has consistently led the fight to preserve national park resources. He was instrumental in preventing the siting of a

nuclear waste repository next to Canyonlands National Park, Utah, in 1985. Later, as the NPS representative working with an international joint commission, he orchestrated inquiries into the danger posed to Glacier National Park, Montana, by the proposed Cabin Creek coal mine. Permits for the mine were denied and the facility never

opened. He also played a major role in successful efforts to minimize damage to Grand Canyon National Park caused by water releases from the Glen Canyon Dam. And when the threat of geothermal leasing outside Yellowstone National Park was imminent, Kimball helped forge a compact with Montana that put strict limitations on the allocation of surface and subsurface geothermal waters. Most recently, during restructuring, Kimball has been helping to lead the drive to preserve the NPS scientific ability to protect

parcs. "Good science, along with adequate inventory and monitoring capabilities, is crucial to preserving park resources," Kimball commented.

Recipients of the Mather Award have demonstrated initiative and resourcefulness in promoting environmental protection; they have taken direct action where others have hesitated, and they have placed commitment to principle ahead of job security in the pursuit of good stewardship of the national parks. The honor included a \$2,500 cash grant donated by Faultless Starch/Bon Ami Company of Kansas City, Missouri.

## Jury convicts wolf's killer

A federal jury of 12 Montanans deliberated less than 2 hours on October 25 in Billings to convict Chad McKittrick of Red Lodge, Montana, of three counts of killing, possessing and transporting a wolf. The 122-pound male wolf had been acclimated and released from the Rose Creek pen inside Yellowstone National Park as part of the northern Rocky Mountains wolf recovery effort, begun over a year ago in both the park and central Idaho. McKittrick was accused of shooting the wolf last April 24 while black bear hunting with a friend near Red Lodge.

The silvery-gray male wolf, known as R-10, had sired a litter of 8 pups who were born near Red Lodge about the time of the shooting. Biologists learned of its death when its radio collar transmitted a mortality signal. They found the collar near a public road; following an area search, they were led to McKittrick's home by his hunting partner, where they found the head and pelt.

McKittrick could be sentenced to up to 6 months in prison and fined \$25,000 for possessing and killing the wolf, which are violations of the Endangered Species Act. Maximum penalty for the transportation count, a high misdemeanor, is a year in prison and a \$100,000 fine. McKittrick has yet to be sentenced.

After the shooting, biologists moved R-10's mate and her pups back to a Yellowstone pen, concerned that the nursing mother might starve without the father's help. Shortly before the trial, biologists released the mother and her growing pups back into the park. In mid-De-

ember, a delivery truck accidentally hit and killed one of the pups (then 70 pounds), but the others remain healthy. Another male from a different pack has recently joined the adult female's group, now roaming as a pack in the Lamar Valley in Yellowstone.

Wolf restoration activities in Yellowstone and central Idaho are continuing this winter. Private funds are being used to augment the federal monies used to capture and transport wolves from Canada to the restoration sites. Biologists have already released 8 wolves, with 6 or 7 more to come, in central Idaho and transported 11 wolves to Yellowstone acclimation pens where they will remain for 10 weeks before being released. The park anticipates receiving 6 or 7 more wolves this winter.

### NBS names science center directors

In a spate of activity last fall, the National Biological Service (NBS) announced the selection of four biologists to serve as science center directors around the country. Dr. James A. Kushlan, an internationally renowned wetlands scientist, has been named director of the Patuxent Environmental Science Center. Located in Laurel, Maryland, this center focuses its research on environmental contaminants, populations and habitats of migratory birds, endangered species, urban ecology, and vertebrate systematics in the eastern United States. Field stations reporting to this director include the Northeast Research Station in Orono, Maine and the Center for Urban Ecology in Washington, D.C.

Biologist and geneticist Dr.

William Mokahi Steiner will head the Pacific Islands Science Center located in Honolulu, Hawaii. His responsibilities will include directing research into the uniqueness, diversity, stability, and conservation of Hawaiian ecosystems and various Pacific Islands under U.S. jurisdiction. Projects currently under way there address ecosystem degradation resulting from biodiversity loss, endangered species surveys and recovery, and nonnative species monitoring and management. An estimated 35% of the endemic plant species and 76% of the endemic bird species in Hawaii are extinct, endangered, or need protection.

The Northwest Biological Science Center in Seattle, Washington, also has a new director. Dr. Frank A. Shipley is experienced in dealing with estuarine issues and hopes to direct the science program to provide sound information on natural resource issues, including the complex and controversial plight of Pacific Northwest salmon. Established in 1934, the center is known internationally for fish disease research contributing to the success of salmon and steelhead hatcheries. Today, the center also emphasizes research in the Columbia basin and other Northwest river systems, and on forestry and wildlife concerns throughout the west.

Coming from a 9-year appointment as Director of the Alaska Science Center, Dr. A. William Palmisano, Jr., will head the Leetown Science Center in Kearneysville, West Virginia. A wildlife biologist and botanist, Palmisano will oversee a research program that concentrates on restoring and protecting aquatic species and their supporting ecosystems.

Center scientists use specialized training in ecology, health and disease, genetics, behavior, population modeling, fish physiology, and aquatic populations restoration technologies to support management of healthy populations of declining or threatened fish and other aquatic organisms.

### Biological data to go on-line

The National Biological Service and numerous partners have been busy arranging for several biological databases to go on-line. The products are either available now or will soon become accessible through the World Wide Web feature of the Internet.

The NBS and the Fish and Wildlife Information Exchange, in cooperation with the Organization of Fish and Wildlife Information Managers, are developing a directory of state biodiversity databases and information sources. The partners will compile information about biological databases and information maintained by state fish, wildlife, natural resources, and environmental agencies. The resulting directory will describe the contents and subject matter of each database or information product, give institutional and contact information about the source agency, and report the status of electronic accessibility of the information. The on-line directory will include direct "hot links" to agencies or organizations that already have data and information products available through the Internet. The directory will be accessible through the National Biological Information Infrastructure (NBII), a NBS initiative to foster the development of a distributed electronic network of

biological data maintained by a variety of federal and state agencies, universities, museums, libraries, and private organizations. The Internet address for NBII is

*"<http://www.nbs.gov/nbii/>".*

Five federal agencies and the Smithsonian Institution have also joined forces with the National Biological Service to develop and support a new national database on the plants and animals of North America. The database, known as the Interagency Taxonomic Information System (ITIS), will provide for the first time a standardized source of information on the scientific names and synonyms, common names, and information about origin and general distribution of all biological species occurring in North America and adjacent waters. The database is accessible through NBII or directly through the ITIS home page at

*"<http://www.itis.usda.gov/>".*

The National Biological Service is also the first bureau from the Department of the Interior to join CENDI, a federal information organization that works to improve the sharing, exchange, and dissemination of scientific and technical information. Member agencies jointly develop technical information directories, locator systems, standards for cataloging and indexing, while sharing costs and experience on new technologies for data and information exchange and networks. The group also provides user training and support through workshops and conferences. Its home page can be found at

*"<http://www.dtic.dla.mil/cendi/>".*



## ALLEGHENY- CHESAPEAKE

### Highlands Council formed

Nine federal agencies formed the Mid-Atlantic Highlands Coordinating Council in May 1995 to foster and promote efficiency in carrying out natural resource related responsibilities and activities in the Mid-Atlantic Highlands. The highlands comprise many distinct terrestrial and aquatic ecosystems, extending east and west from the Blue Ridge Mountains to Ohio, and north to south from New York to North Carolina-Tennessee. Within these boundaries, the highlands include the Blue Ridge Mountains, the Appalachian Mountains, and the Appalachian Plateau uplands.

In signing "The Highlands Accord," the council agreed to meet periodically and work together to achieve the following objectives:

- Promote better understanding of research, monitoring, and management activities currently underway in the Mid-Atlantic Highlands,
- Identify common goals and objectives,
- Explore ways to improve interagency cooperation, and, where consensus exists,
- Develop mechanisms for extended cooperation among federal agencies to support natural resource management, protection, and monitoring.

The coordinating council held a conference October 24-26, 1995, at Canaan Valley, West Virginia, to focus on the issues and concerns related to the valuable natural resources in the highlands. The group explored the history of the highlands and its current ecological and eco-

nomic conditions. Participants heard perspectives from various organizations interested in the highlands and its values and opportunities. Finally, they presented case studies and discussed local organizations that are working together to achieve ecological and economic balance, thus promoting sustainability.

The nine signatory federal agencies are the U.S. Department of the Interior—National Park Service, National Biological Service, U.S. Fish and Wildlife Service, U.S. Geological Survey, and Office of Surface Mining; U.S. Department of Agriculture—Forest Service, Natural Resources Conservation Service, and Agricultural Research Service; and U.S. Environmental Protection Agency. John Karish, Chesapeake and Allegheny System Support Office Senior Scientist, is the NPS council representative.

## GREAT PLAINS

### Ferret future looks bright

Multiple agency biologists working in Badlands National Park, South Dakota, ended 1995 with several encouraging findings regarding the ongoing black-footed ferret restoration. Between November 19 and December 15, they detected 16 live ferrets during spotlight surveys in and adjacent to the wilderness areas of the park. These animals included: 6 female and 3 male juveniles released last fall that have survived in the wild for more than 50 days; 1 male and 1 female (each 2 years old) released as juveniles in the fall of 1994 that have survived over 440 days in the wild, of which the female raised a wildborn litter last summer; and 3 1995-

wildborn kits (gender undetermined). The ratio of 7 females to 4 males is expected to be adequate for reproduction. Additionally, the ferrets have become very effective predators with those surviving from the fall 1994 release having killed an estimated 125-150 prairie dogs each.

These findings support continued releases and follow-up research. An estimated 60% of 1995 kits born in the park have survived at least 3 months following dispersal from their mother's burrow. This is contrasted with a 30% survival rate of preconditioned juveniles released during 1995. Still, the 30% survival figure is among the highest monitored from the 8 fall reintroductions conducted to date in Wyoming, Montana, and South Dakota from 1991 through 1995.

The park anticipates a February 1996 release of 9 preconditioned juveniles. These 7 male and 2 female ferrets will have spent 2 ½ months in preconditioning pens. They will also be the first released in winter, just before breeding season.

## PACIFIC-GREAT BASIN

### BAER Team reduces fire impacts

From its beginning on October 3 on Mount Vision near Point Reyes National Seashore until containment 4 days later, the Vision Fire burned more than 12,000 acres of private, state, and federal lands. Winds of up to 45 m.p.h. quickly transformed a small fire ignited by the smoldering remains of an illegal campfire into a firestorm that took 45 homes in 24 hours. The nature of the landscape and proximity to private lands lead

area managers to fight the fire aggressively.

A battle such as this cannot be won without some impacts to the landscape. Bulldozers plowed over 25 miles through thick vegetation in an effort to contain the blaze. Among the many unsung heroes are those that helped the land recover from the fire suppression efforts. At the request of Superintendent Don Neubacher, the Department of the Interior Burned Area Emergency Rehabilitation (BAER) Team arrived. The BAER team is made up of resource specialists with expertise in plants, animals, soils, water resources, cultural resources, structures, roads, and trails. Working for various federal agencies, the team members assessed the impacts made by the fire and suppression efforts and made recommendations to the superintendent and affected communities for both long- and short-term restoration.

The BAER team concentrated on rare plant populations that might be impacted by the burn and the invasion of non-native species to the newly disturbed areas. They recommended monitoring to assess impacts to the rare plant populations and monitoring in conjunction with plant removal for nonnatives that are likely to grow along the dozer lines. The team also proposed that bulldozer lines be stabilized using materials such as wood mulch to prevent accelerated erosion on the steep topography of the park and its environs. Recommendations also included restoring helispots and safety zones to their prefire conditions, rebuilding fences, repairing bridges and other structures, and stabilizing an archeological site.

## GULF COAST

**Turtle nest success surveyed at Dry Tortugas**

Located 70 miles west of Key West, Florida, the islands of Dry Tortugas National Park are the most pristine subtropical marine environment in the contiguous United States. The park supports the largest loggerhead turtle (*Caretta caretta*) rookery in the Florida Keys and perhaps the largest green sea turtle (*Eretmochelys imbricata*) rookery in Monroe County. However, before being established as Fort Jefferson National Monument in 1935 and Dry Tortugas National Park in 1992, the turtles were hunted to near extirpation by both mariners and local turtle cannery. Today, the national park is a refuge for these nesting season residents, giving them a chance to recover from historic exploitation. Where habitat preservation has undoubtedly aided turtle recovery over the last 60 years, inventory surveys are providing nesting success information on which to base management decisions and future population trend comparisons.

The park began inventorying both the endangered green and threatened loggerhead turtles as early as 1980 in an effort to determine their populations and reproductivity. Unfortunately, these efforts were inconsistent and inconclusive. Then, investigators began a 3-year tagging operation, limited to one island where over half the park turtle nesting occurs, and tagged 44 loggerheads and 2 green turtles. After nearly a decade of no further inventorying activities, the park revived the surveys in 1994, concentrating on excavating nest sites (after the hatchlings emerged). From

August through September, researchers counted 47 loggerhead and 25 green turtle nests. Although this research was incomplete, these results were exciting as this was the first time green sea turtles were verified as nesting in the park since the study of the early 1980s, and the 25 nests set a Monroe County record.

In 1995, recognizing a need for more comprehensive turtle research, the park recruited a Student Conservation Association-Americorps intern to expand inventorying to all park keys and make nesting observations throughout the entire nesting season. Investigator Scott Boykin explained that the April to September investigation period and consistent inventory methods distinguished the 1995 season from earlier efforts. "This project began before nesting and continued until all nesting was over," he said. "It provides the most realistic snapshot of turtle nesting activity on the Dry Tortugas to date."

During the study, Boykin determined that loggerhead turtles used 5 of the 7 islands within the park. Nesting success was generally high, with 79% of the loggerhead turtle eggs that were laid in successful nests emerging as viable hatchlings. Average clutch size was 98 eggs, with a range of 50-188. Average incubation was 54 days with a range of 45-58 days. Based on the estimate that loggerhead turtles nest an average of 4.1 times per season, 53 females used the Dry Tortugas in 1995.

Boykin also documented green turtle nesting in 1995, and found that numbers were down from 1994. In contrast to the more common loggerhead turtles, green sea turtles nested from late June to early August,

used only one key, and produced 4 nests, of which only 3 were successful. Combined with the 24 successful nests of

1998 because the typical nesting interval of loggerhead and green turtles is 2-3 years. This would allow for a proper assess-



Loggerhead female (above); (right) hatchlings emerge from their Dry Tortugas nest during 1995 nesting season surveys.



1994 (27 total over 2 years), 78% of the successful green turtle nests produced viable hatchlings. The average clutch size from the 2 seasons was 124 with a range of 55-191. Average incubation for the 1995 nests was 51 days. Investigators estimate that 7 female green turtles used park beaches for nesting during both 1994 and 1995.

The research also closely examined nesting loggerhead scute patterns to determine if hawksbill turtles were nesting in the park. The discovery of one nest with partially developed hatchlings possessing scutes characteristic of hawksbills indicated a possible nest of hybrids. After further analysis, however, the aberration was attributed to variation in loggerhead scutes.

Having had a successful 1995 field season, the park hopes to continue the surveys through

ment of turtle use patterns, seasonal fluctuations, and the population density of nesting females that use park beaches. Considering the historical importance of this rookery, a 4-year study would constitute the first comprehensive modern inventory, and would aid management in protecting the turtles. Boykin added, "the study is also important regionally as the Dry Tortugas are the least disturbed of any of the other Florida turtle nesting grounds. Results from these surveys will become valuable standards for regional comparison and for future park turtle population trend comparisons."

## 1995 BIOSPHERE RESERVE MANAGERS WORKSHOP

By ANTOINETTE J. CONDO

THE BIOSPHERE Reserve Directorate of the United States Man and the Biosphere Program (USMAB) sponsored a biosphere reserve managers workshop held October 29-31 in Washington, D.C. Managers from across the country and representatives from Canada, Mexico, Germany, and Russia participated.

Karen Wade, Harold Smith, and Raymond Dasmann were all honored at the October 30 banquet. Superintendent Wade and staff of Great Smoky Mountains National Park, one of five units within the Southern Appalachian Biosphere Reserve Cooperative, and Superintendent Smith and staff of Organ Pipe Cactus National Monument and Biosphere Reserve were each presented a plaque by Dean Bibles, Chair of the USMAB National Committee, recognizing each site as "1995 outstanding U.S. Biosphere Reserve, a site of U.S. MAB excellence, demonstrating conservation and sustainable development on a regional scale." Bibles also commended Dr. Dasmann for his many years of service to the biosphere reserve program and the Golden Gate Biosphere Reserve in particular.

Guest speakers were John Reynolds, Deputy Director of the National Park Service; Gene Hester, Deputy Director of the National Biological Service; and the Honorable John Fraser, Canadian Ambassador for the Environment. Ambassador Fraser, Chair of Canada MAB; Miguel Equihua (for Gonzalo Halffter), Chair of Mexico

MAB; and Dean Bibles, USMAB Chair, signed a memorandum of cooperation among biosphere reserves of the three countries.

Bibles also announced the creation of a new category of biosphere reserve to be recognized by the USMAB National Committee. The new category is designed to encourage participation in the principles of the biosphere reserve program among those who may not be prepared to join an international program. This designation would not preclude the biosphere reserve from seeking UNESCO recognition at a later time.

Several presentations and working groups addressed electronic communication involving biosphere reserves. John Dennis of the National Park Service, as facilitator with the technical expertise of Brand Niemann and Jennifer Gaines, both of the National Biological Service, explored the UNESCO-MAB Internet home pages. Professor James Quinn of the University of California, Davis, reviewed the MABFauna database, the accessibility of biological inventory data on the Internet, the development of the USMAB e-mail discussion group (see following article), and new USMAB project to provide software and technical support to additional U.S. biosphere reserves.

The chairs of the five USMAB research directorates reported on their multiyear research projects and discussed with managers ways to relate research to management needs. Case studies focused on the efforts of agencies, organizations,

and local people to plan and implement the goals of the U.S. Biosphere Reserve Program. The case studies included:

- Southern Appalachian Man and the Biosphere Program (SAMAB) by Hubert Hinote of SAMAB;
- Sonoran Desert Biosphere Cooperative by Tony Ramon of the Tohono O'odham Nation and Harold Smith of Organ Pipe Cactus National Monument;
- Mammoth Cave Area Biosphere Reserve by Jeff Bradybaugh of Mammoth, Cave National Park;
- Colorado Rockies Regional Cooperative by Craig Axtell of Rocky Mountain National Park;
- Proposed Catskills Biosphere Reserve by Janet Crawshaw of the Catskill Center; Proposed Tijuana Watershed (U.S. - Mexico) by Fred Cagle of Immedsys, Ltd.;
- New Jersey Pinelands by Robert Zampella of the Pinelands Commission;
- Crown of the Continent Biosphere Reserve (U.S.-Canada) by Brace Hayden of Glacier National Park; and
- Proposed Ozark Highlands Biosphere Reserve by David Foster of the Ozark National Scenic Riverways.

Bill Gregg of the National Biological Service reported on the results of a survey of manager perceptions regarding the biosphere reserve program. Managers indicated many benefits from biosphere reserve status, particularly in facilitating ecosystem management (the most significant of the 16 benefits surveyed), promoting public environmental awareness, facilitating research and international cooperation, and addressing regional environmental problems. They cited increased local funding and staffing, more emphasis on long-term ecological research, and expanding local constituencies as the greatest needs for enhancing biosphere reserve activities.

Six working groups recommended ways to implement the goals of the Strategic Plan for

the U.S. Biosphere Reserve Program. These goals focus on communication, education and training, local participation, operational framework, research and monitoring, and filling biogeographic gaps in the network. The summaries of recommendations for the working groups will be available in hard copy from the USMAB Secretariat, and on the USMAB home page:

["http://www.nbs.gov/nbii/mab/"](http://www.nbs.gov/nbii/mab/).

*Antoinette Condo is the Program Officer for USMAB. Her phone number is (202) 776-8316; fax (202) 776-8367.*

### USMAB e-mail discussion group gets underway

The purpose of this e-mail forum is to facilitate communication among agencies, organizations, and individuals participating in USMAB and the world network of biosphere reserves. Topics of particular relevance to this group include, (1) discussion of issues relating to the Man and the Biosphere Program; MAB interdisciplinary research proposals and ongoing projects; U.S. participation in MAB international networks; (2) biosphere reserves, including building an electronic network connecting U.S. biosphere reserves; linking MAB with other programs concerned with ecosystem

*Continued in column 1 on page 19*

## CROP OF ISLAND PRESS RELEASES WORTH PERUSING

By Jean Matthews

**I**SLAND PRESS, THE ONLY nonprofit organization in the United States whose principal purpose is publication of books on environmental issues and natural resource management, has been busy publishing several works over the last 18 months. Highlights include:

The *Grizzly Bears of Yellowstone: Their Ecology in the Yellowstone Ecosystem, 1959-1992*, by John J. Craighead, Jay S. Sumner, and John A. Mitchell, all of the Craighead Wildlife-Wildlands Institute. Published last September, it has 88 figures (6 in color), 202 tables, 146 black and white photographs, 69 color photos, 448 references, and over 1,800 index entries. The hardcover book sells for \$100. ISBN: 1-55963-456-1.

Three others are paperbacks:

*Compass and Gyroscope*, by Kai N. Lee argues that sustainable development is not a goal, not a condition likely to be attained, but rather (more like freedom or justice) a direction in which we strive. He starts by imagining that the concept is like Utopia—a faraway, perhaps imaginary island—and that humanity searches for it in a ship guided only by a “compass” of science and a “gyroscope” of politics. The subtitle is “Integrating Science and Politics for the Environment,” and the book purports to be a “practical yet innovative guide to environmental management.” It is 6"x9" in size, 243 pages long, with figures, maps, and index, and costs \$16.95. ISBN: 1-55963-198-8.

*Wildlife Policies in the National Parks* was published in July 1995 and is the result of a 5-year study of NPS wildlife management policies. All of its seven authors are distinguished professors,

who have had much experience working in the area of NPS wildlife management and its consequences. Hal Salwasser and Joseph Sax are best known to me, and they are impressive; I suspect the rest measure up. Sax wrote *Mountains Without Handrails*, which is now a classic work on the national parks, and is currently a counselor to the Secretary of the Interior. In the “Future Directions” section, the parts about the research role in the national park system and the functions of science in the system are worth the price of the book. The latter talks about building bridges between the National Park Service and National Biological Service, and shares problems and approaches to solutions. It also mentions “weak leadership at the top” in the past, and concomitant failure “to convey a strong sense of mission, commitment, and pride.” It is 6"x9", 300 pages, has figures and index. Cloth: \$49.00; ISBN: 1-55963-404-9; Paper: \$26.00; ISBN: 1-55963-405-7.

*Environmental Policy and Biodiversity*, edited by R. Edward Grumbine, examines the need for scientists and policy makers to work together if solutions to the biodiversity crisis are to be found. This book presents an overview of important concepts in the field of conservation biology and an examination of the strengths and limitations of the policy making process. The essays come from a broad range of disciplines, are pro-

vocative and clearly argued. They discuss the ethical and scientific bases for conservation biology, the effectiveness of existing policy, numerous case studies from around the nation, and overall environmental policy goals and processes. The essayists are nearly a score of experts in this field, beginning with Michael Soule and continuing with that caliber of persons. (The editor is director of the University of California, Santa Cruz, Sierra Institute, and he lives in Rattlesnake Gulch, Bonny Doon, California... an address that fascinated me). It's 6"x9", 416 pages, contains figures, tables, and an index. Hardcover: \$45.00; ISBN: 1-55963-282-8. Paperback: \$22.00; ISBN: 1-55963-283-6. It was published in October 1994.

*Island Press is located at 1718 Connecticut Avenue, N.W., Suite 300; Washington, D.C. 20009; (202) 232-7933; fax (202) 234-1328.*

Jean Matthews is the founder and former editor of *Park Science*. She is enjoying retirement in Vancouver, Washington.

## KEYSTONE CENTER MEETING ON ECOSYSTEM MANAGEMENT

By KAREN WADE

FOR THE PAST YEAR, DR. John Dennis of the NPS Natural Systems Management Office and I have participated in a series of meetings sponsored by the Keystone Center (see sidebar) entitled "The National Dialogue on Ecosystem Management." Fifty people from diverse places and viewpoints are exploring the possibility of achieving consensus on whether ecosystem management offers a realistic new process within which to design and implement policies and decisions affecting natural resources. Represented are academics, agency bureaucrats and scientists, ranchers and forest products executives, and advocates from institutions as diverse as The Nature Conservancy, the Wilderness Society, and the Farm Bureau. Three of four plenary sessions have been completed and supplemented by break-out meetings organized as field trips to look at examples of ecosystem management. The latest meeting, held in Chicago early last November, was largely devoted to constructing the basic outline of a final product to be completed at the final plenary this March.

This dialogue was largely generated by the recognition that contemporary institutions and concepts are not capable of resolving the cross-boundary issues raised by our new understanding of natural systems and the increasing conflicts over scarce natural resources. In earlier meetings we defined "boundaries" not only as the obvious physical, natural, and political boundaries, but also those created by narrow academic disciplines, rigid property rights and tax codes, outdated economics, legal doctrines, antiquated managerial and institutional structures.

In all of our meetings, we have been privileged to be able to confer with those in our group who can articulate the growing sense of disenfranchisement expressed in grassroots rebellions. Grassroots rebellions are not only producing an agenda for the political process, but also generat-

ing interest in landscape level solutions created in a nonconfrontational, voluntary consortium of affected parties. The investigation of this phenomenon is what has brought us together and, we hope, will result in a clear articulation of the benefits of the approach and what might be done to actually strengthen it.

In order to define these landscape level management efforts, we have observed various examples believing that the definition lies in the practice. Those that exemplify ecosystem characteristics reflect sociological, economic, and ecological objectives in an integrated process that manages across jurisdictional boundaries. Most importantly, those that appear to be the most successful require stakeholder involvement that is fully collaborative and voluntary. Again, those collaborating are looking at units of management that reflect ecosystem patterns, like major watersheds, and consider all natural and cultural elements in an interdisciplinary context. In many of the best examples, government representatives are playing more of a participative or support role to a locally driven initiative.

Our inquiry has focused largely on the process of decision making. The process is built on trust, mutual respect, and a

genuine partnership of stakeholders. The structure is centered around strategic planning and negotiation with values explicitly stated, goals defined in outcomes, and landscape level involvement in decisions that directly affect those at the table.

Observing this grassroots phenomenon in practice has led me to believe that there

is something of value occurring spontaneously across the country that may well lead to a dramatic change in the institutions in which we all work. The examples we have observed are extremely diverse in adapting to the environments and cultures of the landscapes within which they are located, but they have generic characteristics, such as being adaptive, flexible, collaborative, interdisciplinary, or involving partnerships. They appear to provide an excellent model for interorganizational efforts that cross old agency boundaries and involve communities in a partnership. I like what I am seeing and look forward to being able to

*The Keystone Center, located in Keystone, Colorado, is a private, nonprofit organization. Under the auspices of its Science and Public Policy Program founded in 1976, the center facilitates the resolution of national public policy conflicts through the use of a consensus dialogue approach.*

*Keystone's mission is to design and facilitate innovative processes to address complex and controversial issues and assist participants in the development of productive and practical solutions. At stake in most of the issues Keystone facilitates is quality of life, the economy, and utilization and conservation of natural resources.*

provide my colleagues with a copy of the final product.



*Karen Wade is Superintendent of Great Smoky Mountains National Park, Tennessee and North Carolina. Her phone number is (615) 436-1200.*

## PARTNERS IN FLIGHT CONSERVATION PLAN:

Building Consensus for Action at the 1995 International Workshop

OCTOBER 1-5, 1995, CAPE MAY, NEW JERSEY

BY MIKE BRITTEN, KATY DUFFY, MARK SCHROEDER, AND GARY JOHNSTON

**M**ORE THAN 550 PARTICIPANTS from state and federal agencies, conservation groups, private organizations, and Latin America attended the 1995 Partners in Flight International Workshop last October 1-5 in Cape May, New Jersey. The workshop goal was to begin developing an international migratory bird conservation plan.

A basic tenet of the Partners in Flight (PIF) conservation effort, begun in 1990 to conserve neotropical migratory birds, is that hundreds of migratory bird species are at risk. Neotropical migrants are those birds that winter in Central or South America and nest in North America, making coordination of both breeding and wintering habitat conservation especially important. The ecosystems on which these species depend extend across political and management boundaries throughout the western hemisphere. Impacts to breeding or wintering areas or to migratory stopover areas threaten the long-term survival of many of these species. Ecosystem management, on a grand scale, is necessary to conserve migratory species.

Our efforts are carried out by state and regional working groups and overarching monitoring, research, international, and information and education working groups. An international Partners in Flight conservation plan is necessary to coordinate and strengthen these efforts. The plan has a precedent in the North American Waterfowl Conservation Plan.

Dr. Michael Soule, science advisor to the Secretary of the Interior, gave an inspiring opening to the conference by reminding us that species protection, i.e., protection of biodiversity, is the basic need. Dr. Jack Ward Thomas, Director of the U.S. Forest Service, vowed his commitment to protecting natural systems on

public lands. Noting that public lands are essential to preserving biodiversity, he warned us to beware of congressional intent to "devolve" the Bureau of Land Management and other public lands by turning over management to the states whose primary goals may not include species conservation. Dr. Thomas pointed out that Forest Service lands contain the most breeding bird habitat under one jurisdiction in the United States and that congress recently cut funding for his agency's migratory bird monitoring programs.

Mr. Steve Wendt of the Canadian Wildlife Service, recommended using birds as a link for conservation across international boundaries by designing bird monitoring programs (e.g., the joint America-Canadian bird banding effort) with a hemispheric approach. Dr. Roberto Roca, of the Nature Conservancy, outlined the challenges to the Partners in Flight initiative in Latin America. He noted that Latin America contains 50% of all avian species known on earth (3,000+ species) and 175 different ecosystems. While conservation of North American species that winter in Latin America is important, conservation of incredible biodiversity of the neotropics is critical. A major challenge, he explained, is international coordination and cooperation given that 40 countries and more than 200 indigenous languages exist in Latin America.

On Monday morning, a panel discussed "A Study in Bird Conservation Planning: the Mississippi Alluvial Valley." Only 4 million of the original 24 million acres (1.6 and 9.7 million hectares, respectively) in this area remain in their natural state. Habitat conservation needs in the area are integrated through cooperative planning

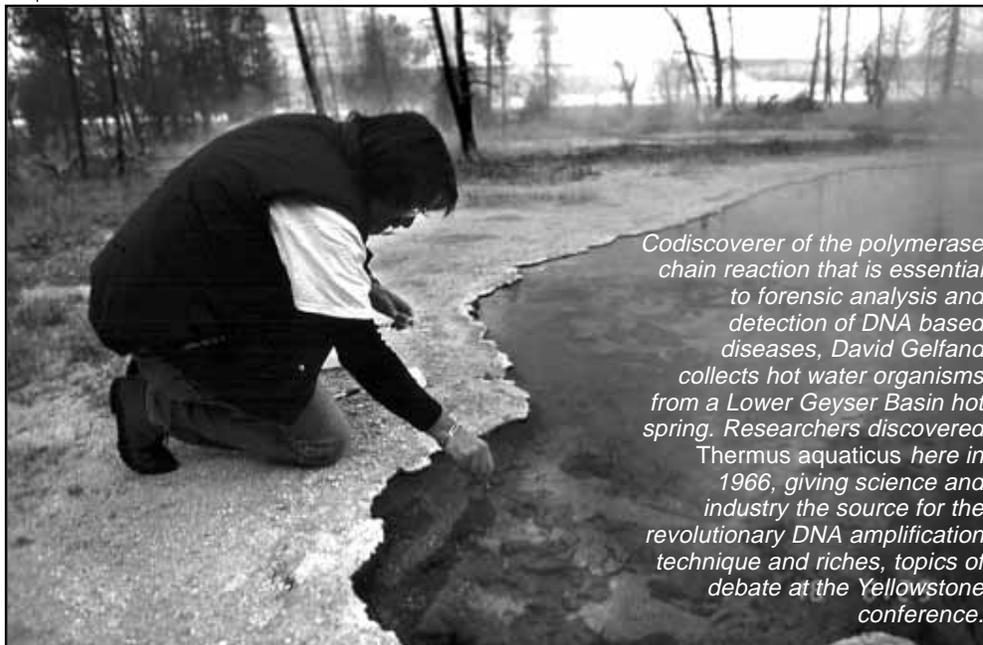
(among corporate landowners, government agencies, academic institutions, and conservation organizations) for all birds including waterfowl, shorebirds, and migratory land birds. This presentation made obvious the preference of protecting systems before they are drastically altered because recovering highly modified systems is very expensive. Regional conservation plans like the Mississippi Alluvial Valley plan are a model for the Partners in Flight International Conservation Plan.

Terry Rich of the Bureau of Land Management presented results from his nationwide survey of PIF activities by state. Thirty-seven states have formed state working groups to coordinate and implement PIF actions. Eight states have either full-time or part-time paid coordinators. The National Park Service was recognized as making significant contributions to 12 state working groups. The broad conclusion from the survey is that although every state program is different, states are accomplishing migratory bird conservation through Partners in Flight. The greatest advances occur where infrastructure (e.g., a state working group or steering committee or a dedicated PIF coordinator) exists to implement the goals and objectives of the organization. Partners in Flight is currently recruiting and hiring coordinators for four of the regional working groups (Northeast, Southeast, Midwest, and West).

At the workshop, the International Association of Fish and Wildlife Agencies (which includes all 50 state wildlife agencies) introduced us to "Teaming with



*Continued in column 2 on page 19*



Codiscoverer of the polymerase chain reaction that is essential to forensic analysis and detection of DNA based diseases, David Gelfand collects hot water organisms from a Lower Geyser Basin hot spring. Researchers discovered *Thermus aquaticus* here in 1966, giving science and industry the source for the revolutionary DNA amplification technique and riches, topics of debate at the Yellowstone conference.

## BIODIVERSITY, ECOLOGY, AND EVOLUTION OF HOT WATER ORGANISMS IN YELLOWSTONE NATIONAL PARK:

### Symposium and Issues Overview

By BOB LINDSTROM

THE GREATEST CONCENTRATION of experts in the field of Yellowstone microbiology held a highly successful 4-day symposium at Old Faithful, September 17-20, 1995. Organized by the Yellowstone Center for Resources and aquanaut-microbiologist Anna-Louise Reysenbach of Rutgers University, the symposium aimed at increasing communication and establishing contacts among the academic, biotechnology, and resource management communities. Three government agencies (NASA, National Science Foundation, and the Department of Energy) and 17 biotech companies, all interested in advancing knowledge and generating research into the fascinating world of life at high temperatures, funded the symposium. The synergy, communication, and contacts fostered amongst scientists, biotech companies, and resource managers in this es-

oteric research field went a long way toward elevating the profile of this important Yellowstone natural resource.

The 4-day conference delved into the state of the art of research into Yellowstone microbial resources, the colorful prokaryotic inhabitants of the Yellowstone geothermal ecosystem. Attended by 110 scientists from around the world, the conference brought together micro- and molecular biologists whose primary focus is thermophilic (heat loving) microorganisms and their heat-stable enzymes, the protein macromolecules that make up the building blocks of life. A conference publication, being prepared by the American Society of Microbiology, will serve as a milestone, updating modern thermophilic research and synthesizing NPS management options towards commercial development of research specimens.

The keynote address by Dr. Thomas Brock, an introduction to modern Yellowstone microbiological research, included

his story behind the 1966 discovery of *Thermus aquaticus* (*Taq*). This was the first life-form detected growing above the known upper temperature limit for life, then believed to be 72° C (162° F). A heat-stable enzyme from this organism, *Taq* DNA polymerase, was essential in establishing the polymerase chain reaction (PCR) process. This DNA amplification technique revolutionized DNA science and earned its inventor, Kary B. Mullis, a Nobel prize in 1993. The gene expressing *Taq* polymerase was removed from specimen YT1-25104 (Yellowstone Type 1, deposited in the American Type Culture Collection as sample 25104) and inserted into *E. coli* ("microbial livestock") producing a genetically engineered organism called pLSG1. Polymerase chain reaction made possible a quantum leap in the DNA diagnostics industry including forensic analysis and detection of any type of DNA based disease; it grosses \$200 million per year for the patent holder, Hoffmann-LaRoche, a Swiss pharmaceutical company. According to David Gelfand (see photo this page), codiscoverer of PCR, in his presentation on DNA polymerase, "PCR generated revolutions within the revolution" in molecular biology by providing new tools in amplifying DNA. O.J. Simpson's PCR evidence, and Michael Crichton's Jurassic Park scenario are spin-offs of how PCR could be used to make millions of copies of DNA. Medical technology is perhaps the greatest beneficiary of PCR. For example, Amplification of the Human Immunodeficiency Virus (HIV) DNA provides the only reliable early detection of AIDS. Polymerase chain reaction allows scientists to create any quantity of any type of DNA at will, opening up to humankind what until now has been the elusive domain of fundamental natural processes.

Biological diversity represented in the Yellowstone thermophiles is of special interest to biotechnology companies. Since microbes can perform most biochemical reactions known, their enzymes are used in manufacturing chemicals, antibiotics, plastics, detergents, and fermentation products. The recent development of heat-stable enzymes is increasingly important to such companies as Lily,

Exxon, E.I. DuPont, Roche Molecular Systems, and the dozen others with representatives attending the conference. Thermostable enzymes lend themselves to vast industrial processes and are less susceptible to denaturation than their mesophilic (body temperature) counterparts.

A good example of what national parks contribute to society is habitat protection and resulting preservation of biological diversity. In the case of thermophiles, conservation has yielded great utilitarian value in the enzymatic diversity that has been preserved, inadvertently, along with the geological curiosities and wonders for which the park was established in 1872. The Yellowstone geothermal ecosystem consists of the world's greatest concentration of thermophilic biodiversity in its 10,000 thermal features, and the companies want to contribute to the preservation of this unique biosphere reserve. They discussed voluntary contributions, royalties, foundations, and user fees as means by which companies could financially support National Park Service resource management efforts. Such funding could sponsor public and legislator education (through interpretive presentations) as to the value of maintaining biological diver-

Old Faithful Protection Act, which would prohibit geothermal drilling activities within 15 miles of the park boundary.

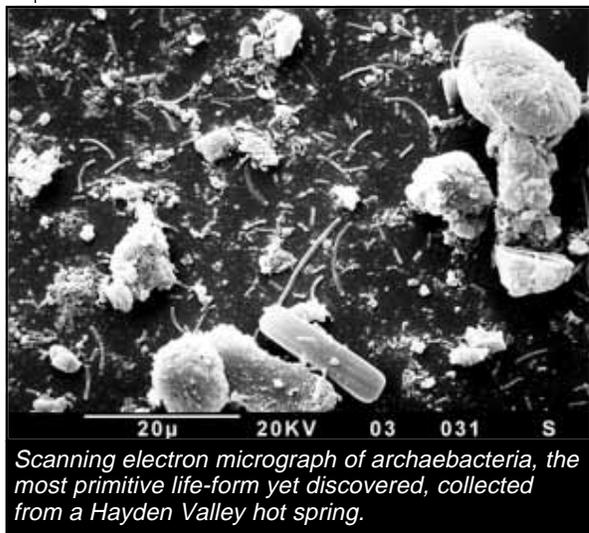
A full day of presentations and roundtable discussions centered on the management of publicly owned resources and included active audience participation. The National Park Service does not encourage commercial development of natural resources within its jurisdiction. If, however, during the course of investigation, researchers make a commercially significant discovery, a means of sanctioning that discovery is now available through their research permit agreement with the superintendent and according to ongoing revisions in the Code of Federal Regulations. Intellectual property rights, patenting organisms, their products, and genes, trade secrets, and material transfer agreements are all issues related to research specimens that participants also addressed in their presentations and discussions. The symposium failed to reach consensus on royalties from profitable discoveries but did initiate a workshop entitled "Conservation and sustainable use of thermophilic microbial biodiversity at Yellowstone National Park: consensus building initiative" being conducted at the National Biodiversity Institute (Instituto Nacional Biodiversidad or INBio) of Costa Rica, January 20-27, 1996.

Thomas Lovejoy, science advisor to the Secretary of the Interior, spoke of Yellowstone thermophiles as "environmental extremists." Living in the extremes of temperature and pH, thermophiles clearly point out the importance of preserving biological diversity. He spoke of the biotechnology age (the interface of technology and biodiversity) where, through use of modern research, tremendous wealth is generated, exemplifying the utilitarian value of species preservation. He implied that in this era of hyperextinction, if we cannot preserve biodiversity for the obvious ethical reasons, then we should preserve it for the potential unknown benefits to humankind, such as the polymerase chain reaction.

During his presentation, "The Biological Wealth of Nations," Dr. Lovejoy also introduced the concept of INBio, the Costa Rican quasi-government organization that funds biodiversity preservation through private sector cooperative agreements. In exchange for access to Costa Rican National Park genetic resources (and excellent public relations), companies such as Merck Pharmaceutical and Bristol-Meyers invest large sums on rain forest preservation. Although distinct, INBio has evolved a biodevelopment track record Yellowstone could draw upon in respect to thermophiles. Indeed, Ana Sittenfeld, Director of Biodiversity Prospecting at INBio, gave a presentation on this issue and offered to share their experience, a wealth of details, on how to manage microbial resources in Yellowstone. In a presentation on high-tech molecular approaches to assessing biodiversity, Eric Mathur, Director of Recombinant BioCatalysis, Inc., of La Jolla, California, linked resource preservation to private industry in these days of public fiscal austerity by saying that "if industry does not support preservation of biodiversity, it probably won't happen."

Natural history presentations of thermophiles included an outline by Dave Ward of Montana State University on microbial ecology and the impacts of increasing numbers of researchers on bacterial mats. Since the small samples (a few milliliters) needed to start tissue culture collections are usually gathered with tweezers, and since the high growth rates of thermophiles revegetate disturbances quickly, no long-term harm to the resource is apparent. Human impacts are monitored closely by resource managers who emphasized that the research community must police itself with respect to minimal sampling and minimal impact to the system. Research permits are granted on a yearly basis on the premise that "no harm" to the resource will result from the research.

Other presentations included newly discovered species by Jurgen Wiegel and Beverly Pierson. Their work is being included in the NPS database known as the



Scanning electron micrograph of archaeobacteria, the most primitive life-form yet discovered, collected from a Hayden Valley hot spring.

sity. Biotech companies could also support political activism in lobbying for passage of conservation efforts such as the

*Continued in column 3 on page 19*

# YELLOWSTONE PREDATORS DRAW A BIG CROWD

By NORM BISHOP

THE THIRD BIENNIAL Scientific Conference on the Greater Yellowstone Ecosystem was held at the Mammoth Hot Springs Hotel from Sunday, September 24 through Wednesday, September 27, 1995. Entitled "Greater Yellowstone Predators: Ecology and Conservation in a Changing Landscape," the conference was attended by more than 200 researchers, managers, and the public.

Monday morning, Superintendent Mike Finley welcomed the conferees, and in his opening remarks highlighted the need for all researchers and managers to take an active role in educating the public on how nature really works. His examples included the roles of fire and predators in natural ecosystems. Dan Janzen illustrated his keynote talk on the role of predation in ecosystems with three stories spanning Asia, Australia, the Serengeti, and the New World. Nine speakers then addressed multiple species interactions, from lake trout and cutthroat trout, to red foxes and coyotes, to complex communities of carrion beetles.

At the Superintendent's international luncheon, keynote speaker Stephen Herrero, author of the well-known book *Bear Attacks: Their Causes and Avoidance*, spoke on the topic of "wild love"—the dedication and commitment to the wild that he sees as a common characteristic in wilderness and wildlife researchers throughout the world. Following lunch, four speakers addressed behavior of predators, from mountain lion killing methods to helping behaviors of coyotes to restored wolves. Then a session of natu-

ral history addressed a variety of species: ravens, tiger salamanders, mosquitoes, and midsized carnivores (lynx, wolverines, fishers, and martens). Scientists discussed

value of Yellowstone trout, and changing public attitudes toward wolves. Two speakers treated physiological ecology: energetics in marten, and nutritional ecology of bears. Others discussed population dynamics and ecology with two talks relating to bald eagles and one to the influence of ungulate carrion on coyote behavior and demographics.

The first two very busy days of the conference concluded with the poster session, the evening banquet, and the presentation of the A. Sarker Leopold Lecture. Posters, which were displayed for most of the conference, were presented on 11 topics, ranging from aquatic insect predators to a test of the attractiveness to bears of the alternative snowmobile fuel

rape ethyl ester. World renowned wolf biologist L. David Mech presented the A. Sarker Leopold Lecture, "The Value of Long-term Carnivore Studies in National Parks." The proceedings of the conference will be published with details to be printed in the quarterly *Yellowstone Science*.

On Wednesday, both the National Park Service and the Northern Rockies Conservation Cooperative co-hosted a special symposium, "Carnivores in Ecosystems." This symposium featured a series of invited speakers exploring carnivore topics at greater length (only the authors who spoke follow, though many had coauthors). University of California, Santa Cruz, Assistant Professor Steve Minta introduced the symposium with a discussion of Yellowstone as a model system for understanding carnivores, and asking, "Is There a Theory of Carnivore Ecology?" Moderator and Yellowstone Center for Resources Director John Varley



PHOTO BY KERRY MURPHY, HORNOKER WILDLIFE RESEARCH INSTITUTE

*Yellowstone researchers radio collared this large male mountain lion in the Paradise Valley, north of the park, as part of a long-term cougar population dynamics and social ecology study that they reported on at the conference.*

techniques of inventorying and monitoring carnivores, and detecting rare or difficult-to-observe midsized carnivores.

At a special wolf update session on Monday evening, Yellowstone wolf project leader Mike Phillips presented an overview of the current status of wolf recovery in Yellowstone, and then introduced cinematographer Bob Landis, who showed his footage of the newly arrived Yellowstone wolves interacting with coyotes, grizzly bears, elk, and bison.

The Tuesday morning keynote, Steve French, M.D., shared recent applications of molecular DNA techniques to predator ecology, systematics, and conservation, especially that of bears. The topic then turned to conservation biology and management with nine speakers discussing management of grizzly bears, gray wolves, and midsized predators. Three speakers addressed social science: pelican control in early NPS policy, the economic

introduced the morning session on greater Yellowstone carnivores. *Yellowstone Science* Editor Paul Schullery traced the history of carnivores in the Yellowstone region, Wildlife Biologist Frank Singer quantified the carnivore prey base, and Interagency Grizzly Bear Study Team Leader Dick Knight said the bear population is showing signs of saturation in Yellowstone National Park and that we need to learn how better to manage people in the Yellowstone area. Lion researchers Ian Ross and Kerry Murphy spoke on their respective cougar studies (see photo), and U.S. Fish and Wildlife Service Biologist Ed Bangs listed the big issues in wolf restoration, including their feared impacts on livestock, big game hunting, and public land use practices. Coyote researcher Bob Crabtree listed studies of sympatry between coyotes and wolves, and between coyotes and red fox, showing temporal avoidance in the latter two. Zoology professor from the University of Wyoming Steve Buskirk revealed how mesopredators (small mammals of a few pounds or less) are important aesthetically and spiritually, affect prey populations, scavenge, disperse seeds, and structure populations of nonprey species, including each other.

The afternoon session, entitled "The Utility of Experimental Research for Ecological Theory, Conservation, and Management," focused on theoretical issues. Fred Allendorf, University of Montana Professor and biologist, explored genetic considerations—interbreeding, crossbreeding, and inbreeding—as they affect restoration and management of predators. Jackson Hole elk herd expert Mark Boyce assessed models for conservation and management. Steve Minta spoke on refocusing experimental questions and scales, and offered recommendations for research and management. Minta and conservation biology author Michael Soule assessed carnivore recovery and conservation in North America. The session was summarized by Tim Clark, Director of the Northern Rockies Conservation Cooperative), with final remarks by John Varley. Symposium orga-

nizers also intend to publish these papers in book form with *Yellowstone Science* also carrying news of that publication.

The fourth conference in this series will be held in 1997. In recognition of the 125th anniversary of the creation of Yellowstone National Park, which will be celebrated that year, this conference will focus on

people and their role in greater Yellowstone. Announcements will be forthcoming in about 8 months.

PS

*Norm Bishop is the Natural Resources Interpreter for the Yellowstone Center for Resources. He can be reached at (307) 344-7381.*

## THE SECOND ANNUAL WILDLIFE SOCIETY CONFERENCE SETS RECORDS

BY MICHAEL COFFEY

**A** RECORD SETTING 2,100 wildlife biologists, managers, administrators, natural resource leaders, and students attended the second annual conference of the Wildlife Society last September in Portland, Oregon. The conference, "Excellence in Wildlife Stewardship through Science and Education," provided a wide range of topics relevant to the theme and included 19 symposia, 44 sessions, and over 400 papers and poster sessions. Both symposia and contributed papers and posters were grouped by subject matter and, other than the plenary session, ran concurrently. Field trips, associated meetings, and a wide variety of special activities provided opportunities for participants to visit and renew old or make new acquaintances.

The plenary session addressed "Long-term Research on Keystone Species: Implication for Ecosystem Management." Five outstanding speakers fleshed out the symposium. Jack Berryman, the Wildlife Society's 1995 Aldo Leopold Award Recipient, provided opening remarks with James A. Estes of the National Biological Service, who discussed the sea otter in nearshore marine communities following. E. Charles Meslow, the western regional representative of the Wildlife Management Institute, addressed the role of the north-

ern spotted owl in late successional forests, and Samuel J. McNaughton of the University of Syracuse, New York, Biological Research Laboratories examined grazing ungulates in African savannas. H. Ronald Pulliam, Director of the National Biological Service, provided a perspective on human populations and global ecosystems.

The Wildlife Society decided to hold its own conference 2 years ago in part to provide a forum for working field biologists and managers to exchange information. With the vast amount of wildlife management and research activities conducted throughout the national park system this forum is an excellent opportunity for field people to share and present information. Somewhat of a disappointment, however, was the small number of papers reporting research and management activities in the national park system and the small number of National Park Service personnel in attendance. It is time to get our message out to our peers, exchange information, and participate in the wildlife community.

PS

*Mike Coffey is a Wildlife Biologist with the Natural Resource Partnerships Program Office of the National Natural Resource Program Center in Fort Collins, Colorado. His phone number is (970) 225-3553.*

puters is cc:Mail. If this is the case, many of the high-powered, fast, multimedia aspects of the Internet will not be available to you. But that is no reason to put off

( other Internet definitions can be found on page 17). He elaborates that a set of network conventions and common tools is employed to give the appearance of a single large network, although the linked computers actually use many different hardware and software platforms. With more than 3.5 million computers and

### ACCESS TO INTERNET BY E-MAIL

Webmail and Gophermail are two ways you can retrieve information using only e-mail, the lowest level of Internet connectivity (see sidebar). Others, e.g., FTPmail, Finger, Archie, Veronica, Usenet, and Wais, will almost certainly be created in the future.

## Even cc:Mail users can retrieve the text portions of Web pages by using a service known as Webmail.

acquiring useful job-related information and developing professional contacts over the Internet.

### WHAT IS THE INTERNET?

Bob Rankin, author of *Accessing the Internet by e-mail: Dr. Bob's guide to offline Internet access*, defines the Internet as a sprawling collection of computer networks that spans the globe, connecting government, military, educational, and commercial institutions and private citizens to a wide range of computer services

40,000 computer networks, the Internet (Net for short) was born of an experiment in postnuclear war command communications by the U.S. Department of Defense in the 1970s. The effort eventually grew to include the National Science foundation and several universities and advanced from there.

### UNIFORM RESOURCE LOCATORS

To get information over the Internet you need to know the computer and directory in which the information resides.

These two pieces of information essentially comprise an address for the information. When these two pieces of information are preceded by an abbreviation for a specific type of resource (usually "gopher" or "http"), the string of characters is called a Uniform Resource Locator (URL).

Examples of URLs are:

<http://bluegoose.arw.r9.fws.gov/FWSHomePage.html>

[gopher://huh.harvard.edu/11/collections\\_info/aa](gopher://huh.harvard.edu/11/collections_info/aa)

It is important to remember that the difference between upper and low case letters is important in URLs, unlike with e-mail addresses. But don't worry: as with all computer systems, if you make a mistake in typing the URL, be assured that you will get an error message.

### WEBMAIL

In the past 3 or 4 years, a system of moving information between computers on the Internet was created called the World Wide Web. Unlike e-mail, which moves only text-based information across the Net, the World Wide Web (the Web or simply WWW for short) can interactively move sound, moving images, still images, and text. The multimedia documents being produced these days, with embedded links to other computer documents, are known as web pages or hypertext documents. Not all Internet computers can deliver the web pages that are now the state of the art. However, even cc:Mail users can retrieve the text portions of these more sophisticated hypertext pages (without ever seeing them) by using a service known as Webmail. The service is available at four Internet addresses (that I know of):

- [webmail@www.ucc.ie](mailto:webmail@www.ucc.ie)
- [webmail@curia.ucc.ie](mailto:webmail@curia.ucc.ie)
- [agora@w3.org](mailto:agora@w3.org) (out of service, temporarily)
- [agora@www.undp.org](mailto:agora@www.undp.org)

A request for a Web page returns only the text portion of the document. While the sounds, images, and movies are not returned, the URLs for links to other Web pages are returned. These URLs can then be used to retrieve additional documents. Using cc:Mail the steps are as follows:

- (1) select "Address to person" [enter]
- (2) select "np—Internet" [enter]
- (3) type one of the Webmail addresses given above [enter]
- (4) select "End addressing" [enter]
- (5) type a subject line (optional)
- (6) in the message body, type "go" (if using one of the Webmail addresses) followed by a URL. Alternatively, use the word "send" followed by a URL if using one of the agora addresses.
- (7) F10
- (8) send message

## Levels of Connectivity

### E-mail Gateway

Accessing the Internet through a gateway, usually to send or receive e-mail, is the lowest level of connectivity. For example, a NPS cc:Mail user may send a message through the gateway ("NP--INTERNET" on the cc:Mail address list) to any e-mail address, e.g., "stephen\_fettig@nps.gov". The gateway computer controls the flow of information between one computer network and the rest of the Internet and forwards the message. The specific type and method of information transfer is determined by those who administer the gateway computer.

### Modem

Connecting to the Internet by modem is the most common method. At this level a user runs programs (clients) located on another computer (host), which connects to the Internet. Access to the Internet is limited by the client programs, which the system administrator places on the host computer. On-line services, such as Prodigy or Compuserve, are popular examples of commercial hosts.

### Direct Connection

A full, 24-hour, hardwired connection to the Internet is the highest and most costly level of connectivity. With a minimum price tag of around \$30,000 per year, this option is usually limited to large organizations and universities.

## Selected Internet Definitions

Archie	A computer information system that searches for documents, images, sound files, and software at anonymous FTP sites based on key words supplied by a user.
cc:Mail	E-mail software used by the National Park Service, some universities, and other groups.
Client	Software that resides on a local computer and is used to retrieve or view information on other computers on the Internet. To use Archie you need an Archie client; to use Gopher you need a Gopher client.
Cyberspace	All or any functioning subset of computers, computer networks, and software that are interconnected. The word connotes the existence of electronically created environments used for entertainment or communication that appear to have little or no relationship to their physical locations.
E-mail	A general term for any text-based electronic communication between computers. Cc:Mail, Popmail, and Pine are examples of e-mail software (clients).
FTP	File Transfer Protocol. A system for transferring either text or binary data between computers. Anonymous FTP sites allow access without using a confidential password.
Gopher	A program for viewing directories and getting text information from computers, which are set up as Gopher servers. Using Gopher requires a Gopher client (software).
Server	A computer specially set up and administered to provide information (data or software) to other computers. Servers can provide any combination or subset of Gopher, Archie, Veronica, FTP, World Wide Web, e-mail, or other services.
URL	Uniform Resource Locator. The string of characters used to identify files by resource type, directory, and computer anywhere in the world.
Veronica	A computer information system that searches for documents, images, sound files, or software at Gopher sites based on key words supplied by a user. Veronica is to Gopher as Archie is to FTP.
The Web	The World Wide Web. Collectively, the computers (servers) that are set up to provide interactive and interlinked multimedia documents over the Internet. Whereas the e-mail function of the Internet only allows messages to be sent one way and is limited to text, the web is interactive and allows users to browse through documents that contain text, images, sounds, and movies.

will be sent to you. Whereas items that will take you to additional menus end with a forward slash ("/"), document names do not. By selecting a menu name with an

*Continued on page 18*

Web pages that I have found useful are:

<http://Internet.edu/about/scientis/menu.htm>

A list of scientists working on Long-term Ecological Monitoring Network (LTER) projects and links to other LTER information;

<http://www.nrcg.gov/home-page/htmls.html>

A National Biological Service site that gives many links to Internet resources for biologists;

<http://bluegoose.arw.r9.fws.gov/FWSHomePage.html>

The U.S. Fish and Wildlife Service home page;

<http://www.nwi.fws.gov/Welcome.html>

Information on the National Wetlands Inventory with several links to other WWW resources;

<http://nmnhwww.si.edu/departments/vert.html>

Information on the vertebrate zoology department at the Smithsonian Institution Museum of Natural History;

<http://nmnhwww.si.edu/nmnhweb.html>

The home page for the Smithsonian's natural history museum;

<http://straylight.tamu.edu/bene/bene.html>

The site of the Biodiversity and Ecosystems Network webserver. This is one site where you can learn of e-mail lists related to biodiversity topics;

[http://florawww.eeb.uconn.edu/FAM\\_DESC/fdlist.htm](http://florawww.eeb.uconn.edu/FAM_DESC/fdlist.htm)

An index of detailed plant family descriptions

By following other URL links you can, for example, retrieve family descriptions of the Rubiaceae at...

[http://florawww.eeb.uconn.edu/fam\\_desc/Rubiaceae.htm](http://florawww.eeb.uconn.edu/fam_desc/Rubiaceae.htm)

or the Ericaceae at...

[http://florawww.eeb.uconn.edu/fam\\_desc/Ericaceae.htm](http://florawww.eeb.uconn.edu/fam_desc/Ericaceae.htm)

<http://www.aps.edu/HTMLPages/WERP.html>

Background information on the New Mexico Museum of Natural History Water Ecology Research Project;

<http://envirolink.org/enviroweb.html>

Links to many Web pages, including the Endangered Species Act On-Line, Environmental Legal Documents, and the Frog Information Server;

<http://ash.lab.r1.fws.gov/usfwslab.html>

Links to many wildlife related Web pages, including summaries of natural resource protection laws, such as the Lacey Act, the Migratory Bird Treaty Act, the Endangered Species Act, and others. A link to a list of endangered species is also included;

<http://envirolink.org/florida/other.html>

South Florida environmental resources; and

<http://www.satelnat.org/manatee/facts.html>

Facts about manatee biology and natural history.

### GOPHERMAIL

Gopher provides menus or indexes of available text information in list form. It was named after the Minnesota Golden Gophers of the University of Minnesota where the software was first created. Items in each list are either titles for other menus or names of text documents. Menus do not just apply to one computer. Rather, a

Gopher menu on a computer in Seattle, Washington, may have list information for dozens of computers around the world.

To get a Gopher menu, send an e-mail message to one of the following addresses:

[gophermail@calvin.edu](mailto:gophermail@calvin.edu)  
[gopher@ucmp1.berkeley.edu](mailto:gopher@ucmp1.berkeley.edu)  
[gophem@mercury.forestry.umn.edu](mailto:gophem@mercury.forestry.umn.edu)  
[gopher@pip.shsu.edu](mailto:gopher@pip.shsu.edu)  
[gopher@solaris.ims.ac.jp](mailto:gopher@solaris.ims.ac.jp)  
[gophermail@ncc.go.jp](mailto:gophermail@ncc.go.jp)

Using cc:Mail, the steps are as follows:

- (1) select "Address to person" [enter]
- (2) select "np—Internet" [enter]
- (3) type one of the addresses above [enter]
- (4) select "End addressing" [enter]
- (5) type a subject line (optional)
- (6) type "help" in the message area
- (7) F10
- (8) send message

If you have a specific gopher URL that you want to reach (such as "gopher://sunsite.unc.edu/1m/./pub/academic/biology/ecology+evolution/bioguide/bioguide.item"), use one of the Webmail addresses from the table or place the computer host name in the subject line, as follows:

**[gopher.micro.umn.edu](mailto:gopher.micro.umn.edu)**  
 Main gopher menu at the University of Minnesota;  
**[muse.bio.cornell.edu](mailto:muse.bio.cornell.edu)**  
 Biodiversity and biology menu at Cornell University;  
**[biodiversity.ups.edu](mailto:biodiversity.ups.edu)**  
 Another biodiversity gopher menu;  
**[gopher.epa.gov](mailto:gopher.epa.gov)**  
 Environmental Protection Agency Gopher menu; and  
**[marvel.loc.gov](mailto:marvel.loc.gov)**  
 Library of Congress.

Gophermail will return a menu. When you select a document by placing an "X" before the document name and return the message to Gophermail, that document

"X" and sending the message, Gophermail will connect to the appropriate computer anywhere in the world and give you a new menu. That can be done iteratively until you give up, or find the information you are looking for. Because there are no rules as to which computers hold which information, you may find the same information on several computers, or you may not find what you are looking for.

**CAUTION**

Accessing the World Wide Web using e-mail is a lot like getting a transcript of a television program by U.S. mail: you get text and stage directions, but no images or sounds. Often the message needs re-formatting. The servers providing these access services get extremely heavy use. Thus, expect a full day or more for a response. If you do not get a response in 4 or 5 days, resend your request. It helps to avoid sending requests during regular business hours when Internet use is staggering at many sites. Consider sending your requests at the end of your work day or at the end of a work week, so the server can process the request overnight or over a weekend. If you are at a site where the telephone lines give cc:Mail problems when large messages are delivered, consider sending only one request at a time. Reply messages are frequently more than one page and can often be several pages. Finally, these Internet-by-e-mail services are provided free of charge to all Internet users, worldwide, but can be costly to the providers. Thus, changes, cancellations, and interruptions to the services can and do occur.



*Steve Fettig is a NPS Biologist stationed at Bandelier National Monument, New Mexico. You may have guessed that his e-mail address is "stephen\_fettig@nps.gov".*

## E-LISTS AND LISTSERVERS

**E**-LISTS, OR LISTSERVERS, ARE electronic mail distribution lists. They can be two-way or outgoing only. With the two-way lists, subscribers can post messages to the list at any time and the messages will be automatically distributed to all subscribers. Outgoing lists are like electronic news periodicals. The own-

ers and operators of outgoing lists are the only ones who can post messages to all subscribers.

The Environmental Protection Agency (EPA) offers several very useful outgoing lists. The following lists are distributed from the *Federal Register* on the day of publication.

**Listserver Name**

**Description**

*EPA-Meetings*

*All meeting notices*

*EPA-Impacts*

*All environmental impact statements published in the Federal Register*

*EPA-Species*

*All endangered species documents published in the Federal Register*

*EPA-Pest*

*All Office of Pesticide Program documents*

*EPA-Waste*

*All hazardous and solid waste documents*

*EPA-Water*

*All Office of Water documents*

*To subscribe to any of the above lists, address a message to: listserver@unixmail.rtpnc.epa.gov*

*Your message should contain only the following one line: subscribe <listserve-name> <Your first name> <Your last name>*

For more information and additional listserve names, descriptions, and commands send a note to the above listserver address with "Help listserver" as the message.

Be aware that each listserve may distribute between zero and ten messages per day. Some documents are long and will be split into several messages. To avoid being overrun by messages, you

will need to learn to quickly delete many messages. I delete 90-95% of the messages within a few seconds. One very annoying problem with these lists, however, is that the subject lines given in each message are usually worthless. But otherwise the lists are very useful and provide Federal Register information very quickly.



**INTERNET GUIDES AVAILABLE BY E-MAIL:**

Rankin, Bob. 1995. Accessing the Internet by e-mail: Doctor Bob's guide to offline Internet access. 4th edition, July 1995. 31 pages.

*Send e-mail to "listserv@ubvm.cc.buffalo.edu". Leave subject blank and type only this line in the message area: "get internet by-email nettrain f-mail".*

*Or retrieve from: "webmail@curia.ucc.ie" The one-line message should be:*

*"go gopher://sunsite.unc.edu/1m/./pub/academic/biology/ecology+evolution/bioguide/bioguide.item"*

Smith, Una R. 1993. A biologist's guide to Internet resources. 30 pages.

*Send e-mail to "agora@w3.org". On one line, place the following message:*

*"send gopher://sunsite.unc.edu/1m/./pub/academic/biology/ecology+evolution/bioguide/bioguide.item"*

Yanoff, Scott. 1995. Yanoff's list. 37 pages.

*Send e-mail to "inetlist@aug3.augsburg.edu". The server will automatically reply with a blank message.*

sustainability; developing proposals that support cooperation, innovation in conservation, ecosystem management, and use; submitting proposals for new biosphere reserves and additions to existing biosphere reserve and regional MAB cooperatives; and (3) announcements of conferences and upcoming meetings.

To subscribe to the USMAB e-mail discussion group, send an e-mail message to the address: "listproc@ucdavis.edu". In the body of the message (you can leave the subject line blank as it will be ignored by the computer) type:

`"subscribe usmab_program <firstname>  
<lastname>,"`

where you insert your first name and last name. For example, type: "subscribe usmab\_program John Smith". To send a message to all USMAB program participants, send an e-mail to:

`"usmab_program@ucdavis.edu".`

To unsubscribe from the usmab\_program e-mail listserv, send a message to: "listproc@ucdavis.edu". In the body of the message type: "unsubscribe usmab\_program".

For more information about the U.S. Man and the Biosphere Program; contact Roger Soles; United States Man and the Biosphere Program; OES/ETC/MAB, 1st Floor SA-44C; United States Department of State; Washington, D.C. 20522-4401; phone (202) 776-8318; fax (202) 776-8367 or Jennifer Gaines; U.S. Department of Interior; National Biological Service; 1849 C Street, NW MS 3070; Washington, DC 20240; phone (202) 208-1687; fax (202) 208-7275; "jennifer\_gaines@nbs.gov".



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*Inquiries about the operation of this e-mail group may be addressed to James F. Quinn, Division of Environmental Studies; University of California, Davis; Davis, CA 95616; "jfqinn@ucdavis.edu".*

Wildlife." The funding initiative promotes an "outdoor enthusiasts" user fee on a range of outdoor equipment (such as backpacks, tents, mountain bikes, recreational vehicles, photographic equipment, bird seed, and field guides). It aims to raise \$350 million annually to fund "wildlife diversity programs." The proposed fee is similar to the fees that hunters and anglers have been paying for more than 50 years to support game and sport fish conservation programs. The funds would be allocated to states using a formula similar to that used to distribute Dingell-Johnson, Pitman-Robertson, and Wallop-Breau funds for game and fish management programs. Under this proposal, states must provide 25% of project costs and federal agencies are not eligible for funds. However, projects funded under the program could be conducted on federal lands.

Teaming with Wildlife funds would be devoted entirely to nongame species management. The initiative is already endorsed by more than 300 different groups including several companies whose products would be assessed. Reportedly, Speaker of the House of Representatives Gingrich expressed support for a user fee (as opposed to a tax) to support nongame conservation. "Teaming with Wildlife" seems to have momentum and could soon provide funds for land bird conservation (and nongame conservation overall) at a time when funds are desperately needed.

To date, Partners in Flight has stimulated interest and action promoting conservation of migratory birds. The primary benefits have arisen through communication and increased awareness among diverse PIF partners. Concrete examples of conservation action already exist in areas like the Mississippi Alluvial Valley. If successful, the International Partners in Flight Conservation Plan will provide a tool to stimulate conservation on scales (ecosystem, regional, national, and international) that are ecologically meaningful for migratory birds.



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thermophilic microorganism survey, a baseline inventory of these species which is being established on the World Wide Web. Other topics included physiology, distribution, evolution and techniques used to study these enigmatic creatures, most of which cannot be grown in tissue culture.

The symposium generated suggestions on how we might proceed with the Yellowstone microbiology program. They included the establishment of an independent blue-ribbon panel of senior scientists connected via an Internet list server. Representing the three constituencies of academia, industry and resource management, the expert panel could suggest solutions to commercial use issues, review technical material concerning research permits, develop or review protocols for field researchers working in the geothermal ecosystem, and provide insight into the long term preservation and management of this national treasure.

The symposium drew to a close with a field trip led by Dr. Brock to Black Sand Basin, within walking distance from Old Faithful. It was made clear that the private sector is enthusiastic about working with the NPS in formulating strategy on the preservation and maintenance of thermophilic biodiversity in Yellowstone National Park. With an estimated 99% of Yellowstone's thermophiles yet undiscovered, according to Norm Pace of Indiana University, who developed a new way of detecting enigmatic species called "phylogenetic analysis," our 40 ongoing microbiology research projects have much work to look forward to.

As with many other issues in conservation biology, Yellowstone has a long history of setting precedents. To me, the National Park Service conference organizer, the end of this symposium marks the beginning of the Yellowstone Microbiology Program, an initiative to preserve, protect, educate and attract funding for the benefit of all participants interested in this nontraditional, superheated field of resource management.



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*Bob Lindstrom is Management Assistant with the Yellowstone Center for Resources. His phone number is (307) 344-2234.*

# COOPERATION ENHANCES REVEGETATION EFFORTS IN GLACIER NATIONAL PARK

By RAYMOND C. SHEARER, RACHEL W. POTTER, LAURIE L. KURTH, JENNIFER M. ASEBROOK

THE SCENIC GOING-TO-THE-Sun Road in Glacier National Park, Montana, is currently being reconstructed. Several cooperating agencies, including the Federal Highway Administration, U.S. Department of Agriculture, Forest Service (Intermountain Research Station), Natural Resources Conservation Service (formerly the Soil Conservation Service), and the National Park Service participated in the construction and revegetation planning efforts that began in the mid-1980s. Provided for in the 1982 National Surface Transportation Assistance Act, road rehabilitation began in 1991. However, initial revegetation planning for the 16 km (9.8 mile) Lake McDonald section of the road was hampered because information regarding natural regeneration by conifers and revegetation success of several native herbaceous species was lacking.

Research was needed to determine the best way to restore native vegetation to the disturbed road corridor while providing adequate soil stability and minimizing the number of invasive exotic species. Study sites were established in both Glacier National Park and the nearby Coram Experimental Forest (administered by the Intermountain Research Station and located on Flathead National Forest), two biosphere reserves, which are units of the United Nations Program on Man and the Biosphere. The two areas combine a large natural park managed for ecosystem conservation (Glacier National Park) with a field research site (Coram Experimental Forest), a beneficial pairing for the needed revegetation research. The common biosphere reserve designation stimulated cooperation between personnel at both reserves to study dispersal and viability of conifer seedfall and planting of native species for revegetation.

## OBJECTIVES

A dense conifer forest canopy paralleled the road, and we expected that most, if not all, disturbed areas would quickly regenerate with conifers. The purpose of the conifer seedfall study was to estimate by species the number of conifer seeds that (1) dispersed from cones maturing from 1987 through 1995 above and below the road, (2) germinated on cut slopes from 1992 (the first year after treatment) through 1996, and (3) produced surviving seedlings through 1996.

Research on planting native species required a recent road cut. To minimize disturbance from the study in Glacier National Park, we chose a comparable site on Coram Experimental Forest to determine if (1) seeding with native forbs and grasses could provide a stable cover and reduce volunteer exotics or if a rapidly growing agronomic mix would be necessary, (2) fertilizer presence or timing would benefit natives or exotics, (3) specific native species would establish from seed, and (4) seeding or transplanting would be a better way to establish pinegrass (*Calamagrostis rubescens*) and beargrass (*Xerophyllum tenax*).

## STUDY AREAS AND METHODS

The seedfall study is located along the Lake McDonald section of the road within Glacier National Park. This section lies along the 975 m (3,200 ft) contour within the western red cedar (*Thuja plicata*)-western hemlock (*Tsuga heterophylla*) forest type (Eyre 1980), and is composed mostly of stands originating after fires in 1735 (Barrett 1988). Other conifers within this predominantly cedar-hemlock forest are Douglas-fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*), spruce (probably hybrids of Engelmann [*Picea engelmannii*] and white spruce [*Picea glauca*]), lodgepole pine (*Pinus contorta*), western white pine (*Pinus monticola*), and subalpine fir (*Abies lasiocarpa*). Seedfall from the conifer trees was estimated along the road using forty



Figure 1. A researcher shows one of the seed traps used in the study to catch and measure seedfall.

0.4 m<sup>2</sup> (4.4 ft<sup>2</sup>) seed traps (fig. 1). We positioned two seed traps about 15 m (50 ft) apart above the road cut and also below the road fill at each of 10 locations. Contents of the traps were emptied periodically after seeds began to disperse in early September each year. Time and amount of seedfall for each species was determined each year. Near each group of seed traps, four 0.25 m<sup>2</sup> (2.7 ft<sup>2</sup>) plots were established in the new road cut to monitor germination of conifer seed and mortality of seedlings once a month from May through September beginning in 1992.

For the planting study, we chose a section of road in the Coram Experimental Forest for its similarity to the Lake McDonald road section. Research staff regraded approximately 2.5m (8.2 ft) of high cut slopes above the road. In the fall of 1987, crews installed ten treatments in 1 m<sup>2</sup> (10.8 ft<sup>2</sup>) test plots, each with four replicates. Treatments on the cut slopes were (1) a native grass and forb seed mix (Table 1) that received (a) no fertilizer, (b) fertilizer at planting, and (c) fertilizer the spring after planting; (2) a control treatment with no seed or fertilizer, (3) pinegrass seed, (4) pinegrass rhizome sections, (5) beargrass seed, and (6) small beargrass transplants. We planted two treatments in the ditch using (1) the same native mixture as on the slopes, and (2) an agronomic mixture consisting of Kentucky bluegrass (*Poa pratensis*), Canada bluegrass (*Poa compressa*), and red fescue (*Festuca rubra*). We measured percent of coverage, seedling density, and transplant size for 3 years following planting.

## RESULTS AND DISCUSSION

Conifers began to reforest cut and fill slopes the first year after treatment. Much of the seed that fell on cut slopes from a

poor cone crop that matured in 1991 washed into the ditch below in the spring of 1992 because there was no vegetation to hold it on the site during snowmelt and associated overland waterflow. Conditions improved the following years after vegetation established, holding more of the seeds where they fell. The amount of conifer seed dispersed varied greatly by species and year (Shearer and Potter 1994). During the study, over 90% of the seed fall, germination, and survival was western hemlock or western red cedar. Hemlock and cedar will be the major conifers to regenerate cut and fill slopes along the road naturally. Other conifer species will establish less frequently and provide diversity.

After three growing seasons, we summarized the results of the planting study at Coram. The unseeded control had higher cover of volunteer forbs and grasses and higher densities of volunteer forbs than the seeded treatments, indicating that seeding may reduce growth of volunteers, includ-

crease in the future. Competition, resulting from a high grass seeding rate (1,830 seed/m<sup>2</sup>), may have contributed to grass cover increasing the first 2 years and markedly decreasing thereafter. All seeded native species germinated and established satisfactorily, but cover of forbs and pinegrass was low (Table 1).

When pinegrass seeded by itself at 646 seeds/m<sup>2</sup>, it had canopy cover of 49%; however, when seeded in the mix with faster growing species, its cover was only 5%. Although only 11% of pinegrass rhizome sections sprouted, they quickly produced vigorous, large plants. When beargrass was seeded by itself, 29% of seeds established the first year. This increased to 49% the second year and did not increase thereafter, indicating that many seeds required 2 years of cold stratification. Beargrass seeds planted in a mix had 22% establishment the first year and the numbers remained constant. Ninety-five percent of beargrass transplants survived and were larger in the third year than at planting. All mortality occurred in the first summer.

Based on these results, the park planned to seed along the road to provide quick cover, increasing native species and reducing exotics. We did not need to use an agronomic mix because native species provided sufficient cover. A very light fertilizer was applied at seeding to balance carbon content of the mulch. Seeding rates of early establishing grasses were decreased and pinegrass and forbs were increased. All available native species in the study were included on the road seed mix. We seeded pinegrass and beargrass rather than use the more labor intensive transplants, but we did not plant

bluegrass as originally planned. Results of revegetation along the Lake McDonald section of the road parallel those from the cooperative studies. Ninety percent of germinating conifers were western red cedar or western hemlock with other conifer species establishing less frequently. Native species canopy cover, especially seeded grasses, has increased each year and to date usually exceeds weed cover by 10-

25%. In control areas that were not seeded, weed cover exceeded native cover by the same amount; this result supports the use of native seed to increase native species and reduce exotic cover. Both pinegrass and beargrass, seeded on the road with fast-growing species, were not observed until the second year after seeding. Presently, each species provides less than 1% cover but both continue to increase in frequency. From 1992-94, beargrass has increased in frequency from 0-40%, while pinegrass has increased from 0-5%.

## SUMMARY

Work conducted in the experimental portion of one biosphere reserve has augmented protection of the core area of another biosphere reserve. The Man and the Biosphere Program promotes cooperative studies such as this, which enables input from several specialists and results in sound resource management decisions. Significant applicable information was obtained that the park could not have generated alone, due to the lack of subject expertise or ability to conduct manipulative experiments. Not only did Glacier National Park receive information that directed efficient and effective revegetation, but our basic silvicultural knowledge increased for several conifer species.



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- Shearer, R.C., and R.W. Potter. 1994. Conifer seedfall in the cedar-hemlock forest near Lake McDonald, Glacier National Park, Montana. Pages 249-256 in Symposium proceedings of interior cedar-hemlock-white pine forests: ecology and management. 1993. March 2-4, Spokane, WA. Department of Natural Resource Sciences. Washington State University, Pullman, WA.

*Ray Shearer is Research Silviculturist and Manager of Coram Experimental Forest, Intermountain Research Station. Rachel Potter is a former biosciences technician at Glacier National Park. Laurie Kurth is a former Ecologist at Glacier National Park and is now a Botanist at Zion National Park, Utah. Jennifer Asebrook is a biosciences technician at Glacier National Park.*

**TABLE 1.**

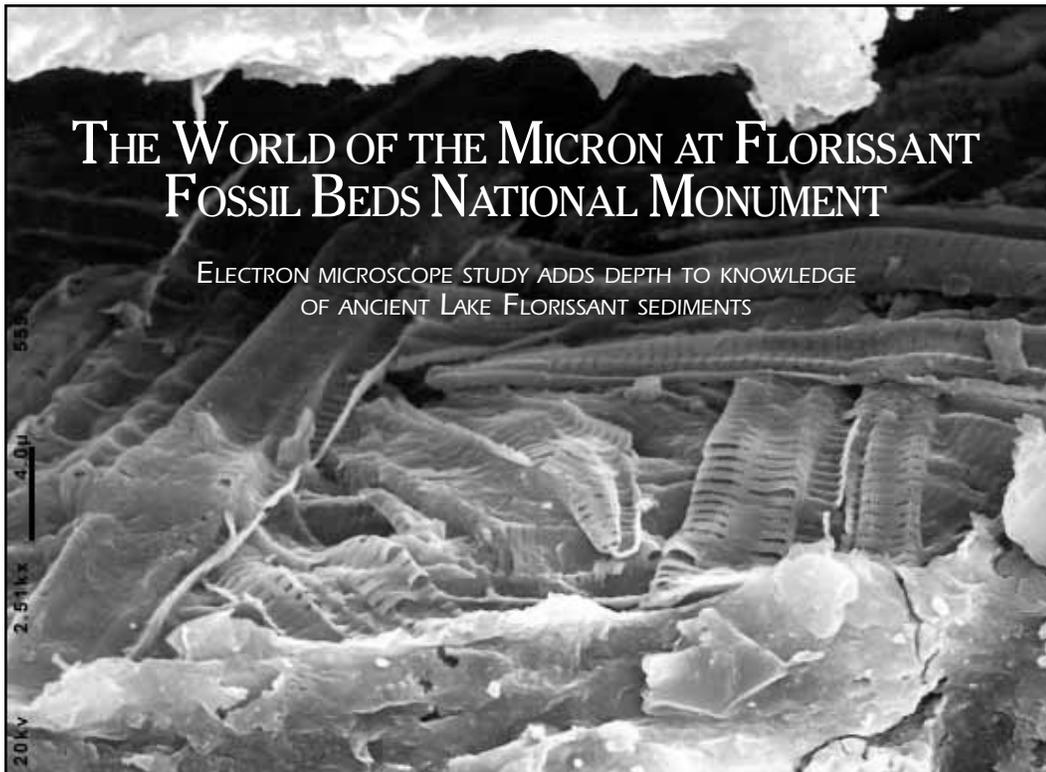
**MEAN CANOPY COVER OF SEEDED GRASSES AND FORBS AND MEAN ESTABLISHMENT OF SEEDED FORBS IN NATIVE MIX TREATMENTS IN THE CORAM STUDY DURING THE THIRD GROWING SEASON. (NM=NOT MEASURED)**

Species	Mean Cover (%)	Seed Establishment (%)
<i>Agropyron spicatum</i>	4.8	NM
<i>Bromus carinatus</i>	41.7	NM
<i>Calamagrostis rubescens</i>	5.4	NM
<i>Anaphyllis margaritaceae</i>	2.9	34
<i>Antennaria microphylla</i>	<.1	35
<i>Antennaria neglecta</i>	<.1	14
<i>Arnica latifolia</i>	4.4	91
<i>Aster laevis</i>	7.1	>98
<i>Xerophyllum tenax</i>	<.1	25

ing weeds. In the ditch treatments, the agronomic mix had higher grass cover than the native mix but no significant difference in the number of volunteer forbs occurred. Results from the fertilizer study were inconclusive. The unfertilized treatment had the highest cover of seeded forbs and the lowest cover of volunteer forbs, but it also had the largest number of volunteer forb species, suggesting that its cover may in-

# THE WORLD OF THE MICRON AT FLORISSANT FOSSIL BEDS NATIONAL MONUMENT

ELECTRON MICROSCOPE STUDY ADDS DEPTH TO KNOWLEDGE OF ANCIENT LAKE FLORISSANT SEDIMENTS



**Note:** Scale for all figures shown in microns (millionths of a meter).

Figure 1 (left). Scanning electron micrograph of a diatom mat.

BY NEAL R. O'BRIEN AND HERBERT W. MEYER

**L**YING IN THE SHADOW OF Pike's Peak in the Rocky Mountains of Colorado is an ancient lake bed containing remarkably preserved fossil remains of plants, leaves, and insects at Florissant Fossil Beds National Monument. Since the early 1870s, the delicate fossilized remains of conifers and many species of broad-leaved plants have been found entombed in the sediment layers along with a variety of insects such as beetles, flies, wasps, dragonflies, and butterflies. Although over 300 publications describe the fossil content of this unique geologic deposit, only a few discuss the details of the geological history of the lake that existed in the area during the later part of Eocene epoch 34-35 million years ago. During the summer of 1995, with support from the National Park Service, we began an intensive geological investigation to examine minute details of the sedimentology and paleontology of ancient Lake Florissant using the scanning electron microscope. We want to know what happened 35 million years ago in Colorado.

An impressive feature of the lake deposits is the abundance of fine millimeter or less thick laminated sediments. Laminated sediments are common in many

lake deposits where they often show a seasonal alternation of deposition. Previous study of the laminations in the Florissant area (McLeroy and Anderson 1966) revealed that the deposit contained alternating fine layers of volcanic debris (pumice and ash), diatoms, and organic rich matter called sapropel. They indicated that the lake water was stratified and that these fine laminae recorded episodic events occurring with the seasons.

We undertook a detailed investigation of the laminated sediments in order to understand the ancient sedimentary processes during lake existence and what might have caused the alternating or episodic events recorded by the thinly layered sediment. Using a scanning electron microscope, we hoped to find microscopic clues to the source of sediment and how it was deposited in the lake basin. Viewing the lake deposits at the scale of the micron has revealed a world of sediment and fossil features never before seen in such detail from the Florissant beds. Presented here are our initial results of photos showing some of the features in the unexplored microscopic world of Lake Florissant. Our study is continuing; however, these initial results show that

there is another exciting aspect of the Florissant deposits in addition to previously described fossils.

Some very thin layers are composed entirely of the siliceous remains of diatoms belonging to a single species that bloomed in the lake water and accumulated on the bottom following a die-off. The diatom-rich layers indicated to McLeroy and Anderson (1966) clues of spring blooms

occurring during the time when winter and spring runoff supplied abundant nutrients to the lake for diatom growth. Our view at the micron level shows a mat of randomly scattered diatom fossils arranged like bodies on a battlefield after a terrible massacre (fig.1). A more accurate interpretation would be that the haphazard arrangement of fossils is proof of diatom blooming, mass dying, and fairly rapid burial. Another species of the diatom (fig. 2, page 20) also is found in other layers, but it does not form mats. These two diatom types may have lived and died under different ecological conditions. Our future study will try to determine if changes in the ancient lake conditions had an effect on the type of life living in the water.

Other alternating millimeter thick layers contain ostracode shells embedded in volcanic ash sediment. The bean-shaped shells of this crustacean (like a shrimp) sometimes are large enough to be seen with a hand lens but often escape recognition. However, their microscopic shells are very common in certain layers when viewed with scanning electron microscopy (SEM).

The structures of spores and wood are also revealed in the world of the micron of Lake Florissant. A valuable investiga-

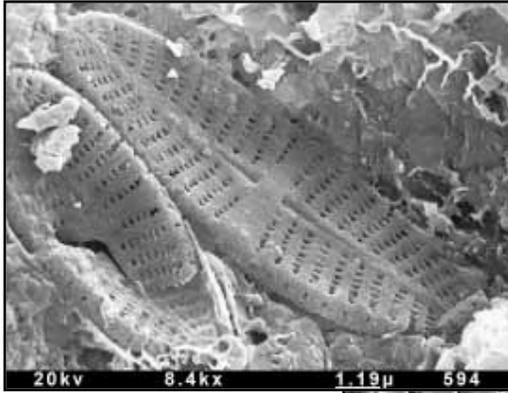


Figure 2 (above). SEM of the diatom type.

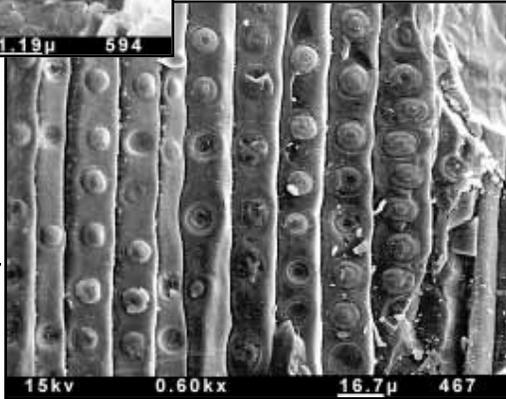


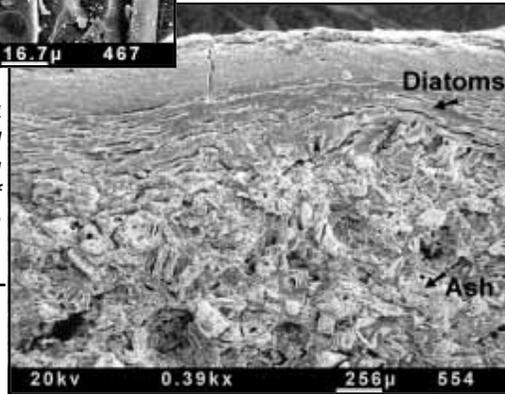
Figure 3 (right). SEM of redwood tree structures.

tory procedure that supplements the scanning electron microscope and aids in identification of the chemical composition of particles is energy dispersive X-ray analysis (EDX), which gives an elemental analysis of the substance in the SEM viewing area. The EDX pattern of the spore picture confirms a carbon (thus organic) composition of the particles. EDX has been useful in recognizing the composition of other fossils and sediment particles. The minute details of a petrified redwood tree are visible in the SEM view in figure 3.

The lake deposits frequently show an alternation of volcanic ash and diatom layers (fig. 4). The famous insects, leaves, and other fossil remains commonly occur entombed in the fine ash. Apparently, their delicate remains were not disturbed as they were buried in the fine volcanic ash, which was washed into the lake basin from land or fell from ash clouds over the lake itself. Figure 4 shows layers of ash and diatoms. As our study continues, we wish to determine the period of time represented by an ash-diatom couplet (or pair). In some lake deposits, couplets represent 1 year of deposition. Determining the time represented by the couplets in the Florissant deposits would help determine the duration of the lake's existence.

Another aspect of our study is to learn about the chemical changes that take place in volcanic sediments during and after deposition. Geologists commonly know that volcanic ash weathers to a clay mineral called smectite. The shapes of the ash particles are indicators of the weathering processes. Our results have shown details (fig. 5) of the process of a volcanic

Figure 4 (right). SEM showing layers of volcanic ash and diatoms.



grain (see the arrow) changing to clay (C in fig. 5). Our future investigations will attempt to determine morphological differences between airborne and washed-in grains in order to understand the geologic events responsible for filling in the lake.

#### FURTHER STUDIES

To date, our observations reveal an abundance of small-scale fossils and mineralogical evidence in the ancient lake deposits. Much of this evidence has not been previously obtained simply because no one used the scanning electron microscope to journey into the microscopic world. Also, the other remarkably preserved and larger fossils have absorbed the attention of most investigators. We hope

to continue gathering more evidence of features at the microscopic level because it promises to reveal further clues about lake history. Currently underway is a detailed study to determine the geological features present in sediments deposited near the ancient lake shore and along a traverse out into the center of the lake itself. Results should provide clues of the constancy of or amount of change in sedimentary lake processes and thus help in reconstructing ancient lake history. Results of this study including the SEM photos also are to be arranged in an interpretive display for the visitor center. Our contribution shows that there is another facet of the Florissant fossil beds, which is revealed in the intriguing "world of the micron."

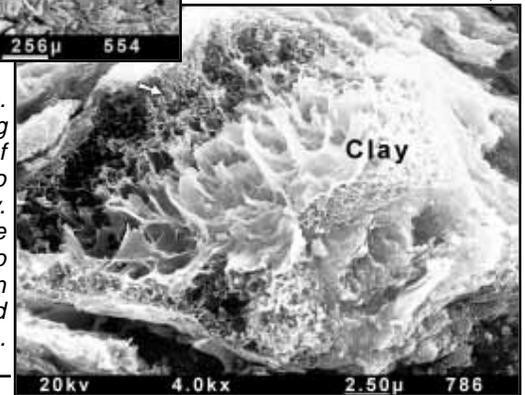
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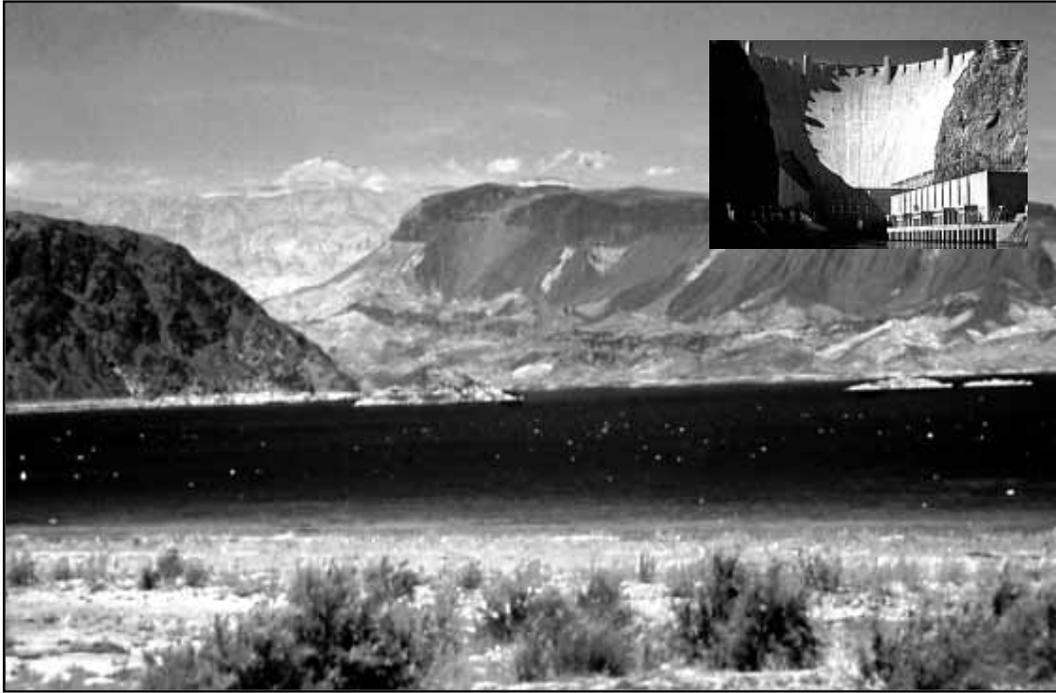
McLeroy, C.A., and R.Y. Anderson. 1966. Lamination of the Oligocene Florissant Lake deposits, Colorado. Geological Society of America Bulletin **77**:605-618.

Dr. Neal R. O'Brien is

Figure 5 (right). SEM showing weathering of ash (arrow) to smectite clay. Notice how the clay appears to grow like a thin film on the solid volcanic grain.



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*Engineering marvel of the 1930s, Hoover Dam and its Lake Mead National Recreation Area home were the site of a November meeting to assess the effects of the NPS reengineering and restructuring phenomenon of the 1990s on natural resource management and science.*

## IS THE NATURAL RESOURCE DISCIPLINE FLOURISHING?

A summary of the Lake Mead meeting  
on natural resource management in the restructured NPS

BY THE EDITOR

**G**OVERNMENT REINVENTION, one theme of our work over the last year and a half, has brought about fundamental and long-lasting change to everyone associated with natural resource management and science in the National Park Service. Some changes are positive for resource management while others are still evolving. However, where initial success in the transition has been high, more recent indications are that it has slowed or, in some cases, stalled altogether. Some problems associated with the complex task of bringing about fundamental cultural change are just beginning to surface and be studied and understood. Mid-course correction is now needed to address staffing, communication, and funding problems in order to enable natural resource managers to work effectively and flourish under the new structure.

The current state of resource management was the subject of a November meeting of a broad range of resource management professionals who gathered at Lake Mead National Recreation Area (see photo), Nevada. Associate Director for Natural Resource Stewardship and Science Mike Soukup set the tone for the 2½-day meeting by acknowledging that the reorganization has had a profound effect on everyone in the National Park Service. The associate director charged the nearly 45 resource management professionals from parks, system support offices (SSOs), the National Natural Resource Program Center (NNRPC), and field directorates with the task of assessing the effects of restructuring on resource management and moving beyond problems by focusing on the areas that are most important to further natural resource management in the parks.

### CHANGES IN COMMUNICATION

Over the next 2½ days, the group heard 25 sessions that covered the spectrum of natural resource activities taking place in parks, SSOs, at the field area level, in the NNRPC, and within the Washington Office. From the start, meeting participants indicated that communication had increased out of necessity, but had become more complex under the new organization. They also noted that cooperation between parks and SSOs is up. Creativity is high and field areas, most SSOs, and most clusters (groups of biologically, geographically, or culturally associated parks) are devising individual approaches to managing day-to-day concerns. Thus, functions that were once familiar across regions may not exist any longer or may have changed substantially making communication both vital and a basic challenge for nearly everyone.

Adding to communication complexities are the differences by which SSOs have filled out their new structures. Two field areas (the Pacific/West and Intermountain) have largely completed their organizations, filled positions, and generally understand how they will function. The Pacific West Field Area has nine positions in three SSOs related to natural resource management excluding GIS and compliance; the Columbia Cascades SSO has an additional 3.3 positions for GIS and compliance. The Intermountain Field Area reports 18 positions filled, including six devoted to GIS and one for compliance. At the other extreme are the Southeast and National Capital Field Areas, for they have little or no staff in their SSOs to provide park support. The other field areas are somewhere in between. For example, the Northeast Field Area has 15 positions allocated for three SSOs, including the compliance and GIS functions, but only eight are filled and two of the seven vacancies are unfunded. Likewise, only half of the Midwest Field Area's 13 required positions (including GIS, but excluding compliance) for two SSOs are funded and filled. An additional two positions are needed for compliance.

Many resource management job titles are new, longer than before, and reflect new roles and functions for many positions. For example, each field area now has an Associate Field Director for Natural Resource Stewardship and Science (or similar title) that was filled, in most cases, by a former regional chief scientist. The role has changed from one of coordinating the science and resource management activities for a region (with line authority, programs, and budgets) to one of filling a strictly advisory role with no funds, staff, or programs. While these positions may also include other areas of responsibility, such as planning, the incumbents raise important resource management concerns to the field directors and still serve a liaison function between the field, CPSUs (cooperative park studies units), and the National Biological Service. As an exception, two former chief scientists have retained the title of Chief Scientist and now serve the Allegheny/Chesapeake and New England SSOs in advisory and coordination roles.

At the system support office level, one former regional chief scientist and several

regional chiefs of resource management have become either Team Coordinators for Stewardship and Partnerships (supervisory positions with a broader role than the former regional chief of resource management) or Program Leaders for Natural Resources who report to the team coordinator. Program leaders work with small staffs of SSO resource managers, but are no longer supervisors.

#### **ALASKA DIFFERENT**

Whereas all field areas are trying different operational approaches under restructuring, the Alaska Field Area has changed very little. The legal requirements for subsistence fishing and hunting, etc., under ANILCA (the 1980 legislation creating most Alaskan parks in their present form), combined with severe park isolation and lack of park housing led to a practical and successful central office organizational approach. The Alaska SSO has requested that the National Leadership Council allow them to maintain higher central personnel levels than originally targeted for downsizing. If granted, the positions would have to come from unfilled positions elsewhere.

The Alaska Cluster of parks, like the National Capital Cluster, also has adopted no new structure. With just 14 superintendents, this group already functioned somewhat like a cluster and has not had to make fundamental changes.

#### **CLUSTER CONSIDERATIONS**

The focus on the cluster is perhaps the biggest change affecting parks in the reorganization. Where parks formerly constituted the basic unit of planning and work, clusters are now beginning to play this role. In the case of the Pacific/Great Basin Cluster, annual cluster work planning is becoming as important as park work planning has been. Larry Bancroft, Sequoia-Kings Canyon National Park Chief of Resource Management explained, "[Restructuring] has removed the prioritization processes that [we] normally went through with strategic planning and leads [us] to try to take on everything at high quality. We can't. We must prioritize, then we could come out ahead... Now the clusters must approach work plans cluster by cluster. Then [we] must share the resources to get the work done." Carrying this new concept through

to a practical conclusion, Air Resources Division Chief John Christiano noted that "park hiring may need to be influenced by the greater needs of the cluster rather than the individual needs of the park. A cluster may need to do a staffing plan for the good of the cluster."

While locating the right person for a particular purpose has become more difficult as staff learn how the clusters and system support offices function, communication between superintendents has increased. Superintendents now have more decision making power and budgetary control than in the past and are competing less with one another for funds. Instead, they tend to be considering the broad range of issues for all parks in their respective clusters. They now have no regional office funds to compete for, but must decide how to divide monies amongst themselves.

To help provide leadership for the cluster, many clusters have adopted a "cluster executive council," a subgroup of cluster superintendents, to take action on cluster concerns and communicate with the field director on behalf of the cluster. Here, too, different approaches to the same circumstance have evolved. Some clusters have identified one superintendent as an "executive superintendent," while others use the council format, but call this group by another name. One field area cluster uses a "desk officer" to act as liaison with the field director, another uses an "advocate." The Alaska and National Capital Clusters have no such group at all. Whatever it is called, this function is important to natural resource management as it often serves to prioritize projects for the cluster, feeding projects into the list of priorities for the field area at large.

#### **SUPERINTENDENTS KEY**

Under the new order, superintendents have clearly become more important for the advancement of resource management. Less emphasis on resource management is coming from central offices and superintendents are the ones who must become advocates for resource management as a management tool. This puts added emphasis on the need for resource management experience or training for

*Continued on page 26*

superintendents, especially first time superintendents and those with assignments in small parks.

Southeast Field Area Associate Field Director for Natural Resource Steward-

With scarce resources all around, Ocmulgee National Monument Superintendent John Bundy indicated that resource management projects must be promoted on the basis of how they add value, lead to lower cost or simplification, or could compete on the open market.

have done. Janet Wise, Natural Resource Program Leader for the Colorado Plateau SSO indicated that 60% of their SSO positions operate across cluster boundaries, increasing the expertise each SSO has to offer parks. Where SSO expertise is lacking, they have identified park expert leads

or cooperating students pursuing higher degrees to fill the niches. They also use one Denver Service Center natural resource planner living in a park for support. Their cre-

## *Under the new order, superintendents have become more important for the advancement of resource management*

ship and Science Suzette Kimball has noticed both positive and negative effects of this role elevation. "Park superintendents," she commented, "have become involved in the [resource management] issues, have had to set priorities, and have become more technically proficient in the skills necessary to evaluate resource management problems [than in the past. However,] much is not getting done at all or as well as it once was being done." Nevertheless, resource managers in general have been able to increase contact with their superintendents since restructuring. With support no longer coming from the regional office level, superintendents must rely on help from park resource management staff more.

To help them deal with natural resource concerns, some clusters are using natural resource advisory groups (often chiefs of resource management), subordinate to the cluster leadership, to bring forth recommendations, identify priorities, carry out the staff work associated with natural resources, and give advice on natural resource issues. For example, the Columbia/Cascades Cluster has identified a natural and cultural resource advisory group and the Pacific and Great Basin Clusters share such an advisory group. The Pacific West Field Area also has an advisory committee for natural resources at the field area level. Areas of member expertise may include natural resource program management, the National Biological Service, or other technical areas. Some clusters, however, have no such organ and either rely on the cluster executive council to fill this niche or convene ad hoc groups at their discretion (with some eventually becoming permanent structures).

"It's crisis management in the field," he added, "and long-term resource management needs are hard to sell." He also said that the more ties a resource management proposal has to legal mandates, the more leverage it has. Public education is also necessary to gain support for long-term resource management funding.

### **SSOs AND TECHNICAL SUPPORT**

Under the new structure, SSOs have replaced regional offices for field support, but they have no line authority or budgetary control as in the past. Through downsizing, they have generally lost personnel to the field in numbers that they no longer have the complete complement of expertise that they had under the regional office system. Instead, expertise must be shared among parks and their respective SSOs; SSOs now have to delegate some work to parks to serve the cluster effectively.

Some superintendents are surprised at the amount of work this is generating. Not surprisingly, larger parks with better developed resource management programs are beginning to feel the burden of these

ative approach has given more resources to parks without having to fill the positions from within. In the spirit of reengineering, they served an important coordination role assembling a complete set of experts from a variety of sources.

Unfortunately, this is not yet an option for SSOs that are very poorly staffed. As already mentioned, the Atlantic Coast and Gulf Coast SSOs have no permanent staff person to call for support, and the Appalachian SSO has only one—the Natural Resource Program Leader. After directing their attention toward reducing central office staff, the Southeast Field Area was prepared to rehire for restructured positions when a hiring freeze went into effect. In order to accomplish some resource management work while their positions have remained empty, they have made good use of contractors and cooperative agreements. However, they expect to begin losing ground if they cannot fill approved vacant positions. Likewise, the National Capital SSO has no staff related to natural resource management. These numbers are unusually low for SSOs (most others have 3-6 filled positions, in-

## *SSOs have lost personnel in numbers that they must now partner with parks to serve clusters effectively*

requests. Smaller parks are beginning to look to them for help, and unfortunately, the phones in *some* SSOs are no longer ringing. Although interpark work experiences offer terrific professionalization opportunities, superintendents are sure to have a tough time responding to all requests without staff and budget increases.

A potential solution is to share SSO expertise across cluster boundaries as the SSOs of the Intermountain Field Area

cluding clerical) and reflect the most current and potentially difficult problem for resource management in the National Park Service: lack of funds to fill approved positions.

### **FILLING PROFESSIONAL POSITIONS**

The money problem is not the result of restructuring per se; restructuring may have been predicated on a faulty assumption of increasing staff *and* funds at the

park level, while reducing the same in central offices. Although central office staff reductions are generally progressing at a pace to meet 1999 personnel targets, the funds to pay for the increased staff in parks this fiscal year are lacking. As Northeast Field Area Associate Director for Natural Resource Stewardship and Planning Bob McIntosh summarized, "The budget is the key for parks to be able to pick up the responsibilities being dropped by the central offices... We must get growth back into the parks or they will begin to lose ground."

Tighter funds also means that central offices may not have until 1999 to meet

their reduced personnel targets. The implication for parks, if reductions in force (RIFs) are to be avoided, is that they may be asked to take experienced, yet professionally unqualified, staff into resource management positions. Furthermore, the Department of the Interior (DOI) has begun to require that displaced DOI employees be considered for vacancies rather than allowing parks to recruit. This situation could have long-term ramifications for the professionalization of natural resource management and makes each hire, however restricted, especially important.

#### **NATIONAL PROGRAMS**

Associate Director Soukup outlined the new national natural resource organization, indicating that restructuring has had a very positive effect on the former Washington Office programs. Now organized under a National Natural Resource Program Center, located primarily in Colorado, six programs formerly operating under three different associate directors have been consolidated and strengthened through their closer association with one another. The NNRPC is now comprised of the Air Resources Division (formerly Air Quality), Water Resources Division, Geologic Resources Division (formerly Mining and Minerals), Environmental Quality Division, Natural Systems Office, and the Natural Resource Management Information Division.

Both the Geologic Resources Division and the Environmental Quality Division are new to the Natural Resource Stewardship and Science Directorate, but al-

ready have well developed programs that serve parks very effectively. The Geologic Resources Division has recently hired a cave specialist and is trying to expand its mission beyond mining and minerals to include other geologic resources. The Environmental Quality Division improves the national natural resource connection with park operations. This group brings scientific data to the compliance process and facilitates the use of compliance planning tools (e.g., NEPA) in parks. They also

discussed several initiatives afoot to improve our capabilities. He has brought Dr. Gary Machlis of the University of Idaho on board at the national level for 2½ years to establish a basic social science program in the National Park Service. Most likely, this will be a CPSU (cooperative park studies unit) based program that will need to raise much of its own funding, but it will provide an important service for parks. Soukup has also applied for a Pugh Foundation grant to fund a visiting Chief Natural Scientist position. If filled, this

### *Restructuring may have been predicated on a faulty premise that central office staff and funding reductions would be offset by growth in parks*

conduct damage assessment procedures following environmental disasters (like the Exxon Valdez).

The new divisions (Natural Resource Information Division and Natural Systems Management Office) are comprised of some staff that formerly worked for the Wildlife and Vegetation Division (now dissolved). The former will assist parks in making better use of existing databases and will develop systems for facilitating a free exchange of natural resource information over the next several years. The Inventory and Monitoring Program, resource management database, national GIS coordination, and publications functions (including *Park Science*) now reside here. The Natural Systems Office will devote its time to helping parks deal with boundary influences, and will support parks negotiating land use easements with park neighbors. They may also help national park areas begin to approach strategic planning on a landscape scale. Some familiar programs once in the Wildlife and Vegetation Division are now here, such as National Natural Landmarks, Man and the Biosphere, Threatened and Endangered Species, and Exotic Species Management. A new direction for this group is furthering partnerships through grant writing and developing cooperative agreements. These efforts have already paid off with a \$1.2 million grant from Canon that was dedicated to park natural resource management projects.

Soukup explained that his emphasis in Washington will be on advocacy for the national natural resource program, and he

person will help focus the National Park Service on the need for science in park management. Soukup will continue to look for other funding sources to accomplish more research and resource management work in parks.

With the reorganization of the former Washington Office functions, parks now have greater technical expertise available in one place. The NNRPC will be publicizing the scope of services available to parks before contacting parks to offer technical assistance. Furthermore, they plan to unify all calls for assistance, incorporating those for both NRPP research (NBS provided) and resource management projects, to simplify the process.

#### **RESEARCH**

Cooperative Park Studies Units remain central to accomplishing research in national parks, and Mike Soukup encouraged natural resource professionals to strengthen ties with these valuable partners. The resources that CPSUs make available to parks are so useful that Soukup suggested that we broaden the cooperative agreements and go beyond research to include other programs, such as interpretation, cultural resources, and training. The status of some CPSUs was not clear since establishment of the National Biological Service and other changes in agreements, and the group agreed to update a list of CPSUs for the entire national park system.

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Participants also discussed the services provided by the National Biological Service, another primary NPS research source. A little over 2 years ago, we transferred \$30 million and 173 positions to the fledgling research agency. This change has required greater effort in parks to get assistance, and the problem appears to have become worse recently with the specter of NBS dissolution and eventual transfer to the U.S. Geological Survey. Now it is harder to get the same level of service as we got initially, and potential cuts to previous NPS projects worry many. Several meeting participants voiced their concerns about the fate of NRPP research projects given to the National Biological Service to carry out, when they may not have the expertise to do so. Others voiced frustration with having produced project priority lists without having seen results. The group resolved to support the NBS during this time of transition, but to get them to share their fiscal year 1996 work plan with us to help us track their level of

for resource management. They included: keeping the Natural Resource Stewardship Today for Parks Tomorrow initiative going in the hopes of eventually increasing resource management positions in parks; participating fully in the new NPS training strategy to make sure natural resource needs are fully met (including supporting a resource management fundamentals course this year); continuing to encourage superintendents to build resource management expertise in the parks and to include resource managers in the decision making process; completing the fiscal year 1996 goals of the Vail Agenda natural resource careers committee; promoting GIS as a general park management tool; and improving the service of the National Biological Service through participation in their strategic planning meetings.

#### **SUMMARY**

Restructuring has created a very different National Park Service in relation to natural resource management and science. Science must be specific and rel-

parks from attracting the professionals that are needed, and SSOs are in jeopardy of failing in regard to resource management technical support. Garnering support for long-term resource management projects is also especially difficult now with fiscal resources so scarce. Solutions to these problems appear to be limited to finding other funds (through government budget initiatives, soft monies, partnerships) to help us make progress. A separate initiative to create new research grade technical support scientist positions in parks (conducting applied science) is also needed, and this potential solution may be explored this year.

The empowerment of superintendents in the restructured National Park Service may have the greatest effect on resource management in the long run. Where Assistant Secretary Frampton initially vowed that restructuring would create an environment where resource management could "flourish," we now have an organization that will allow this to happen, but only if additional funds are found and super-

intendents promote and use the science and resource management tool. Consequently, the consensus of the

## *Through a grant, Soukup hopes to fill a visiting Chief Natural Scientist position to strengthen NPS focus on science in park management*

support. Meanwhile, the associate director will be working on long-term solutions to concerns about the erosion of funding and other difficulties in working with these partners.

Clearly, science and resource management are partners, and where one experiences setbacks, the other feels the impacts. The link between research and resource management needs to be strengthened for resource management to be its best in parks.

#### **AD HOC REPORT**

The 1995 Report of the Ad Hoc Working Group on Natural Resource Management in the National Park Service has always been our benchmark against which to measure the effects of restructuring on the natural resource management discipline. At the close of the meeting, participants agreed that many items identified in the document still needed to be implemented to complete restructuring and realize further benefits

evant to park management problems and must have a broader role in support of law enforcement and interpretation in addition to resource management. Resource managers now have greater access to superintendents these days, giving them improved opportunities to contribute their concerns and data to the decision making process. Creativity in problem solving is high, and more coordination and cooperation is taking place between parks and central offices. Professional development opportunities for resource managers seem nearly limitless. Yet, the times have also created serious problems that appear to be setbacks for resource management.

Professionalization and technical support are areas where we appear to be having the greatest trouble. Budgets and position target limits have reduced the technical expertise in the system support offices and have not allowed parks to make up the difference as originally expected. Hiring restrictions may prevent

group is that superintendents need to be oriented to the resource management profession. We also need to encourage resource managers to develop the skills necessary for becoming effective superintendents.

With all that has changed, we may take pleasure in knowing that some of the things that we have always done well, we can and should continue to do as before. The RMAP database giving us objectivity in making our case for growth in the resource management profession, the resource management database giving superintendents and the NNRPC a tool for providing assistance, the NRPP funding for resource management projects, and our ability to prioritize park needs all put us in a position to get attention and support when times begin to favor resource management again.



# PARK SCIENCE INDEX—1995

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# 1995 PARK SCIENCE FEATURE ARTICLES IN SUMMARY

BY GENERAL SUBJECT

## RESOURCE RESTORATION

- Several agencies cooperated in an ambitious project to reconstruct the long-disturbed, Washington, D.C. Kenilworth Marsh (1):1, 16-18.
- Planning that included site suitability assessments and hydrologic and vegetation monitoring will be key to wetland restoration in Indiana Dunes National Lakeshore (1):23.
- Biologists introduced captive-bred ferrets in Badlands National Park as part of the National Black-footed Ferret Recovery Plan (2):1, 16-18.
- Larvae of the threatened northeastern beach tiger beetle were translocated from the Chesapeake Bay to the Sandy Hook unit of Gateway National Recreation Area (3):1, 16-17 (see illustration, far right).
- An experiment compared three potential methods for restoring native vegetation to razed residential sites within Indiana Dunes National Lakeshore and their costs (4):18-20.
- Managers and biologists prepared for summer and winter releases of black bears within Big South Fork National River and Recreation Area (4):24-26.
- Following a wildfire, Santa Monica Mountains National Recreation Area and its neighbors came together to revegetate part of a 32-acre site using native plants (4):28-30.

## POPULATION ECOLOGY

- A multiyear landscape ecology study of nesting loons at Isle Royale National Park began to answer some basic population ecology questions of the wilderness bird (1):20-21.
- Satellite radiotelemetry used with falcons and eagles from Alaska and Arizona-Utah parks revealed astonishing details about their sometimes intercontinental migrations (2):20-24.
- Tagging studies suggested that Hawksbill turtles migrate long distances between their Buck Island Reef National Monument nesting grounds and wintering areas elsewhere in the Caribbean (2):25.

## GENERAL WILDLIFE

- Wolves are rapidly returning to the Michigan Upper Peninsula and Pictured Rocks National Lakeshore where park staff are assisting regional educators and other managers in tracking the recovery (4):15, 27.
- Park managers and interpreters gained useful information on the behavioral ecology of the striped skunk at Great Smoky Mountains National Park (4):22-23 (top photo).
- Resource managers at Yosemite, Sequoia, and Kings Canyon National Parks reported reductions in bear-human conflicts over the last 15 years (4):31.

## INVENTORIES

- Pecos National Monument mammal surveys provided the data needed to link the 1993 hantavirus epidemic with a rodent population explosion in the Southwest (2):12-13.
- Spruce grouse at Acadia National Park were studied and may be making a comeback, but fragmented habitat on Mount Desert Island will complicate managing for species success (3):10-11 (middle photo).

## GEOLOGIC RESOURCES

- Polyurethane foam proved to be a portable, affordable, and easily managed material for low-impact sealing of remote and potentially dangerous abandoned mines (1):14-15, 28.
- Visitor impacts ranging from inadvertent trail widening to illegal collecting of pocket-sized volcanic bombs lead resource managers at Craters of the Moon National Monument to initiate a photography-based geologic features monitoring program (1):22.
- Geologists and atmospheric scientists measured the ratio of cosmogenic to atmospheric hydrogen in surface basalts at Capulin Volcano National Monument suggesting that the mountain is much older than previously thought (2):10-11.
- After 60 years of incorrect interpretation, paleontologists set the record straight on a late Triassic dinosaur track at Gettysburg National Military Park (2):9.

## WATER RESOURCES

- The U.S. Geological Survey NAWQA program provided a likely means for Morristown National Historical Park to establish a park water quality sampling site for monitoring long-term water quality trends (1):28.
- A review of federal wetlands regulations indicated that while they can slow park construction projects, they also minimize park facilities impacts and provide protection from external threats (2):14-15.

## MARINE RESOURCES

- Unpaved road erosion and subsequent marine resource sedimentation in Virgin Islands National Park are shown to be linked, indicating the need for immediate corrective action (2):26-28.

## **PARTNERSHIPS**

- The NBS science centers are a potential source for park technical assistance, but networking is a key to tapping this resource **(2)**:29-31. The NBS Midcontinent Ecological Science Center focuses on ecological research and technologies development to improve biological systems understanding and management in the western interior United States **(3)**:12-14.
- Twenty parks with resource management inventory and monitoring project needs received a total of \$1,200,000 from the Canon Corporation to get the work accomplished **(4)**:12.
- The National Biological Service requested widespread input in documenting the history of land use in North America, potentially resulting in a tool that would allow land managers to project likely outcomes of future land perturbations based on historical ones **(4)**:21.
- Students from the Buffalo National River watershed learned water quality analysis techniques and spoke out on the value of the regional resource **(3)**:15,17.

## **GENERAL RESOURCE MANAGEMENT**

- A resource manager gained inspiration from a series of natural events (a wildfire and both a bald eagle nest and a rare lily population discovery) that occurred in close proximity with one another over 4 months in Isle Royale National Park **(1)**:13.

## **RESOURCE MGMT. ADMINISTRATION**

- The Assistant Secretary of the Interior convened an ad hoc task force to recommend measures to advance the natural resource discipline under NPS restructuring **(2)**:8,15.
- Grand Canyon National Park reorganized its science and resource management functions in a new science center that accentuated partnerships **(3)**:23.
- Colorado Plateau parks considered NPS restructuring and the resulting clusters of ecologically similar parks advantageous in addressing water resource issues related to Glen Canyon Dam **(4)**:14,27.

## **FIRE MANAGEMENT**

- A landscape-scale fire history study of the Jemez Mountains near Bandelier National Monument revealed frequent fires until the 1890s and suggested the need to allow fire management programs to proceed with prescribed burns today **(3)**:18-19.
- Glacier National Park carefully used its updated fire management plan to allow several prescribed natural fires to run their courses **(3)**:18-19.

## **DATA MANAGEMENT**

- Yellowstone National Park unveiled a computerized rare animal reporting system that facilitates data analysis and retrieval **(2)**:3.
- A natural resource bibliography of Pacific Northwest park-held references was the first of its kind and served as a model for other subsequently developed park and regional bibliographies **(2)**:19.

## **GIS**

- An ambitious project to develop a regional GIS database will allow national parks to develop interagency partnerships for ecosystem management based on scientific principles **(3)**:24-26.

## **SOCIAL SCIENCES**

- Sociologists described the visitor-employed photography technique of assessing visitor values, applied at Rocky Mountain National Park **(1)**:10-12.

## **ARCHEOLOGY**

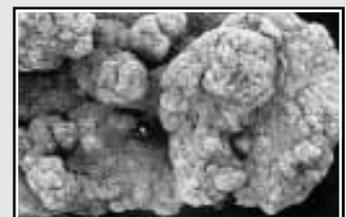
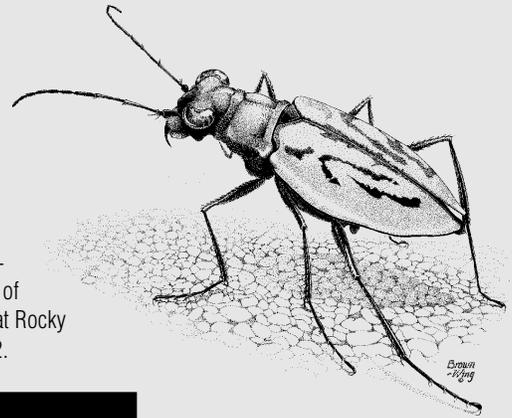
- Archeologists documenting cultural resources at a Yellowstone National Park grizzly bear habitat rehabilitation site teamed with geologists to reconstruct dates of prehistoric human activity **(3)**:28-31.
- When examined under a scanning electron microscope, pictographs at Amistad National Recreation Area revealed an unusual mineral accretion of a biological origin that both protects and obscures the rock art **(4)**:1,16-17 (bottom photo).

## **MEMORIALS**

- Reminding us that field research has risks, a NBS field station leader reported the deaths of Florida cougar researchers Craig Johnson and Scott Shull when their airplane crashed in Big Cypress National Preserve during an aerial survey **(1)**:24.
- Alpine botanist and oldest and longest serving park ranger Carl Sharsmith died at 91 **(1)**:25.

## **PUBLICATIONS**

- Park Ranger Rick McIntyre's *A Society of Wolves* was reviewed as a well-researched, engaging personal account on the biology of the wolf **(1)**:26-27.
- *Saving Nature's Legacy* was characterized as a readable synthesis of the important aspects of the broad discipline of conservation biology **(3)**:27.
- *These American Lands* was cast as both a major resource in and an advocacy organization's (the Wilderness Society) interpretation of the history of federal land management **(4)**:11.
- The Natural Resources Publication Office announced the availability of six new publications **(1)**:27.



## Meetings of Interest

### MAY 1-3

The First Conference on Resource Management and Research in Southern Arizona National Park Areas will take place at the Hilton East Hotel in Tucson. Conference sessions and posters will address major fields of research and resource management, including archeology, historical preservation, plant ecology and management, wildlife ecology and management, multidisciplinary-ecosystem issues, and physical sciences. The preregistration deadline is March 1. For more information, contact Tim Tibbitts, (520) 387-7661, ext. 7114.

### MAY 7-10

The 20th Tall Timbers Fire Ecology Conference will get under way next spring in Boise, Idaho. Entitled, "Fire in Ecosystem Management: Shifting the Paradigm from Suppression to Prescription," the conference aims to discuss specific prescribed fire regime alternatives in the context of modern natural resource management and policy. Many sessions will adopt a case study approach and will link the use of prescribed fire with long-term management objectives to achieve specific future forest, shrub, or grassland ecosystem conditions. Contact Leonard Brennan, Director of Research, Tall Timbers Research Station, Route 1, Box 678, Tallahassee, Florida 32312-9712; (904) 893-4153, ext. 222; fax (904) 668-7781; e-mail "brennan@bio.fsu.edu" for more information.

### MAY 18-23

Pennsylvania State University will host the 6th Symposium on Society and Resource Management, focusing on the usefulness of the social sciences to natural resource decision makers and managers. Attendees will have the opportunity to participate in a wide range of professional development and educational programs including concurrent paper, thematic, and dialogue sessions; a poster session; plenary addresses; field trips; and receptions. Contact Jim Finley, Program Co-chair, School of Forest Resources, The Pennsylvania State University, 2B Ferguson Building, University Park, PA 16802, fax (814) 865-3725, e-mail "FJ4@psuvm.psu.edu" for further information.

### JUNE 9-14

The Society of Wetland Scientists will hold their 17th annual meeting, entitled "From Small Streams to Big Rivers," in the central business district of Kansas City, Missouri. Technical sessions, field trips, and workshops will include wetlands biodiversity, hydrology, soil and geomorphology, classification and evaluation, long-term monitoring, ethnobotany, and stream bioengineering, among many others. Further details appeared in the December issue of the *SWS Bulletin* with another follow-up due in March.

### 1997

### SEPTEMBER 18-20

The Third Biennial Rocky Mountain Anthropological Conference will be held in Bozeman, Montana and will feature forums as an alternative to symposia, to enable thoughtful, focused, and more open discussion of carefully delineated topics. The deadline for symposia and forum proposals is March 15, 1997. Other deadlines and information will be announced in future communications. Contact Ken Cannon, National Park Service, Midwest Archeological Center, Federal Bldg., Room 474, 100 Centennial Mall North, Lincoln, NE 68508-3873, (402) 437-5392, ext. 139, fax (402) 437-5098, e-mail "ken\_cannon@nps.gov" or Jack Fisher, Department of Sociology, Montana State University, Bozeman, MT 59717, (406) 994-5250, fax (406) 994-6879, e-mail "isijf@msu.oscs.montana.edu", to discuss proposals.

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