

NATURAL RESOURCE YEAR

in Review 1 9 9 7

*A report of
the National
Park Service*

*summarizing
and analyzing
the year in
natural resource
stewardship in
the national
park system*



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out on resource
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Natural Resource Year in Review—1997

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Editor

Jeff Selleck (jeff_selleck@nps.gov)

Assistant Editor

Lissa Fox (lissa_fox@nps.gov)

National Park Service

Director • Robert G. Stanton (bob_stanton@nps.gov)

Natural Resource Stewardship and Science

Associate Director • Michael A. Soukup
(mike_soukup@nps.gov)

Deputy Associate Director • Abigail B. Miller
(abby_miller@nps.gov)

Visiting Chief Social Scientist • Gary Machlis
(gary_machlis@nps.gov)

Program Coordinator • Deborah Peck
(debby_peck@nps.gov)

Natural Systems Management Office • Staff

Natural Resource Program Center

Chief, Air Resources Division • Christine Shaver
(chris_shaver@nps.gov)

Chief, Environmental Quality Division • Jacob Hoogland
(jacob_hoogland@nps.gov)

Chief, Geologic Resources Division • David Shaver
(dave_shaver@nps.gov)

Chief, Natural Resource Information Division • Richard Gregory
(rich_gregory@nps.gov)

Chief, Water Resources Division • Dan Kimball
(dan_kimball@nps.gov)

For copies of this publication contact the editor by e-mail or write:

Jeff Selleck
National Park Service
WASO-INFO
P.O. Box 25287
Denver, Colorado 80225-0287

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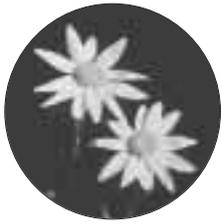
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Front Cover:
Although its waters appeared
serene in Cooks Meadow near
Half Dome, a New Year's Day
(1997) flood in Yosemite Valley
damaged roads, bridges, trails,
campgrounds, vehicles, employ-
ee residences, and lodging
units. A natural event, the 100-
year flood generally confirmed
the wisdom of park plans to
remove or relocate some visitor
facilities from the floodplain to
less sensitive park areas (see
story on page 33).

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FOREWORD

As the recently confirmed 15th Director of the National Park Service, I take great pleasure in presenting the *Natural Resource Year in Review—1997*. Natural wonders abound in the national park system. Seemingly pristine, they draw us in, inspire awe, and symbolize our spirit as a great nation. Yet, in this age especially, nature requires care if it is to be preserved. This report both celebrates the natural diversity found in the parks and describes the complex job of caring for that diversity in modern landscapes. It summarizes the major issues we faced and the trends that developed during the calendar year, and in doing so, preserves a record of our natural resource management activities. It also provides an analysis of why our activities were important and where we need to go from here.

Vital to our goal of resource preservation is a natural resource management program across the Service that matches the level of our efforts to the requirements of this awesome challenge. The recent release of the book *Preserving Nature in the National Parks: A History*, by Richard West Sellars, has given us a fresh perspective on this subject. History shows that while visitor enjoyment of parks has been an important aspect of our mission, the preservation of nature and integration of science in management have been inconsistent and underemphasized. Indeed, we are successful in providing parks for visitors to enjoy. Now the time is right to bolster resource preservation.

In December, at my request, the National Leadership Council began preparing a policy and strategy that will help institutionalize enhanced natural resource management capabilities in the Park Service. Actions will focus on both short- and long-range needs, including efforts to generate broad interest in our natural resource protection role. If Administration budget allowances and priorities allow, budget initiatives for fiscal year 2000 and beyond will seek increases in natural resource funding, staffing, and programs such as the Inventory

and Monitoring Program, Natural Resource Preservation Program (NRPP), the Resources Careers Initiative, and a professional development training program. Obtaining and using the best available science in park management is also a focus of these efforts. Change of this magnitude and nature will take time, but we will see it through.

Garnering support for these initiatives is predicated on our ability to define in compelling terms what our natural resource program seeks to accomplish. This report helps address this need through its honest and popular presentation of resource protection challenges and the role the National Park Service plays in addressing them. Ecosystem health in parks is no accident; without adequate information, without resource managers to apply that knowledge as “ecosystem physicians,” and without park managers to rally support, our legacy of natural wonders would surely suffer greater damage and attrition. As you read the stories of the past year, you will be struck by the variability and complexity inherent in our task—to preserve unimpaired the natural resources of the national park system for the enjoyment of future generations. To succeed, we must build a National Park Service that can match the challenge of these tasks every year.



Robert G. Stanton
Director, National Park Service



National Park Service, Bill Clark

bob_stanton@nps.gov
Director, National Park Service;
Washington, D.C.

Sitka spruce, Redwood National
Park, California



THE YEAR IN REVIEW

As we chronicle 1997, what is the emerging message—the takeaway lesson? The year began under the pall cast by the killing of nearly 1,100 bison by the State of Montana and the National Park Service to control brucellosis as the animals left the harsh winter conditions of Yellowstone National Park. Disagreements over the need to take such extreme action were highlighted during a year of preparation of a joint long-term bison management plan. The Secretary of the Interior brought in the National Academy of Science to settle the major technical points. Other wildlife issues, such as the overabundance of white-tailed deer, placed parks in the crossfire between park neighbors and animal rights advocates.

Beyond park boundaries, the year was dominated by large-scale phenomena. During summer, the ambush dinoflagellate *Pfiesteria* bloomed in the Chesapeake Bay, causing widespread fish kills and concerns for both the health of humans and the bay ecosystem. Questions about the reality of global warming and climate change were also pervasive, with inquiries into what El Niño was really responsible for leading the way. Most significantly, rising recognition of the overpowering success of the human species in dominating its habitat was apparent. On July 25, *Science* devoted an issue to “Human Dominated Ecosystems.” Various articles concluded that (1) between one-third and one-half of the earth’s surface has been transformed by human action; (2) the carbon dioxide concentration in the atmosphere has increased by nearly 30% since the beginning of the Industrial Revolution; (3) more atmospheric nitrogen is fixed by humanity than by all natural terrestrial sources combined; (4) more than half of all accessible fresh water is put to use by humanity; (5) about one-quarter of the bird species on earth have been driven to extinction; and (6) approximately two-thirds of major marine fisheries are fully exploited, overexploited, or depleted (for a summary of these findings see J. Lubchencko. *Science*. January 23, 1998). Thus, no longer a mere part of the eco-

system, the human species has become a force of nature. As this process accelerates, preserving the natural systems of our national parks takes on greater implications both for park managers and for society.

In the fall, publication of Richard Sellars’ *Preserving Nature in the National Parks* (Yale University Press) documented the National Park Service’s historical neglect of natural resource management. Subsequent discussions by the NPS National Leadership Council and a call by Director Bob Stanton have resulted in a process to rejuvenate natural resource management to meet the challenge of preserving parks in a human-dominated landscape. Thus, the year ended on a note of both serious reflection and promise. The events and accomplishments of 1997, described herein, demonstrate the breadth and severity of our challenges. They also showcase the nucleus of talent, creativity, and commitment the National Park Service already possesses to make real progress in achieving natural resource protection in 1998.



Michael Soukup
Associate Director, Natural Resource Stewardship and Science



Natural Resource Information Division

Year at a Glance

January

- Yosemite Valley floods, prompting assessment of damage to facilities and resources.
- First senior scientists hired during year to ensure park research and technical assistance needs are met.

February

- First Canon Scholars park research competition announced to 565 universities and in the journal *Science*.

March

- George Wright Society biennial meeting draws high superintendent turnout.

April

- Kemp’s Ridley turtles return to Padre Island National Seashore to nest for third consecutive year.
- Land management agencies brief Congress on joint strategy for attacking invasive plants.

May

- President Clinton and Secretary Babbitt celebrate long association of U.S. and Costa Rican national parks at Central American economic summit.

July

- Forty nonnative zebra mussels discovered in a new portion of St. Croix River.
- Army Reserve engineer units restore abandoned mine lands at El Malpais National Monument.

August

- Director’s award winners for natural resource management announced.
- Ecological restoration of the Sequoia Giant Forest begun.
- Natural Resource Advisory Group meets for first time.

September

- Nonnative ball python confirmed on Maui near Haleakala National Park.

October

- The book, *Preserving Nature in the National Parks*, published.
- Yellowstone agrees to study the effects of winter use on bison.
- Fiscal year 1998 appropriation funds Social Science Program and new Abandoned Mine Lands Program, and provides increases to Air Resources and Inventory and Monitoring Programs.

November

- Standardized position descriptions drafted for professional and technical natural resource management series.
- Congress appropriates funds for purchase of New World Mine near Yellowstone.

December

- Judge rules Yellowstone wolf reintroduction illegal.
- National Leadership Council explores means to invigorate NPS natural resource management programs.

Heartleaf arnica, Yellowstone National Park, Wyoming



THREATS

Threats to natural resources in parks are as varied as the parks themselves. Urban encroachment, water quality and quantity issues, air pollution, and human activities are responsible for most external threats. Internally, inholdings and commercial development in parks, nonnative wildlife or plant species, illegal activities such as poaching, and improperly controlled recreational uses threaten parks. Unchecked, threats degrade resources and lead to a loss of park values: scenic views diminish, streams become polluted, habitat is destroyed, and biodiversity declines. As world population increases, so do threats. However, strategic efforts targeted at specific threats may help stop them. For example, the National Park Service took steps during 1997 to address the threat of invasive nonnative plant species. These efforts included helping to develop interagency and private-sector partnerships, educational activities, and local management actions that prevent the introduction of invasive species, control those already present, and restore affected areas.

Joshua Tree dodges a bullet: the Eagle Mountain landfill

by Jacob Hoogland

When Congress passed the Desert Protection Act in 1994, it expanded the boundary of Joshua Tree National Park (California) toward the rim of an inactive open-pit iron mine. The new lands included in the park expansion were carved from those administered by the Bureau of Land Management (BLM) and brought with them some land use controversies. One issue regarding the Park Service as a new neighbor to the inactive mine was the proposal to turn it into the world's largest landfill, accepting 10,000 tons of garbage daily by rail from Los Angeles and Orange Counties.

The landfill proposal previously was approved by Riverside County only to be turned back by a court action brought by environmental organizations.

Recognizing the possibility of future litigation and the potential for the proposal to be approved, Superintendent Ernie Quintana sought technical assistance from the Department of the Interior Office of the Solicitor and the NPS Natural Resource Program Center in addressing some of the issues.

The proposal itself presented certain environmental benefits. A land exchange with BLM would provide for access to the mine; additional lands would provide for protection of desert tortoise habitat. Also, previous negotiations had provided for the establishment of a trust fund to mitigate environmental damage potentially arising from the landfill operation. The challenge to the Park Service was to provide for adequate mitigation of possible damages, while continuing to oppose the landfill based on principle.

To establish the scientific basis for evaluating the potential impacts of the landfill, Quintana convened a group of scientists and specialists with experience in

jacob_hoogland@nps.gov
Chief, Environmental Quality
Division, Natural Resource Program
Center, Washington, D.C.



Parks with oil fields nearing depletion and those in oil and gas producing areas began seeing renewed industry interest in oil exploration during 1997. An advance in oil exploration seismic technology, called 3-D seismic, has opened up older oil fields in parks to new exploration, with both low and high-impact techniques.

(Photo) Located 1½ miles from designated wilderness within Joshua Tree National Park (California), the inactive Eagle Mountain iron mine (foreground) is the proposed site of the world's largest landfill, now on hold following a tentative court ruling.



\$65 million was made available for federal acquisition of Crown Butte Mining's New World Mine holdings as part of the Interior appropriations bill signed by President Clinton in November. In keeping with his August 1996 announcement from Yellowstone National Park, this funding will effectively halt construction of the controversial New World Mine located northeast of the park.



Joshua Tree National Park

In the proposal for the landfill, the inactive open-pit mine would receive 10,000 tons of garbage daily by rail from Los Angeles and Orange Counties.

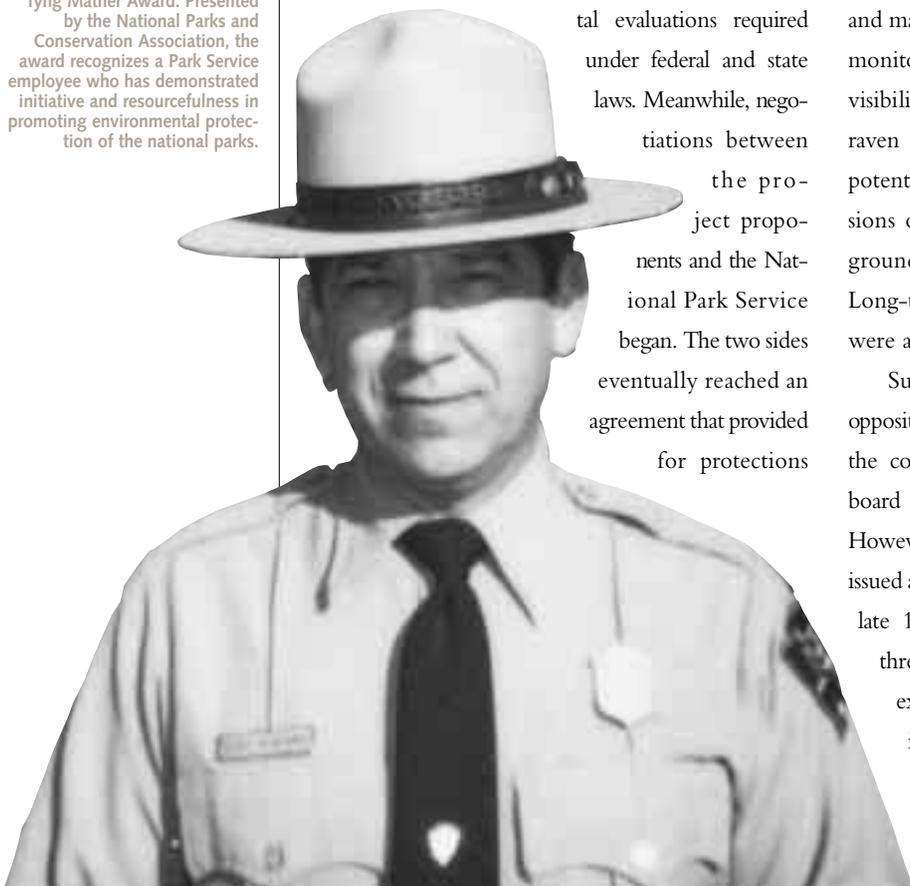
landfill impacts. This group surveyed the potential impacts and provided information on what possible mitigation measures could be implemented and the likelihood of the anticipated impacts. During this time the National Park Service joined with the BLM and Riverside County in the preparation of environmental

evaluations required under federal and state laws. Meanwhile, negotiations between the project proponents and the National Park Service began. The two sides eventually reached an agreement that provided for protections

to the park if state and local authorities approved the project. Among the many provisions, the agreement stipulated that the project developers convey to the government all mining claims they owned that were located within the park. It required them to minimize odor during the operation of the project, to install and maintain a visibility monitoring station and other monitoring equipment, and to maintain night sky visibility. The agreement directed them to monitor raven and other predator populations and mitigate potential increases in these populations. Other provisions of the agreement related to the protection of groundwater and monitoring of ambient noise. Long-term research and public education programs were also indicated.

Superintendent Quintana continued to voice opposition to the project at public hearings held during the county review process. Nonetheless, the county board of supervisors approved the landfill operation. However, a San Diego County superior court judge issued a tentative ruling rejecting the proposed landfill in late 1997, indicating that the proposal presented a threat to the desert tortoise and to the wilderness experience of the park. The future of the proposal is undetermined, as is the land exchange with the BLM to enhance desert tortoise habitat that was part of the original proposal.

For his efforts in protecting the park, Superintendent Ernie Quintana received the Stephen Tyng Mather Award. Presented by the National Parks and Conservation Association, the award recognizes a Park Service employee who has demonstrated initiative and resourcefulness in promoting environmental protection of the national parks.



Joshua Tree National Park

Internal Threats

Underwater resource damaged by recreational boating

by Bob Dusek and Karen Battle

During 1997, 161 vessels ran aground in Biscayne National Park (Florida) damaging 8,000 square meters of submerged seagrass (*Thalassia testudinum*) beds. This ecosystem is one of the most productive in the world, and Biscayne has many rich and healthy seagrass communities, some with as many as 400 shoots per square meter. A refuge and nursery for numerous commercial and sport marine species, seagrass beds also stabilize sediments, reduce wave energy, and filter organic and metallic compounds from the water.

Despite regulations that protect these resources, motorboats are seriously damaging seagrass communities. Although park groundings in 1997 numbered 15% fewer than in 1996, the area damaged was more than double in size; just two incidents accounted for almost 2,000 square meters of damage. As boats travel into shallow water, their propellers cut the grass beds, in many cases trenching the bottom, removing all grass blades, rhizomes, and even sediment. In rare instances boats may excavate holes more than a meter deep and displace more than 20 cubic meters of sediment. All of Biscayne's shallow water shoals show some degree of propeller scarring.

Once grass rhizomes are damaged, natural recovery often takes three to ten years. Damaged sites can be restored by refilling the scars and then replanting.

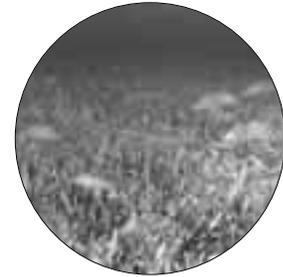
However, restorations outside the park have had little success. Biscayne's best seagrass protection tool is education. Boat operators often do not understand the ecological importance of seagrass communities; also, once they have run aground, they may not know how to get out of a seagrass bed without causing further damage.

Without an entrance gate to distribute educational literature, Biscayne has had to develop an education program targeting boaters. Through this program, recreational boaters and commercial operators are now learning the importance of the seagrass communities, the level of destruction caused by inattentive boat operation, and how to safely get off the shoals. In addition, contractual arrangements with park commercial tow-boat operators require that they report grounded vessels and, in some cases, mark grounding sites. These commercial contractors operate under strict guidance for vessel removal designed to minimize damage.

The park has also identified heavily impacted areas so that additional navigational aids can be installed. Nine new pilings with large warning signs will be in place by early 1998. Moreover, the U.S. Coast Guard will be improving its marking of channels based on park grounding data. Meanwhile, the park has been working closely with the NPS Environmental Quality Division and the Department of the Interior regional Office of the Solicitor to recover monetary damages through the Park System Resource Protection Act for site restoration, boater education, and protection of undamaged seagrass resources. During 1998, the park hopes to begin site restoration after many of the civil suits are settled.

robert_dusek@nps.gov
Supervisory Biological Technician;
Biscayne National Park, Florida.

karen_battle@nps.gov;
Biological Technician; Biscayne
National Park, Florida.



Biscayne National Park

A highly productive park ecosystem, seagrass beds are nurseries for numerous commercial and sport marine species. As boats travel into shallow waters, their propellers cut the grass beds, in many cases trenching the bottom, removing all grass blades, rhizomes, and even sediment.



Biscayne National Park, A. Celler

Motorboat propeller scars crisscross shallow seagrass beds at Biscayne National Park (Florida). During 1997, 161 vessels ran aground damaging 8,000 square meters of the biologically diverse submerged habitat.

Sue Jennings

(Contact: randy_ferrin@nps.gov)
Former Resource Management
Specialist; Saint Croix National
Scenic Riverway, Wisconsin.

Exotic Species

Zebra mussels move upstream in the St. Croix River

by Sue Jennings

Award Winner Profile

Ken Czarnowski honored for warding off threats

The 1996 Director's Award for Natural Resource Management was awarded to Ken Czarnowski, Hydrologist at Rocky Mountain National Park, Colorado, in August. This award recognizes outstanding contributions to technical expertise, continuity, and innovative thinking in resource management. Through his creativity and persistence, Czarnowski has resolved numerous complex natural resource issues at the park, primarily those dealing with water rights. For example, he negotiated with the Bureau of Reclamation and other parties to redirect water back into a park drainage, providing for natural park processes and restoring a high altitude park wetland. Working with the Office of the Solicitor, the Department of Justice, and the NPS Water Resources Division, Czarnowski developed agreements to protect the park from future litigation on water issues. Additionally, Czarnowski's broad understanding of park resources, negotiation skills, and ability to work with attorneys and technical staff from other agencies have helped to address aircraft oversight issues at the



Ken Czarnowski, winner of the 1996 Director's Award for Natural Resource Management.

No bigger than a fingernail, the zebra mussel (*Dreissena polymorpha*) is capable of inflicting serious damage to the ecology, economy, and recreational uses of the St. Croix National Scenic Riverway (Wisconsin and Minnesota). Despite a five-year quarantine program designed to keep the species from gaining a foothold within the riverway, resource managers discovered 40 juvenile zebra mussels in a new part of the park last July. The species had previously been detected only on boats moored in the Lower St. Croix River, downstream from a hydroelectric dam. This time they were attached to a mussel-sampling station suspended in the river 2 miles upstream of the dam and several miles upstream of the only known population of the federally endangered winged mapleleaf mussel (*Quadrula fragosa*).

The discovery posed a number of immediate threats. The park supports a world-class mussel fauna, including several state and federally listed species, and a large fishery. Zebra mussels can wipe out native freshwater mussels by blocking their feeding, respiration, and reproductive structures. As a result of their enormous filtering abilities, zebra mussels remove large quantities of phytoplankton ordinarily consumed by fish. Divers could possibly remove a small population of zebra mussels; however, any undetected population could expand rapidly, altering the structure and function of the ecosystem.

The park's first response was to conduct SCUBA-diver searches and other monitoring, but no additional zebra mussels were found. As a result, the Zebra Mussel Task Force (an interagency group formed in 1992 to address the problem) proposed to draw down the water level behind the dam and systematically search the river. The exposure of an additional 6 feet of riverbed along 20 miles of riverbank would increase visibility and help



1997, St. Paul Pioneer Press, Joe Otkin, Photographer

Crews assembled along the rocky shoreline of the St. Croix River (Minnesota and Wisconsin) last fall in the latest effort to stall the spread of zebra mussels into the national scenic riverway. Their task: to inspect a 20-mile stretch of the river for the nonnative mussel and remove those found.

the park and its partners assess the situation in time to develop a mitigation strategy before spring spawning.

Wearing rubber boots and armed with nets, buckets, and clipboards, searchers combed the shoreline on both sides of the river in late September. Crews rescued stranded fish and other organisms and moved thousands of native mussels into deeper waters. However, no zebra mussels were located. The large numbers of native mussels that were exposed, particularly to unusually warm temperatures, prompted the task force to return the water levels to normal and abandon the search one week after it began. Consensus is that the July find was a chance event, perhaps from an isolated population that had gone undetected or reached the location by a contaminated boat that was transported beyond the dam by trailer. Other possible sources include contaminated bailing bucket water and deliberate introduction. Exposure has occurred. However, no evidence of a self-sustaining population upstream or downstream of the site has been found, and the riverway is still considered uninfested.

The park will continue to protect its resources from a zebra mussel infestation in 1998, relying heavily on education, boater compliance, and early detection. This will require additional support from the task force, local communities, and others. It will certainly be a race against time: in September, resource managers discovered successful reproduction of the endangered winged mapleleaf for the first time in several years, providing hopes for its recovery.

Ball pythons on Maui?

by Lloyd Loope

The September 1997 capture of a ball python (*Python regius*) near Haleakala National Park and the appearance of its picture on the front page of *The Maui News* is symbolic of movement toward a paradigm change for this Hawaiian island and the park. Concerns regarding invasions of alien pest species are now taken very seriously by local people.

Native to central and west Africa and popular in the international pet trade, the snake was captured in a garage in Makawao, just 7 miles from the park. The python's capture and a rash of other recent snake sightings in nearby sugar cane fields has led several local agencies, led by the Hawaii Department of Land and Natural Resources, to collaborate in a night road survey and trapping effort to try to determine whether snakes are on the verge of establishment and what response may be appropriate. Meanwhile, the understaffed and harried Hawaii Department of Agriculture, which is responsible for front-line prevention of introductions, dismisses the recent snake reports as "hysteria" and focuses on imposing a \$25,000 fine in the few cases where snake owners can be apprehended.

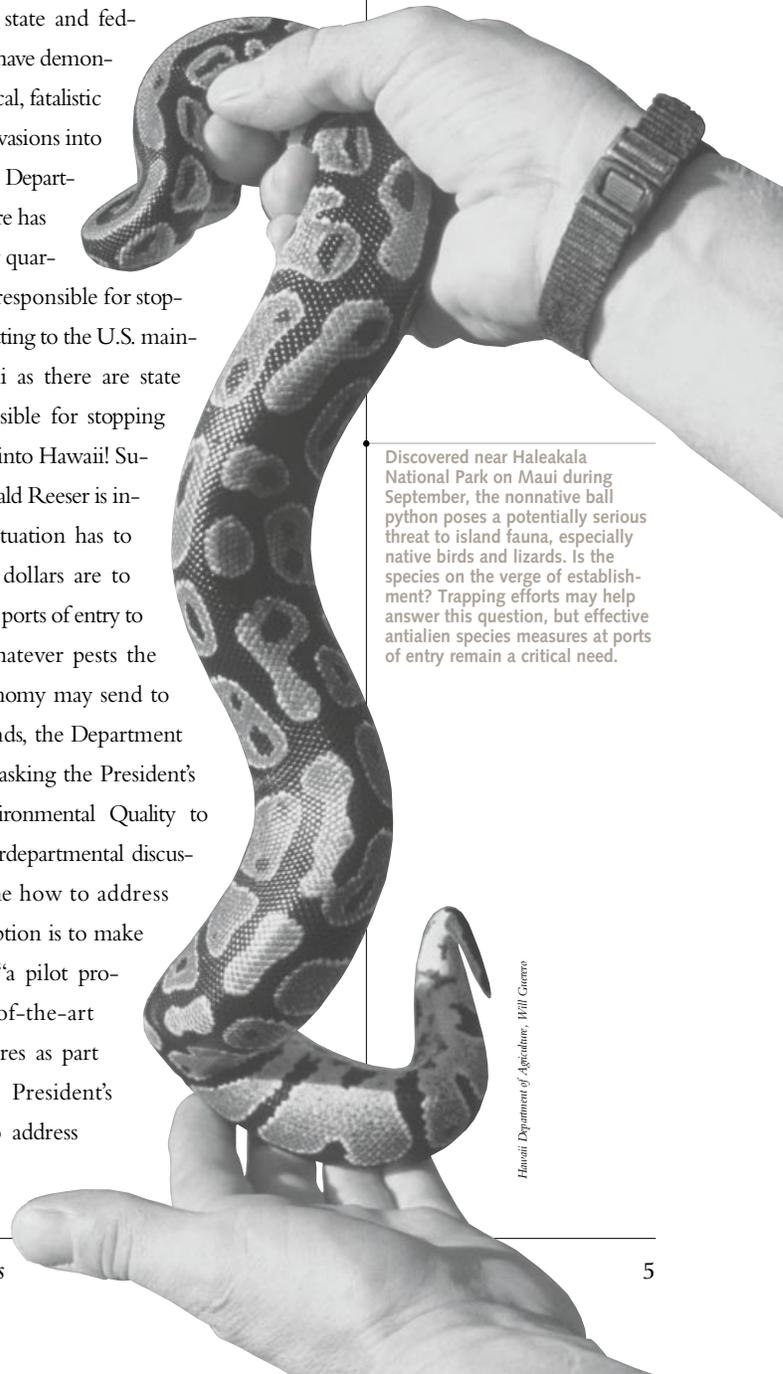
The biotas of oceanic islands in general, and the Hawaiian Islands in particular, are highly susceptible to damage caused by alien plants and animals transported by humans. Freed from the natural predators and parasites of their native habitats, invaders often thrive in newly occupied environments. The case of the brown tree snake (*Boiga irregularis*) on the island of Guam is illustrative. Forty years after arrival, it had attained population densities of 10,000-30,000 per square mile, feeding on birds, rats, shrews, and lizards; it had also exterminated nine of Guam's 12 native forest birds and approximately half the native lizard fauna and left the three surviving forest bird species and remaining fruit bat highly endangered. The threat if this snake species were to establish in Hawaii is now well recognized. What is not so widely recognized is that many other biological generalist snake species, including many of those commonly kept as pets, are

very likely to respond to new island habitats (such as Maui) in a very similar way. Citizens of Maui increasingly sense that establishment of snakes and other pests threaten not only the native biota, but also tourism, agriculture, and the local quality of life.

The Haleakala National Park Superintendent and the USGS Biological Resources Division office recognize the paramount importance of such insidious threats from outside park boundaries. Together, they have been waging a campaign for eight years, culminating in late 1997 and early 1998, to call for effective antialien species measures at ports of entry in conjunction with expansion and internationalization of the local airport. Traditionally, the state and federal governments have demonstrated a lackadaisical, fatalistic attitude toward invasions into Hawaii. The U.S. Department of Agriculture has five times as many quarantine inspectors responsible for stopping pests from getting to the U.S. mainland from Hawaii as there are state inspectors responsible for stopping pests from getting into Hawaii! Superintendent Donald Reeser is insisting that this situation has to change if federal dollars are to be used to expand ports of entry to accommodate whatever pests the international economy may send to Maui. As 1997 ends, the Department of the Interior is asking the President's Council on Environmental Quality to participate in interdepartmental discussions to determine how to address this issue. One option is to make Kahului Airport "a pilot project with state-of-the-art mitigation measures as part of the Vice President's national effort to address invasive species."

lloyd_loope@usgs.gov

Research Scientist, Pacific Islands Ecosystem Research Center, Haleakala Field Station; USGS Biological Resources Division; Makawao, Maui, Hawaii.



Discovered near Haleakala National Park on Maui during September, the nonnative ball python poses a potentially serious threat to island fauna, especially native birds and lizards. Is the species on the verge of establishment? Trapping efforts may help answer this question, but effective antialien species measures at ports of entry remain a critical need.

Hawaii Department of Agriculture, Will Cramer



RESOURCE KNOWLEDGE

In the nearly 35 years since biologist Starker Leopold noted that “management without knowledge would be a dangerous policy¹,” many more parks are in the system, threats are perceived to be more widespread and diverse, and complex issues routinely require specialized expertise. As a result, the need for scientific natural resource information has increased. Scientific information is available from many sources, but it is not often specific to the unusual management concerns frequently encountered in parks. The National Park Service must continue to foster research and its application in complex areas such as landscape ecology, the natural dynamics of ecosystems, the effects of fragmentation on resources, and resource restoration. During 1997, several developments indicate progress. The Park Service hired several senior scientists to ensure that park research and technical assistance needs are being met. A social science program was established to study the relationship between people and parks. The Inventory and Monitoring Program revised its priorities to become more effective in gathering baseline inventories in more parks.

Gathering Information

Mapping Alaska’s coastline

by Rusty Yerxa

In 1989, the Exxon Valdez oil spill in Alaska’s Prince William Sound destroyed invaluable coastal resources, many unknown and unmeasured. In the aftermath of the spill, the Alaska Region’s resource managers recognized the need to map the location of coastal resources of parks to provide a baseline for measuring change and, in the worst case, to assess damage from future oil spills. Currently, no appropriate coastal resource inventory mapping protocol exists.

After evaluating the needs of Alaskan parks, resource managers determined that the mapping effort had to be

accurate, flexible, and repeatable. Most importantly, it had to be affordable for parks that do not have the means to acquire expensive mapping expertise. Once established, the inventory protocol and its resulting GIS (Geographic Information System) layers can be used by coastal parks throughout the nation to collect, analyze, and display biological and physical shoreline data.

Developed by the resource management staff at Glacier Bay National Park and Preserve, with assistance from the Glacier Bay Field Station of the USGS Biological Resources Division, the new mapping effort uses aerial photography and GPS (Global Positioning System) technology to locate prominent shoreline features. During a low-tide “window,” a two-person team determines the location of a variety of physical and biological resources, equipped with only a clinometer, a

rusty_yerxa@nps.gov

Wildlife Biotechnician; Glacier Bay National Park and Preserve, Alaska.

Distribution of *Fucus*, or rockweed, was just one of the numerous shoreline attributes recorded by resource managers at Glacier Bay National Park and Preserve (Alaska) during recent coastal mapping.

¹ Leopold, A.S., S.A. Cain, C.M. Cottam, I.N. Gabrielson, and T.L. Kimball. 1969. *Wildlife Management in the National Parks*. Reprint from *Administrative Policies for Natural Areas of the National Park System*. USDO—National Park Service.

Award Winner Profile

Senior scientist honored

Gary Davis, Senior Scientist and Research Marine Biologist at Channel Islands National Park, California, was honored with the 1996 Director's Award for Natural Resource Research during summer. This award recognizes outstanding contributions to technical expertise, continuity, and innovative thinking in research. Davis is a champion of ecological monitoring and scientifically based ecosystem management. He has shown these strategies to be reliable and cost effective and has developed monitoring protocols used widely by others. He is an inspiration among colleagues and a mentor of young scientists. His research, which has contributed to marine conservation in the Caribbean, Florida, and California, has explored the role of maritime parks as refugia to sustain and restore coastal fisheries and protect biodiversity. Also a leader, Davis has served as president of the American Academy of Underwater Sciences and the George Wright Society; he was a board member of the Natural Areas Association. He returned to the National Park Service recently after serving with the USGS Biological Resources Division, California Science Center, since 1993. His research insights and broad understanding of marine resources have been very valuable assets to the National Park Service and the Biological Resources Division. "To be recognized among peers feels good," Davis said. "These awards remind us all of what a job well done looks like."



During low tide, park staff used global positioning equipment to provide accurate shoreline locations and mapped slope, beach substrate type and composition, and distribution of intertidal life.

compass, an aerial photograph, a differential GPS receiver, and a one-page data sheet for each shoreline segment. Staff record resource attributes such as slope, beach substrate type, composition and distribution of intertidal biota, and other pertinent information. Each coastal segment is then precisely delineated on the aerial photo in the field, enabling future monitoring crews to recreate the segment exactly and detect any distributional changes over time.

The resulting product can be displayed in GIS format using ArcView™ and Microsoft Access™, enabling anyone with access to a GIS-capable personal computer to pull up a detailed assessment of a chosen section of coastline. A user can query any combination of attributes, from the simple (where are the seal haulouts?) to the complex (which bedrock beaches have steep slopes and tidepools?). The program also contains three digitized color photographs of each coastal segment that may be zoomed in on to show details of the actual shoreline.

Piloting the program on the coastline of a remote Alaskan park, staff encountered challenging logistics.

Additionally, lack of quality base maps involved incorporation of complex and expensive ground control protocol components that would not be necessary for parks possessing adequate base maps. As the program moves from design to implementation, we expect that savings to protocol users will be substantial in the long run. Depending on shore complexity, we estimate that teams should be able to field-map 1–2.5 miles of coastline per hour at an estimated maximum total cost (including data processing) of \$70 per mile, plus costs of nominal training and practice, protocol setup and customization, and logistics.

Researchers and park managers can use the resulting information to determine the location of study areas, as well as to monitor distributional change over time. Glacier Bay National Park will produce and distribute to the other Alaskan coastal parks a CD-ROM containing a detailed set of instructions on how to map their own coastlines, along with sample products from Glacier Bay. The protocol has been designed to be maximally scaleable to the needs and capabilities of a variety of parks.

New approach to paleontological surveys having success

by Vince Santucci

The record of life is well represented through fossils preserved within the national parks. Over 120 areas of the national park system have been identified as containing significant paleontological resources. A collective story ranges from Precambrian stromatolites exposed in Glacier National Park, Montana, to Ice Age mammal bones found throughout the Alaskan parks. A great diversity of petrified leaves, wood, pollen, shells, bones, teeth, eggshells, tracks, burrows, and coprolites exist within park strata. Museum collections throughout the country manage NPS paleontological specimens for research and public education.

Unfortunately, the management of nonrenewable paleontological resources in national parks faces increasing challenges. Movies such as "Jurassic Park" have elevated public interest in paleontology. The commercial market for fossils continues to escalate with a proportional rise in fossil resource theft from public lands. The lack of specific funding for paleontology programs within the National Park Service limits the stewardship activities of park resource managers. The fewer than ten professional NPS paleontologists must be innovative in competing for resource management funds in programs dominated by biological and cultural resource specialists.

A national approach to paleontological resource management and research is being advanced through a partnership between the NPS Geologic Resources Division and Fossil Butte National Monument (Wyoming). The NPS Paleontological Outreach Program is designed to provide professional support to national park areas lacking paleontological expertise. The outreach program was piloted at Yellowstone National Park in 1996 and 1997 and increased recognition of the importance of the park's fossil resources through a paleontological survey. The results of the

survey will be published in a report that addresses issues related to fossil resource protection, interpretation, curation, and research. As a result of this project, similar surveys are underway or are being planned at Big Bend National Park, Colorado National Monument, Death Valley National Park, Grand Teton National Park, and the Alaskan parks. The outreach program is also working with the NPS Inventory and Monitoring Program and staff from the U.S. Geological Survey to develop a comprehensive paleontological resource database for the National Park Service.

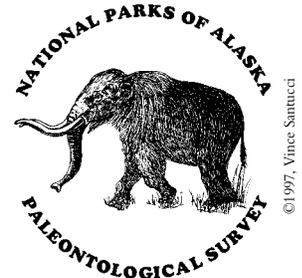
The issues associated with preserving fossils in national parks are just as real as those related to preserving geysers and grizzlies. This can clearly be demonstrated during a short hike through the world-renowned Crystal Forest at Petrified Forest National Park, Arizona. Photographs of the area from the early part of the century reveal pavements of fossil wood covering the ground. Today visitors find the same area nearly vacuumed clean of petrified wood specimens smaller than doorstop or paperweight size. Is it possible that this park could follow the same fate as the now abolished Fossil Cycad National Monument, in South Dakota? Management by neglect at Fossil Cycad led to the near complete loss of the fossil resource there and the reason the area was established as a national monument. In 1957, in an action rarely taken, Congress deauthorized this unit of the national park system.

Most of what is to be learned about the history of life remains buried within the earth. Through appropriate management in parks, partnerships, and the efforts of the Outreach Paleontology Program, part of the story will be revealed and interpreted by fossils discovered in the national parks.



Denali National Park and Preserve

vincent_santucci@nps.gov
Resource Management Specialist
and Paleontologist; Fossil Butte
National Monument, Wyoming.



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Sarah Schlichtholtz, a paleontology intern funded by the Geological Society of America, surveys Denali National Park (Alaska) for fossil resources. Since 1985, paleontological surveys such as this have increased the number of parks known to contain significant fossil resources from 12 to 120. Sure to add to this number is the Outreach Paleontology Program that gathered momentum in 1997 and is assisting parks in beginning to manage this sometimes overlooked natural resource.

sue_consolo-murphy@nps.gov
Resource Naturalist, Center for
Resources; Yellowstone National
Park, Wyoming.

tami_blackford@nps.gov
Secretary, Center for Resources;
Yellowstone National
Park, Wyoming.

People and Preservation

Geologist's death leaves Yellowstone with deep loss and legacy

By Sue Consolo-Murphy and Tami Blackford

During his 28-year career with Yellowstone National Park (Wyoming, Montana, and Idaho), Geologist Roderick A. (Rick) Hutchinson amassed incomparable knowledge about the park's geysers and hot springs, which he shared with thousands of visitors and cooperative researchers from around the world. Rick and Diane Dustman, a private computer specialist who commonly worked with Rick on various projects, died in March 1997 in an avalanche while conducting backcountry monitoring of thermal features. Their deaths left the park and the geologic community with a deep loss. Rick was ever enthusiastic in sharing his knowledge of geothermal resources, from well-known geysers like Old Faithful and Steamboat, the world's largest, to remote areas such as the Heart Lake Geyser Basin, site of his last exploration. Though he preferred to escort visitors personally into the thermal basins, he also wrote or coauthored dozens of publications over the course of his career. In December 1997, a research symposium in his honor was held at the American Geophysical Union convention in San Francisco.

Geothermal features were a primary reason for Yellowstone's establishment and remain a major drawing card for visitors today. Despite this fact, the park has always spent less time and money on their study and management than on fish and wildlife. Only after Rick's death did other staff realize just how much knowledge was vested in one specialist. At a loss to answer information requests and continue monitoring and collaborative research, the park sought advice on how to replace its missing geologic expertise.

In July, a group of earth scientists from academia, the U.S. Geological Survey, and the National Park Service met to discuss the direction of Yellowstone's physical sciences program. They recommended that



Yellowstone National Park

Using a vacuum hose, Yellowstone Geologist Rick Hutchinson made several attempts during his career to remove coins, sticks, and other human-introduced debris from Morning Glory Pool. Vandalism of this kind can clog the hot spring vent, encouraging algae growth, and disturbing the historic appearance of the famous hot spring.

Yellowstone hire three professionals—a thermal geologist, a surficial geologist, and a hydrologist—to build expertise. They also proposed hiring more interpreters educated in geology and strongly supported the development of new visitor center exhibits to increase public understanding about physical resources.

The consultants concluded that only full-time staff members with long-term expertise could fulfill many of the park's day-to-day responsibilities to oversee preservation and protection of geothermal features and systems. Yellowstone's hydrologic systems and issues also warrant attention. The park must complete the basic inventories of thermal features that Rick had been conducting, continue long-term geologic and hydrologic monitoring, facilitate geophysical research, minimize human impacts on geothermal systems, and enhance and disseminate general geologic information. These services will again be provided by the park, although they will no longer be found in just one very special person.

The Social Sciences

New Social Science Program makes strides

by Jean McKendry

As every park superintendent comes to know, the management of national parks necessarily involves the management of people—visitors, employees, concessioners, nearby communities, interest groups, and local governments all play roles in the national park system. From assessing the socioeconomic impacts of the 1997 flood in Yosemite, to resolving visitor use conflicts at Cape Canaveral or understanding international visitation patterns at Death Valley, social science is a necessary and important function of the National Park Service.

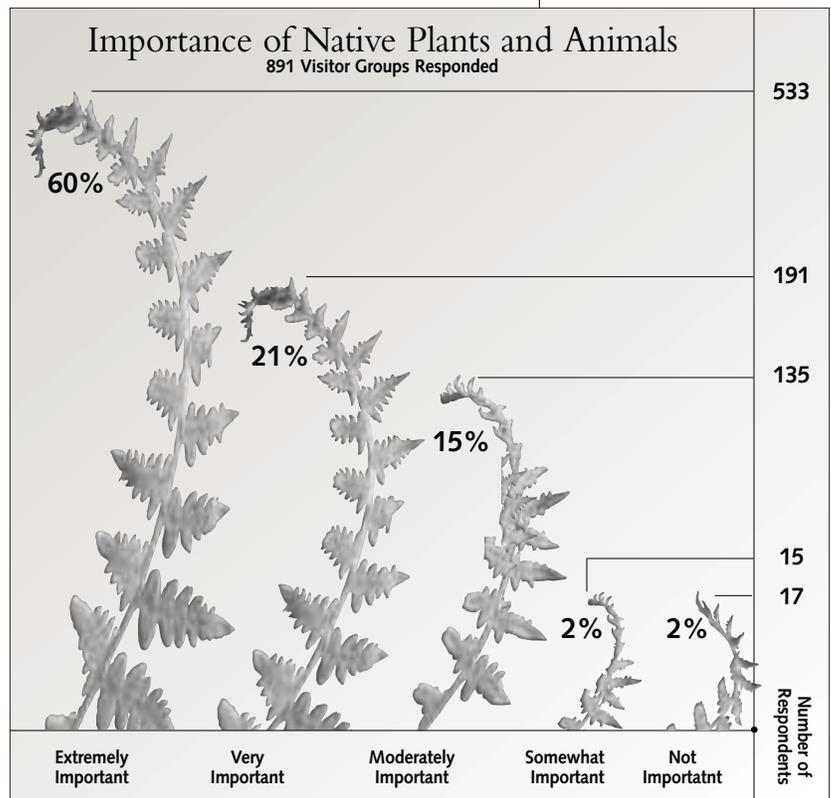
In 1996, the National Park Service approved the social science plan *Usable Knowledge: A Plan for Furthering Social Science and the National Parks*. Dr. Gary Machlis was appointed Visiting Chief Social Scientist. The Social Science Program reports to the Associate Director, Natural Resource Stewardship and Science. This program has as its mission to “conduct and promote state-of-the-art social science related to the mission of the National Park Service, and deliver usable knowledge to NPS managers and the public.” In 1997, several key initiatives described in *Usable Knowledge* were completed. The program produced a social science research plan for the Harpers Ferry Center to improve the effectiveness of interpretive media, published a report on the future of Virgin Islands National Park, and assessed the economic and social impacts of the Yosemite flood; conducted several competitively awarded projects to meet national social science needs, including technical review of the NPS money generation model, studies on the economic effect of the 1995–96 shutdown of the national park system, and initial research on visitor reaction to the Recreation Fee Demonstration Program underway in 100 park units; and coordinated the Canon National Parks Science Scholars Program, which funds scholarships to support dissertation research on issues important to the national parks.

In addition, the Visitor Services Project maintained its busy schedule. This Project has been conducting visitor surveys at various park units since 1982, and has completed over 100 studies. The data are used to protect resources, save money, and improve visitor services. In 1997, the Project completed nine studies and initiated many more at 11 parks. The Project also published the fourth annual NPS customer service report, *Serving the Visitor 1997*.

Looking to the future, the Social Science Program received a base funding increase for fiscal year 1998. The program will develop and manage a customer service evaluation system dealing with park-related GPRA (Government Performance and Results Act) goals for all units of the national park system. The program will also initiate a long-term cooperative research program with a historically black college or university, focused on urban park units, cultural diversity, the needs of special populations, and visitor use management in high density parks. A social science web site for scientists and managers will become available through the NPS home page *ParkNet*.

jean_mckendry@nps.gov
Research Associate, NPS Social Science Program; Washington, D.C.

The visitor study, one service of the NPS Social Science Program, can illuminate visitor attitudes toward natural resource protection. For example, a 1996 study at Great Smoky Mountains National Park (Tennessee and North Carolina) found that native plants and animals are moderately to extremely important to 96% of summer park visitors.



gary_machlis@nps.gov
Visiting Chief Social Scientist;
National Park Service;
Washington, D.C.

Social science to improve employee safety

by Dr. Gary Machlis

Employee safety is essential to the mission of the National Park Service, and the agency faces several important challenges:

- a higher accident rate than other federal agencies with similar responsibilities,
- increasingly complex work tasks that emerge from the NPS mission,
- evolving policies and regulations, and
- limited budget, resources, and staff at all levels.

Since the mid-1970s, psychologists, geographers, engineers, and sociologists have performed studies of high-risk activities and general employee safety.

National Park Service employees are often involved in operations in which safety is especially important, such as snow removal at Mount Rainier National Park (Washington). In 1997, the NPS Social Science Program began planning the research needed to improve employee safety.

Research has been conducted on high-profile events such as the Mt. St. Helens eruption, forest fires, and the Three Mile Island, Chernobyl, Exxon Valdez, and Challenger accidents. Research has also been conducted on more common activities, such as vehicle operation, logging, equipment inspection and maintenance, and handling of hazardous materials. Results from these studies have pointed to the importance of social factors—the social, psychological, cultural, and organizational variables that influence employee safety. Understanding these social factors is important to safety in the National Park Service.

In 1997, the NPS Social Science Program (in cooperation with the Risk Management Division) began an effort to carefully plan the social science research needed to improve employee safety. A research plan can identify and prioritize research needs, increase the usefulness of research results, improve the delivery of information, and reduce costs. The Social Science Program has developed similar research plans for the South Florida units of the national park system and the Harpers Ferry Center.

Employee Safety in the National Park Service: A Social Science Plan includes several elements. It provides a policy analysis of NPS requirements and a rationale for social science research on employee safety. It provides a detailed review of social science literature relevant to employee safety in general and specifically to the agency; over 225 research articles are included in the review. The plan identifies the research priorities of NPS managers, supervisors, and employees, gathered through a workshop with the NPS Risk Management Council and interviews with other NPS employees and safety experts. Based on all this information, the plan includes a research agenda and action plan for employee safety research.

The draft plan was completed in 1997, and following a careful technical review, will be presented to the National Park Service for use in early 1998. Targeted and cost-effective research projects should be undertaken in 1998. The result should be critically needed research on employee safety, usable knowledge for NPS managers, and improved safety for NPS employees.



Mount Rainier National Park

Air Quality

Information compels action to reduce air pollution

by Christine Shaver

The National Park Service has invested a lot of time and money monitoring air quality and studying how air pollution affects park resources. Even though we have no regulatory authority over the pollution sources, the National Park Service can provide others with the information and motivation they need to take action. Information provides the foundation for more stringent environmental standards, which in turn compel the development of additional measures to reduce pollution.

In July 1997, the Environmental Protection Agency adopted new national ambient air quality standards for ozone and fine particulate matter. Air pollution will need to be reduced significantly to comply with the new standards, particularly in the eastern United States and California where parks are besieged with air pollution problems.

In the West, a sweeping set of recommendations for improving visibility in national parks and wilderness areas on the Colorado Plateau was adopted by the Grand Canyon Visibility Transport Commission in 1996. The Park Service worked with eight western states, several dozen tribal nations, and hundreds of

stakeholders to craft those recommendations. Turning them into action is now the challenge.

In October 1997, the Western Regional Air Partnership (WRAP) was formed to implement the commission's recommendations. The Department of the Interior is a charter member. The partnership is examining each of the commission's recommendations, developing more specific strategies, and designing institutional mechanisms to facilitate action by all the western states and tribal nations.

Much work remains to be done, but it is noteworthy that all the western states and tribes are focused on, and devoting resources to, the protection of visibility in our parks. That is because the Park Service provided them with scientifically sound information, worked collaboratively with them in designing remedial strategies, and otherwise convinced them that action was needed.

Based in part on the commission's work, the Environmental Protection Agency proposed new requirements for visibility protection programs in July 1997. Based on data collected over the past 20 years, the National Park Service suggested that a more ambitious schedule for restoring natural visibility was feasible—and necessary. Based on our experience in trying to use the data to reduce pollution, the Park Service recommended the EPA proposal simplify and expedite the process used to reduce pollution from existing facilities.

chris_shaver@nps.gov

Chief, Air Resources Division;
Natural Resource Program Center,
Lakewood, Colorado.



The status of air quality in nine Colorado Plateau Class-I area parks is generally good, according to a 1997 report by the Air Resources Division. The only documented impact of air pollution on air quality-related values is visibility reduction, yet no rapid changes are expected in the next decade. No impacts from ozone are documented, although little work has focused on the sensitivity of plants in this region to the gas.

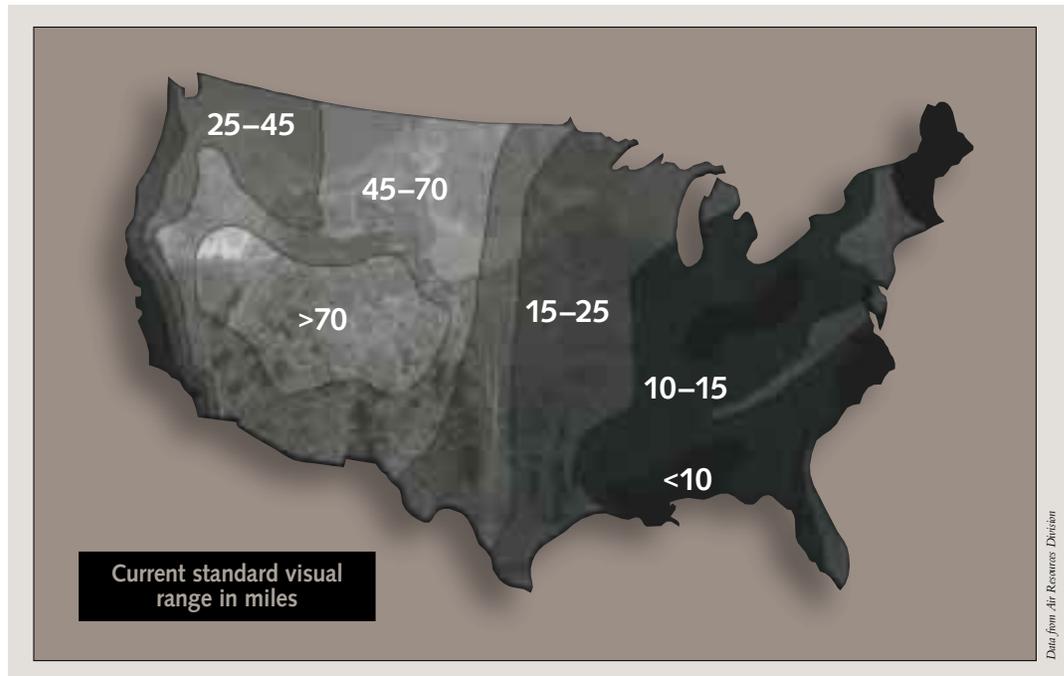


Air Resources Division

Visibility impairment at Grand Canyon National Park (Arizona) is symptomatic of a regional air pollution problem for parks and wilderness areas. During 1997, the Western Regional Air Partnership formed to implement strategies aimed at improving visibility on the Colorado Plateau.



Proposed EPA regulations on reducing regional haze aim to restore natural visibility conditions through gradual reductions in air pollution. Given current pollution levels, the proposed EPA program would require 200-300 years to achieve natural visibility in the eastern United States. In the West, the goal is more optimistic at 60-90 years. The National Park Service recommended faster progress. (The map represents current standard visual range in miles.)



Data from Air Resources Division

jared_ficker@nps.gov
Legislative Affairs Specialist, NPS
Office of Legislative Affairs;
Washington, D.C.

Scientific Information & Legislation

Feral horses at Cape Lookout National Seashore

by Jared Ficker

A U.S. House of Representatives bill (H.R. 765) to ensure the maintenance of a herd of not less than 100 feral horses in Cape Lookout National Seashore (North Carolina) passed the House in the summer of 1997 and was very controversial. Associate Director Finnerty (Park Operations and Education) stressed in her testimony before the Senate Subcommittee on National Parks, Historic Preservation, and Recreation in October that the bill addresses a specific resource management decision that park managers make daily. Park superintendents make these decisions based on a myriad of interrelated factors, including the mission of the park; the best scientific information; input from local, state, and national interests; the policies of the National Park Service; and other considerations. The Park Service continues to believe that such decisions are best made at the individual park level due to their complexity. But, due to the limited scientific information regarding this issue and intense interest in it, the

Administration supported this legislation provided it was amended so that (1) a requirement for keeping a specific herd level was removed, and (2) any adverse impact that the horses might have on the natural resources of the national seashore was considered. A variation of these requirements was included in the Senate-passed bill. The differences in the House and Senate-passed bills must now be resolved before a final bill is enacted. The experience with this legislation stresses the importance of relying on sound and thorough science as the basis for our resource management decisions.



Cape Lookout National Seashore

A feral horse takes a drink from Mullet Pond at Cape Lookout National Seashore (North Carolina).



Prairie Cluster Monitoring Program

Resource managers monitor prairie forb establishment at Wilson's Creek National Battlefield, Missouri.

Issue Update

Priorities revised for inventory and monitoring

by Gary Williams

The priorities used by the Washington Office to fund acquisition of the 12 basic inventory data sets for natural resource parks were revised and updated during 1997. These updates were based on several factors. In a few instances, parks had already completed some of the inventories, and better information about the need for geologic resources data was developed. New threats and other factors had made certain inventories more urgent. Having developed a better understanding of the linkages among the inventories, program managers could suggest a more efficient order in which to acquire data. Finally, new opportunities exist for leveraging funds to complete more of the inventories.

During the summer, parks submitted new priorities for consolidation into the new national listings. A work group consolidated the new information and closely followed the priorities set by

the parks, except where changes were needed to complete inventories in a particular sequence. For example, parks scheduled for vegetation mapping first must assemble all base cartographic information. Nevertheless, the first 50 parks previously listed as top priorities for vegetation mapping were retained at the top of the new list, since some level of data acquisition had begun in most of those areas. A significant change is that vascular plants, birds, mammals, amphibians, reptiles, and fish each have their own priority listings now where they were formerly all lumped under "species inventories." By developing separate priority listings, the program can do a better job of addressing the most pressing needs for information about those taxonomic groups.

In a related activity, the inventory and monitoring committee reaffirmed the existing 12 basic inventory data sets being acquired through the program. The committee decided not to expand efforts to acquire data on other resources such as invertebrates, fossils, and wetlands, citing funding trade-offs and the specialized nature of these resources.

 The first comprehensive report of the Inventory & Monitoring Program was published in 1997 and is available from the Natural Resource Information Division in both hard copy and electronic form (www.nps.gov/pubs/I&Mann96). The report addresses natural resource inventories and data management and describes the status of natural resources in 11 park units that conduct prototype ecological monitoring.

gary_williams@nps.gov
Inventory and Monitoring
Coordinator, NPS Natural Resource
Information Division; Natural
Resource Program Center; Fort
Collins, Colorado.



PLANNING & PRESERVATION

A foundation of good resource management decision-making is the application of sound scientific information. Within parks, many impacts to resources can be averted through careful planning that makes use of science early on and applies it rationally throughout the process. Visitor use planning, for example, is one area in which the National Park Service is taking innovative steps to address park crowding and its attendant natural resource degradation issues. During 1997, the Park Service made substantial progress in planning for alternate transportation systems at Zion and Grand Canyon National Parks. Additionally, infrastructure planning is helping to correct resource impacts at Sequoia and Yosemite National Parks through the removal, redesign, and relocation of visitor use facilities to less sensitive areas in these parks. All in all, planning can be insightful and facilitate environmental protection, resource sustainability, and the preservation of park natural values as long as science is a partner in the process.

Transportation

Changing the way people use parks

by Darla Sidles

Zion Canyon will be a quieter, gentler place, just after the turn of the century. That is when the canyon shuttle system is scheduled to begin, operating from the south end of the gateway town of Springdale, Utah, through Zion Canyon, to the Temple of Sinawava. This system will not only transport people, but will also fundamentally change the way people use and understand the park. Zion National Park is leading an increasing trend in heavily congested park areas to eliminate private vehicles in favor of shuttle systems as a method of managing overcrowding.

Annually, over 2.5 million people visit Zion, and approximately 50% of them drive up the scenic canyon. Towering cliffs hug the winding, 6-mile stretch of road,

narrowing in places to less than a quarter-mile wide. During summer days, as many as 2,000 vehicles crowd this fragile canyon corridor. The problem of managing traffic congestion and visitor use here is not new, however. Zion's 1977 Master Plan called for the study of an interpretive transportation system to solve congestion problems and provide better educational opportunities for visitors. Now, 20 years later, the Canyon Transportation System Environmental Assessment was approved. Funds were also approved for half of the shuttle vehicle acquisitions. Progress is assured, but is often slow. Contracting for construction of related facilities was scheduled for 1997, but was postponed until review by the NPS Development Advisory Board.

Despite some temporary setbacks, the transportation system is still on schedule for debut in the year 2000. Benefits are numerous. Traffic gridlock will be eliminated, providing higher quality, safer visitor experiences. Removing private traffic will reduce

darla_sidles@nps.gov
Special Projects Coordinator, Zion National Park, Utah.

On summer days, as many as 2,000 vehicles crowd Zion Canyon, a fragile 6-mile corridor in Zion National Park (Utah). Traffic gridlock, safety, resource impacts, and a degraded visitor experience are all management concerns related to high numbers of motor vehicles in the scenic canyon.

vegetation impacts along roadside overflow parking areas. Additionally, shuttle fleet design includes measures to improve air quality by utilizing internal combustion propane-fueled vehicles to reduce

emissions. Mechanical noise in the canyon will also be reduced both by the absence of private vehicles, and by noise reduction measures incorporated into the shuttle design.



Zion National Park

A proposed transportation shuttle will replace private automobiles in the canyon in approximately two years, alleviating traffic congestion and parking problems. It will also reduce vegetation impacts, noise, and exhaust along the popular roadway.

The Zion shuttle system also presents some unknowns. The park is not certain how the transportation system will affect the numbers of people visiting the canyon, or what impacts other areas may experience due to visitor redistribution. The shuttle system, by eliminating the traffic and parking dilemma, may actually increase visitation to the canyon. The question then becomes, how should the park best manage the sheer numbers of people? The first few years of shuttle operation will help answer some of these questions.

The Zion system can be used to distribute people within the canyon, thereby managing visitor flow. If visitation increases, however, the visitor “carrying capacity” may be exceeded. In the future, capacity limits may be necessary in order to preserve the resources and visitor experience. As a follow-up to the general management plan currently in preparation, visitor use and resource condition indicators and standards will be developed to guide future decision-making.

norm_henderson@nps.gov
Research Coordinator; Glen Canyon
National Recreation Area, Arizona.

Adaptive Management

Preserving the Colorado River ecosystem through adaptive management

by Norm Henderson

The experimental flood released from Glen Canyon Dam (Arizona) in 1996 through Grand Canyon National Park and Glen Canyon National Recreation Area focused national attention on the benefits that could be derived from operating a dam based in part on the needs of the downstream river ecosystem. During 1997, the National Park Service made further progress in protecting the Colorado River from the effects of dam operations. Through a newly formed adaptive management process, the Secretary of the Interior hopes to provide a scientific basis for proper dam management, taking into consideration

the environmental, recreational, cultural, power, and water-delivery concerns of 25 different stakeholder groups. This cooperative approach to dam management is known as the Glen Canyon Dam Adaptive Management Program and is expected to usher in a new era of dam management in the West.

Before 1992, the Bureau of Reclamation managed Glen Canyon Dam, like most other large western dams, primarily to ensure water delivery and electric power generation. Input into the management process by those with other concerns was limited. In the early 1980s, however, concern about the environmental effects of ongoing dam operations increased sharply. Environmental advocacy groups contended that the operation of the dam was causing continued resource degradation, specifically noting the erosion of beaches and the loss of sandbars. In addition, fish species, including the endangered humpback chub, riparian

vegetation, and near-shore cultural resources were also affected.

This heightened awareness culminated in the passage of the Grand Canyon Protection Act in 1992. This act required the Secretary of the Interior to first prepare an environmental impact statement (EIS) to fully evaluate the resource impacts of current dam operations, and then to change dam management priorities to include a full range of resource protection measures. The act also required the secretary to study and monitor the effects of any actions he took, and to consult with a wide spectrum of interest groups in all aspects of dam management.

To help implement the requirements of the act, the EIS proposed an adaptive management program, which was adopted by Secretary Babbitt in January 1997. Adaptive management is a process whereby various beneficial resource management alternatives are considered and actions are recommended to the secretary based on input from a formal stakeholder group. The ecosystem response to these actions is carefully monitored to determine if resource condition objectives are being achieved. Based upon the results of the monitoring program, modifications in management

may be proposed and evaluated. This program provides broad input into dam operations and other actions that may be taken by the secretary to protect or improve riverine resources.

The Adaptive Management Workgroup (a federal advisory committee) manages the adaptive management process and has 25 members appointed by the secretary. The Superintendent of Grand Canyon National Park represents both Grand Canyon National Park and Glen Canyon National Recreation Area on this committee. During 1998, the committee will evaluate and recommend to the secretary an overall budget for fiscal year 2000 (likely over \$7 million), a comprehensive science program to evaluate the effects of current and proposed actions taken by the secretary, the construction of a selective withdrawal structure to warm the water downstream of the dam for endangered fish, and the installation of spillway gate additions to enable better management of habitat enhancing and unplanned flood flows. In addition, a 45,000 cubic-foot-per-second management flood flow during spring could be recommended, which, like the 1996 experimental flood, may increase sandbar deposits and riparian habitat.

 A planned light rail system will transport future day-use visitors to Grand Canyon National Park from the gateway community of Tusayan, while alternative-fuel buses will make connections along the South Rim. Announced in November, the new transportation system is expected to replace most private vehicles in the year 2000 in the South Rim area while helping to protect park resources and maintain a quality visitor experience.

Since it began operating in 1965, the Glen Canyon Dam has been managed primarily to ensure water delivery and electric power generation. Recent adoption of an adaptive management process, however, now allows for broader concerns, including the needs of the downstream river ecosystem, to be considered in dam operations.



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Wildlife Management

Teton bison management plan completed

by Steve Cain

Working closely with the public, conservation groups, and other government agencies, Grand Teton National Park (Wyoming) produced a long-term bison management plan that promises to satisfy most concerned parties. Exhaustive public input and reviews proved to be one key to success in this planning process.

In 1948, 20 bison were reintroduced into Jackson Hole from Yellowstone National Park. These bison were confined in the Jackson Hole Wildlife Park, a 1,500-acre enclosure for displaying prominent indigenous wildlife that was supported by Wyoming, the New York Zoological Society, and a private land corporation. In 1950 the expansion of Grand Teton National Park encompassed this holding and management of the area began shifting to the National Park Service. In 1968, the 16 bison in the herd at that time were allowed to roam free. The herd grew slowly until 1980; after the animals discovered supplemental winter elk feed on the National Elk Refuge, which borders the park to the south, the herd's number grew from about 35 individuals to its current size of nearly 400.

In 1991, the park and the refuge, in cooperation with the Wyoming Game and Fish Department and Bridger-Teton National Forest, released a scoping statement for the preparation of a long-term management plan and environmental assessment for the Jackson bison herd. Each of the four primary management issues to be addressed in the plan—herd size, herd reduction methods, winter distribution, and disease—was contentious. A draft environmental assessment was released in 1994, a final environmental assessment was released in 1996, and a “finding of no significant impact” (FONSI) was released in 1997.

The FONSI contained several major changes from the final plan due to new scientific information and public comment. Major provisions of the FONSI and final plan include: (1) controlling herd size

through both a managed public hunt on the refuge and surrounding national forest lands, and through donation of animals to Native American tribal governments and low income groups; (2) maintaining a post-hunt herd size of 350 to 400 animals; and (3) minimizing overlap of bison and cattle, and vaccinating bison against brucellosis when a demonstrated safe and effective vaccine is available.

Compared to the Yellowstone bison herd, the Jackson herd and the local situation differ in ways that



Congress has enacted two new laws that will encourage open space conservation surrounding national parks. P.L. 105-81 authorized a study of the significance of pastoral lands within and adjacent to Grand Teton National Park (Wyoming). Since 1977, the price of land in the Jackson Hole area has increased an average of 600%, which has tempted large landowners (such as ranchers) to sell their land for subdivision. The subdivision of large tracts of land has reduced the amount of open space in the valley and has resulted in loss of wildlife habitat and the fragmentation of migration routes. In a more far-reaching effort, Congress also enacted P.L. 105-34, which provides for tax incentives for landowners, in or within 25 miles of a national park or wilderness area, who preserve open space through conservation easements.

were key to the successful completion of the plan. While herds in both areas have brucellosis, the Jackson herd roams primarily on Department of the Interior lands year-round. This avoids the need for agricultural agencies to kill large numbers of disease-exposed bison as they leave park lands, such as has occurred on Yellowstone's borders. In addition, having grazed livestock in the vicinity of free-roaming bison for nearly 30 years, local cattle producers are more accepting of the herds than some of their Montana counterparts. These

factors, as well as dedication and good cooperation among the federal and state agencies, responsiveness to public interests, and support of the final plan by key environmental organizations that included the Jackson Hole Conservation Alliance, Greater Yellowstone Coalition, and Wyoming Wildlife Federation, were all critical components of this successful planning process. In celebration, the local conservation community held an unprecedented "plan completion party" for government and conservation organization participants alike.



Numbering nearly 400, bison in Grand Teton National Park (Wyoming) will be managed according to a bison management plan, completed during 1997. Herd size will be held to 350-400 members through a combination of a managed public hunt and donation of animals.

Grand Teton National Park, Mark Schneider

lee_benson@nps.gov
Wildlife Biologist, NPS Southern
Arizona Group Office;
Phoenix, Arizona.

bvanpelt@gf.state.az.us
Nongame Mammals Program
Manager, Wildlife Management
Division; Arizona Game and Fish
Department; Phoenix, Arizona.

Partners conserve jaguars in the Desert Southwest

by Lee A. Benson and Bill E. Van Pelt

In this century, jaguars (*Panthera onca*) almost disappeared from this country. In an effort to avoid the legal and economic problems associated with listing the jaguar as an endangered species, biologists, land managers, and ranchers in southeastern Arizona and southwestern New Mexico formed a partnership in 1997 to develop a conservation plan. The group hoped to demonstrate to the U.S. Fish and Wildlife Service that conservation actions for the jaguar could occur at the state level and that federal listing would not

be necessary. Although the jaguar was federally listed as endangered in 1997, the partnership accomplished many positive conservation actions and continues to function very much like an endangered species recovery team, proving conclusively that individuals with different agendas can work together successfully.

The jaguar conservation partnership is composed of 16 federal, state, and county agencies, including the National Park Service. The Arizona and New Mexico Game and Fish Departments have been key members and initiators of the effort. Any interested parties can participate. Current members include nonprofit conservation organizations, livestock associations, and private citizens as well as interested federal, state, and county agencies.

In 1997, the partnership drafted a conservation agreement and strategy for the management of the jaguar. The agreement identifies major objectives for the conservation of the species that meet science-based management and education goals. To date, work has been completed on determining historic and current numbers of jaguars, establishing management protocols, assembling a scientific advisory group, and developing an Internet web site (www.gf.state.az.us). Next year the partners will focus on developing habitat criteria for the jaguar to assist land management agencies and for producing information about the jaguar for dissemination to the public.

One of the biggest problems with managing for a species such as the jaguar is the lack of information specific to the animal in the United States. Closing this gap will be a primary task for the jaguar conservation partnership in the coming months and years.

The jaguar is a federally endangered species in southeastern Arizona and southwestern New Mexico. During 1997, the National Park Service participated in a grassroots partnership to conserve the species.



Arizona Game and Fish Department

International Planning

Assessing the effects of NAFTA on border water resources

by Mark Flora

“La frontera,” the culturally distinct U.S.-Mexico border region, changed indelibly with the 1994 implementation of the North American Free Trade Agreement (NAFTA). In addition to creating opportunities for economic development, the agreement will affect the natural resources shared by both nations along the border. At the time, the Secretary of the Interior chartered the U.S.-Mexico Border Field Coordinating Committee for the purpose of facilitating better coordination among bureaus of the Department of the Interior (DOI) in addressing environmental issues within the border area. The committee identified water resources as a primary concern, including water quality and quantity in several units of the national park system. To better categorize the water-related issues, a team of water-resource specialists from several agencies, including the National Park Service, delineated watersheds along the 1,920-mile border and divided the region into eight areas with similar hydrologic and geographic features.

During 1997, the committee published a fact sheet that gives an overview of the water-resource issues of the “Mexican Highlands” border area. The Mexican Highlands is nearly 22,000 square miles in size (25% in Mexico; 75% in the U.S.) and contains 14 basins that drain to rivers in southeastern Arizona, southwestern New Mexico, northern Sonora, and northwestern Chihuahua. Extensive tracts of DOI lands coincide with the highlands, including Saguaro National Park, Buenos Aires National Wildlife Refuge, the San Pedro Riparian National Conservation Area, Chiricahua National Monument, San Bernardino National Wildlife Refuge, Coronado National Memorial, Tumacacori National Historical Park, and Fort Bowie National Historic Site.

Limited water quantity and impaired water quality represent the greatest water resource challenges in the highlands. Activities such as irrigated agriculture, urbanization, and industry compete for and affect the quantity and quality of these shared water resources. Prior to 1940, the basin aquifers were in hydrologic equilibrium—that is, water inflow was approximately equal to

outflow, based on long-term flow conditions. Since then, withdrawal and use have affected water quantity, often depleting stream flows, lowering local and regional aquifers, reducing spring discharge, and generally decreasing riparian habitat. This has sometimes resulted in significant effects on biological, cultural, and physical resources in the area.

Another issue is the effect of contaminants on water quality. Industrial effluent (primarily metals and organic contaminants from border *maquiladoras* or factories), inadequately treated sewage, and agricultural chemical and nutrient runoff are examples. Additionally, the committee is concerned about the effect of water quality degradation on plant and animal communities and their habitats. Riparian areas, such as the nationally significant San Pedro Riparian National Conservation Area are host to a wide variety of amphibians, reptiles, and mammalian species, including numerous species of birds that are obligate riparian users. In addition, the distinctive riparian plant communities in Saguaro National Park, Coronado National Memorial, and Chiricahua National Monument are dependent upon groundwater being near the surface.

The recent efforts of the committee and water resources team inaugurate a program that will provide a border-long assessment of water resource issues affecting DOI lands. Information gained from these assessments will allow NPS managers to better understand complex, interrelated water management issues affecting natural resource management within their units.

mark_flora@nps.gov
Chief, Planning and Evaluation Branch; NPS Water Resources Division; Natural Resource Program Center; Lakewood, Colorado.



The first assessment of potential impacts to water resources as a result of NAFTA focused on a border area named the “Mexican Highlands.” Fact sheets on border water resource issues contain priorities for action and are available on the World Wide Web at www.doi.gov/fcc and from the NPS Office of Mexican Affairs (howard_ness@nps.gov) and the Water Resources Division (mark_flora@nps.gov).



Professionalization of resource management gained a little ground during 1997 when the Resources Careers task group drafted position descriptions for 26 professional and nine technical resource management occupations. Established by the Careers Council of the Vail Agenda, the Resources Careers Initiative is under review by the NPS National Leadership Council for implementation and funding guidance.



WORKING TOGETHER

Given current funding and staffing levels, partnerships have become a necessity in achieving management goals in parks today. These cooperative efforts can fill almost any natural resource management need, including providing funding and staff for fieldwork and acquisition of natural resource information. Partners range from federal and state, to nongovernmental organizations and the academic community. In 1997, many parks found alternative funding for resource management projects through grants offered by companies or environmental organizations. Some of the same sources also provided volunteers for fieldwork, allowing many projects to proceed. Within the National Park Service, several part-time liaisons have been established in recent years at the U.S. Geological Survey and Environmental Protection Agency to improve the coordination of mutually beneficial projects. The most recent of these, with the USGS Biological Resources Division, is working to help improve the knowledge used to protect park resources. On the increase, partnerships continue to help us succeed in our natural resource preservation mission.

Public-Private Partnership

Geologist-in-the-Parks Program: Partnering to meet park needs

by Diann Gese and Judy Geniac

Bob Lorkowski is usually teaching science classes to high school students in California; however, he has spent the last two summers mapping and describing six sandstone units in Hagerman Fossil Beds National Monument (Idaho). Rangers use these research-resource reports in their presentations to park visitors. Bob uses this project as an example to show students “what science is all about” in the real world.

This is just one success story of the Geologic Resources Division’s Geologist-in-the-Parks Program. Created in 1996, this program’s mission is simple: facilitate the temporary placement of geoscience professionals

in the parks. Geoscientists work with park staffs to help them understand and manage geologic resources in the following capacities: interpretation, education, resource management, and research. During 1997, the program placed 36 geologists in parks; six were placed in 1996.

The overwhelming success of this program is the result of forming partnerships and creative advertising of the park’s geologic opportunities. The Geologic Resources Division partners with individual park units, professional societies including the Geological Society of America, American Geological Institute, academia, and other federal agencies.

Parks can request geologic assistance at any time. Each position is advertised on the program’s web site (www.nps.gov/grd/geojob/geojob.htm). Last year several parks received up to 25 inquiries for one geologic position. These geologists varied in experience, education, and background. They included retired professionals who wanted to share their geologic expertise

diann_gese@nps.gov
Geologist; NPS Geological Resources Division; Natural Resource Program Center; Lakewood, Colorado.

judy_geniac@nps.gov
Environmental Protection Specialist, NPS Geological Resources Division; Natural Resource Program Center; Lakewood, Colorado.

Geologist Bob Lorkowski investigates geological strata at Hagermann Fossil Beds National Monument (Idaho) as part of the Geologists-in-the-Parks Program. Begun in 1996, the program facilitates the temporary placement of geoscience professionals in parks.

and interests with national park staffs, undergraduate and graduate geology students interested in gaining geology-related work experience with the National Park Service, and working professionals willing to donate their “spare” time.

In 1997, Dave Bennet, a retired earth science teacher, interpreted Sunset Crater Volcano National Monument (Arizona) to the visiting public and guided geology walks to school groups. Tom Lyttle and Donna Smith, geologists at Los Alamos National Laboratory, helped Chaco Culture National Historical Park (New Mexico) examine paleontological sites and extract specimens. Sarah Schlichtholz, a recent geology graduate, created a paleontological database for Denali National Park (Alaska). A complete list of

1997 program accomplishments can be viewed at the web site.

The National Park Service and the public have benefited tremendously from the thousands of hours that participants have given to the parks this past year. A few are seasonal employees, but most are students or retired professionals who volunteer their time. The Geologic Resources Division funded the program with a \$10,000 grant that was used entirely for stipends and analytical costs. The Geological Society of America provided scholarships (\$2,500 each) for two interns. As this program enters its third year, the Geologic Resources Division plans to expand the program to continue working with parks to help them understand and manage their geologic resources.

kathy_tonnessen@nps.gov
Ecologist, NPS Air Resources
Division; Natural Resource Program
Center; Lakewood, Colorado.

Governmental Partnerships

Taking the pulse of ecosystems with DISPro

by Kathy Tonnessen

Where did you last vacation: at the beach, forest, lakeshore, or mountaintop in one of our national parks? If so, then like most adults in the United States, you got most of your annual exposure to ultraviolet (UV) radiation while outdoors during that too-short respite. Ozone thinning in the stratosphere is likely increasing the exposure of both humans and natural ecosystems to this damaging radiation each year. But up until now, scientists have not measured this “external stress” that can

trigger human cancers and cataracts, and can change the mix of insects and algae.

In 1997, the National Park Service and the Environmental Protection Agency joined forces to fill this gap in knowledge about atmospheric pollution and its effects on park ecosystems. Together we embarked on DISPro (Demonstration Intensive Site Project)—a long-term program of monitoring and research at “index” park sites throughout the country. The DISPro parks represent a range of systems from the arctic to the tropics: Acadia, Big Bend, Canyonlands, Denali, Everglades, Glacier, Hawaii Volcanoes, Olympic, Rocky Mountain, Sequoia, Shenandoah, Theodore Roosevelt, and Virgin Islands National Parks. In selecting these sites, we worked to complement the array of prototype parks included in the national NPS Inventory and Monitoring Program.

In 1997, both agencies forged ahead in constructing this network of parks. More than half of the DISPro parks have functioning UV monitors, making this the largest network of its kind in the world. The National Park Service contributed to the joint effort by maintaining and adding to its existing air monitoring network. Most parks are now successfully collecting data on pollutants in rain, snow, gases (such as sulfur and nitrogen), and particles, as well as on visibility, ozone

Ultraviolet radiation monitors, such as this one at Glacier National Park (Montana), are adding to our knowledge about atmospheric pollution and its effects on park ecosystems. Under DISPro, a network of parks is now collecting data on pollutants in rain, snow, gases, and particles, as well as on visibility, ozone and meteorology.



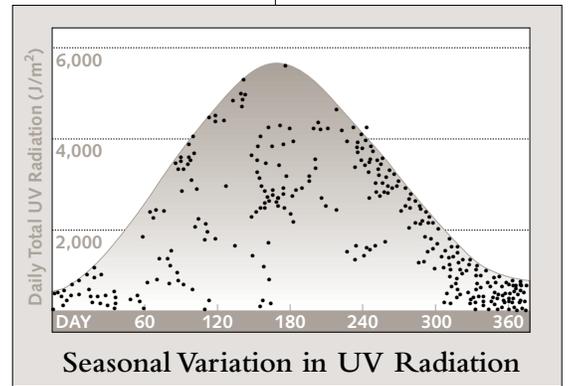
Glacier National Park

(the “bad” type found in the lower atmosphere), and meteorology. This stressor monitoring is critical in being able to chart the success of air quality regulations, and to allow researchers to link the stress (air pollution, UV) to ecosystem responses.

To identify and monitor indicators of ecosystem health, the Park Service and EPA issued a call for research proposals during the summer, with awards of about \$2 million in research projects expected in early 1998. This research program meets the highest standards of peer review and relevance to park and EPA needs. During this first round, the partnership will fund projects to investigate ecosystem effects of tropospheric ozone, nitrogen deposition, and excess UV radiation. The year closed with a meeting of DISPro team mem-

bers (the National Park Service, EPA, and U.S. Geological Survey) at Estes Park, Colorado, a short jog from Rocky Mountain National Park.

There, program staff reviewed the network operations, planned for future ecosystem and indicator research, and highlighted the resource management issues at the DISPro parks. And we also celebrated the beginning of a long, productive association among regulatory, research, and resource management agencies to protect ecosystem and human health.



This graph shows seasonal variations in UV radiation at Great Smoky Mountains National Park (Tennessee and North Carolina) for 1997. To be collected in the 14 DISPro parks, data like these will add to international data sets aimed at assessing the status of stratospheric ozone.

The NPS-BRD partnership

by Denny Fenn and Mike Soukup

One year after merging with the U.S. Geological Survey, the Biological Resources Division (BRD—formerly National Biological Service) is more stable. This stability has provided the opportunity to foster the continued growth of our working relationship and to keep our partnership on track and focused on the future. As always, strong communication between our two decentralized bureaus is imperative.

During 1997, several joint activities helped facilitate this communication. Together we participated in both the George Wright and Wildlife Society meetings. There, NPS resource managers and BRD research scientists explored ways to nurture on-the-ground partnerships. We also participated in each other's business meetings, thus facilitating NPS resource managers discussing with BRD science center managers the biological information needs in parks. These discussions helped the exploration of new ways in which those needs could be met by the research centers. Additionally, funding increases for BRD in fiscal year 1998 will facilitate the opportunity for more joint activities and bode well for the future of the partnership.

Three years have passed since we agreed to jointly fund the operating costs of former NPS researchers who now work for the Biological Resources Division. As a way to assess the effectiveness of this cooperative relationship, the Biological Resources Division will prepare progress reports of its research in parks during the coming year. Also, BRD began to permanently fund the recurring operating costs faced by many of these researchers this fiscal year. The Park Service will continue to contribute project funding, and together we will develop a new process for selecting the next round of jointly funded projects.

A jointly authored white paper prepared during the past year observed that the Park Service depends on research, technical assistance, and operational support for the proper management of park natural resources and that the Biological Resources Division provides only research and technical assistance to its partners. This observation has helped our organizations prepare operating procedures, to be issued during 1998, that best address park needs, including identifying tactical research requirements that will focus on those activities most needed by park managers. Additionally, these procedures will work to ensure that researchers and the methods they use in conducting this research will be those most suitable for individual park contexts.

mike_soukup@nps.gov
Associate Director, Natural Resource Stewardship and Science; Washington, D.C.

dennis_fenn@usgs.gov
Chief Biologist, USGS Biological Resources Division; Reston, Virginia.



Funded by Canon U.S.A., Inc., through the National Park Foundation, Expedition Into The Parks paid for 13 natural resource preservation projects in parks during 1997 with over one million dollars in cash and equipment donated. These important projects could not have been started without these generous grants, now in their third year.



More than ten percent of the researchers who transferred from the Park Service to the BRD have moved on since their transfer, giving the BRD an opportunity to shape its research efforts through changes in personnel and task assignments. The National Park Service has also been able to hire several senior scientists who will begin to satisfy park demands for scientific operational assistance, as well as building better liaisons to BRD. Also, in converting its former regional chief scientist positions to regional science advisors, the Park Service has increased the effectiveness of these staff as liaisons with both the BRD and the academic community. BRD and NPS are participating in initiation of up to four new Cooperative Ecosystem Studies Units to both increase direct contact with each other and increase university focus on land management issues. Other agencies have shown interest in this cooperative, regional scale approach

to providing scientific support and have pledged to commit staff and resources to this cooperative effort.

The first year of the NPS-BRD partnership held significant gains, but challenges remain. We need to address the request for increased coordination of common research activities across BRD regional boundaries. We need to respond to the desire for faster production of park vegetation maps and for continued technical assistance from the Biological Resources Division to park prototype monitoring programs. We need to stimulate parks to ask for technical assistance when they need it. We need to increase the professional standing of NPS staff and simplify park research procedures to improve BRD-NPS collaboration and to attract more BRD projects to parks. By addressing these needs, we can make our partnership even more effective in 1998 than we found it at the close of 1997.

cindy_daly@nps.gov
Public Affairs Specialist, Office of
Public Affairs; Washington, D.C.

Cooperative Funding

Canon National Parks Science Scholars Program

by Cindy Daly

In 1997, the Canon National Parks Science Scholars Program was established to help develop the next generation of scientists working in the fields of conservation, environmental science, and park management. The program's goal is to encourage the best and brightest graduate students in all relevant scientific disciplines to conduct important research in the national parks.

The program is underwritten by Canon U.S.A., Inc. Canon's \$2.5 million commitment will enable 32 doctoral students (four in 1997-98 and eight per year beginning in 1999) to conduct research within the national park system over the next five years. Canon will also support honorable mention awards and fund an annual science scholars symposium. The annual symposium will provide a national forum for scientists to explore the role of science in preserving the national parks.

Other collaborating organizations include the National Park Service, the National Park Foundation (NPF), and the American Association for the Advancement of Science (AAAS). The Natural Resource Stewardship and Science Directorate is responsible for managing the program, coordinating various activities, and monitoring student progress. The Associate Director, drawing on suggestions from park managers in the field, selects research topics in four areas: the biological, physical, social, and cultural sciences. The AAAS assembles scientific review panels to evaluate submitted proposals and select the award winners. The National Park Foundation transfers scholarship funds provided by Canon to each student's university, providing

Secretary of the Interior Bruce Babbitt (third from left) and Canon U.S.A. CEO Haruo Murase (third from right) presented the Canon Scholars awards to (left to right) Tom Meixner (University of Arizona), Dave Smyth (Michigan State University), Andrew Suarez (University of California—San Diego), and Ilene Grossman-Bailey (Temple University) during an August ceremony. The scholarship winners plan original research projects that range from the New Jersey Coastal Heritage Trail to Cabrillo National Monument (California).



National Park Service

for tuition, fieldwork, a stipend, and other expenses. Each winning student is awarded \$25,000 per year for a maximum of three years. The students will complete their dissertation, prepare an article for park managers on the significance of their research, and present a public lecture about their work.

The 1997 science scholars will be conducting their research in Cabrillo National Monument (California), Sequoia-Kings Canyon National Parks (California), and Rocky Mountain National Park (Colorado), the New Jersey Coastal Heritage Trail, and other sites. The program sponsors held a recognition dinner at the

AAAS headquarters in Washington, D.C., that was attended by Secretary of the Interior Babbitt, Canon CEO Haruo Murase, NPS Director Bob Stanton, National Park Foundation President Jim Maddy, AAAS CEO Richard Nicholson, and the winning students, their faculty advisors, and families.

While young scientists will benefit from these scholarships, America's national parks are the ultimate beneficiaries of this innovative program. The Canon National Parks Science Scholars Program will nurture a new generation of scientists to grapple with the challenges that face the national park system.

Hagerman's horse fossils saved and studied

by Lissa Fox with Greg McDonald

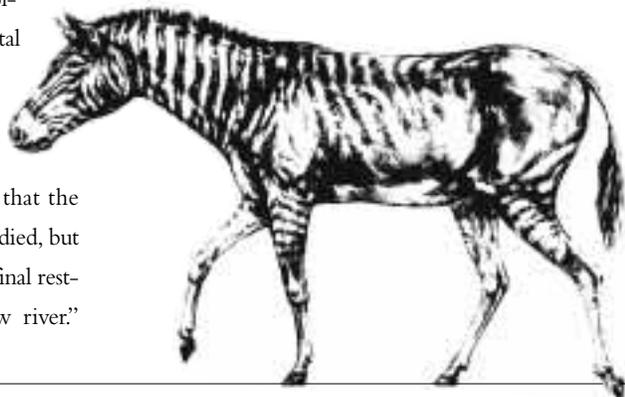
In 1997, Hagerman Fossil Beds National Monument (Idaho) capitalized on a rare opportunity to study and save the park's unique 3.5 million-year-old fossil site. Thanks to a timely grant from Canon U.S.A., Inc., and the National Park Foundation, experts from the National Park Service, the Smithsonian Institution, and other organizations throughout the United States and Canada were able to rescue the fossils in Hagerman Horse Quarry from the threat of landslide and shed new light on how hundreds of dead horses ended up at this site.

"For over 60 years, paleontologists have hypothesized that the horses either died around a water hole or while crossing a fast-moving river during a flood and were immediately buried," says Dr. Greg McDonald, Park Paleontologist. "Studying the sedimentology at the site for the first time added a vital dimension to the picture, telling scientists whether the bones and sediments were deposited in place or were moved from another location. Last summer's work shows that the animals were not lying at the spot where they died, but rather died nearby and were moved into their final resting place by the current of a broad, shallow river."

Besides the numerous horse bones, bones of small animals such as fish, frogs, and rodents were also recovered and provide more insight into the ecology of the river.

Major new technological advances made these new discoveries possible, explains McDonald. Using a laser transit and three-dimensional mapping (GIS), techniques not previously applied to a fossil site, paleontologists precisely mapped the location of bones and sediment types. With this new data, researchers determined that the ancient river system was more like the slow-moving Platte River than the present-day Snake River, which flows 600 feet below the quarry.

The world almost lost the unique fossils at Hagerman Horse Quarry. Threatened by landslides, the world-famous Horse Quarry fossils could have been destroyed at any time. "Excavations of this size are expensive," explains McDonald. "We could not get the funding needed to protect and study these world-class fossils. Without Canon's Expedition Into The Parks, these resources could have been lost forever."



Hagerman Fossil Beds National Monument, John McCluskey

lissa_fox@nps.gov

Writer-editor; Natural Resource Information Division; Harpers Ferry, West Virginia

greg_mcdonald@nps.gov

Park Paleontologist; Hagerman Fossil Beds; Idaho



Hagerman Fossil Beds National Monument, Cliff Dakey

Made possible by a grant from Canon U.S.A., crews excavated the Hagerman Horse during 1997. The number and variety of skeletons and species at the site gave paleontologists a rare opportunity to study an entire Pliocene ecosystem and gather new information about the process of evolution.

The ancestor of all modern horses, zebras, and donkeys, the Hagerman Horse is preserved in abundance at Hagerman Fossil Beds National Monument (Idaho). More than 200 complete skeletons of both sexes and all ages of the animal, in addition to skeletons of numerous other species, are contained in the strata of the renowned Hagerman Horse Quarry.

Partnerships key in securing habitat restoration grants

by Pam Benjamin

The Karner blue butterfly occupies just one percent of its historic range. Habitat restorations, such as an ongoing project at Indiana Dunes National Lakeshore (Indiana) are important for its recovery. During 1997, the park received a grant for the restoration of habitat for the endangered butterfly; also received was a grant for the restoration of a degraded tallgrass prairie. A key to the park's success in securing these grants was its partnerships with The Nature Conservancy and with local organizations and school groups that were able to provide volunteer field support.

In the fall of 1995, The Nature Conservancy approached the park with a request to identify a joint project that its volunteers could assist with at the national lakeshore. The park had previously identified an approximate 150-acre degraded tallgrass prairie as a priority for restoration. As a result,

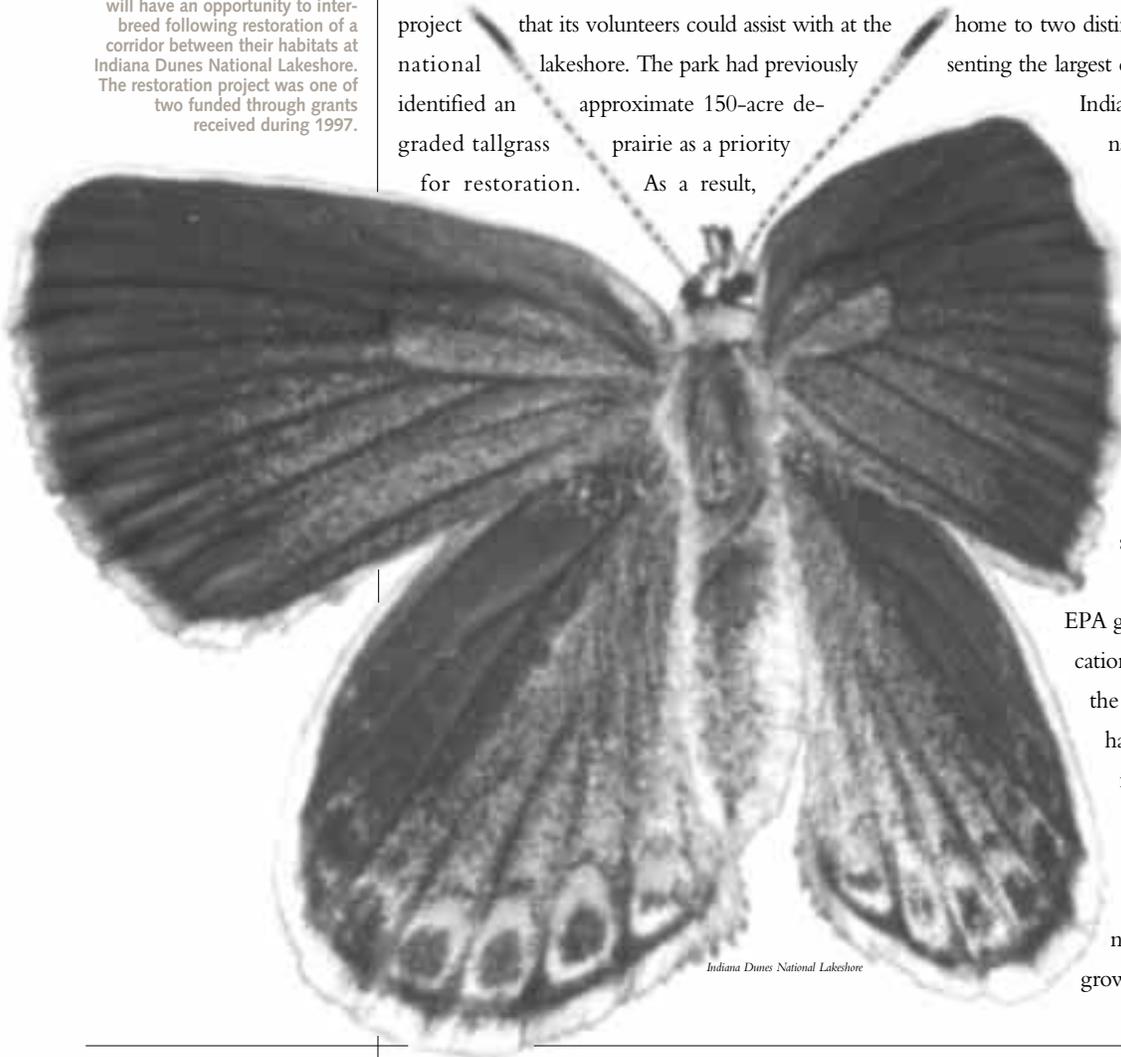
restoration of the Indian Boundary Prairie was initiated in 1996 with financial assistance from The Nature Conservancy and a small grant from the NPS Challenge Cost Share Program. During 1997, the Chicago Wilderness Organization provided an additional small grant to continue the ongoing restoration activities. Although these grants had very specific short-term goals, their overall focus was to develop a dedicated volunteer workforce and to acquire the supplies and equipment needed to sustain it. Volunteers and school groups monitored vegetation, reduced woody species, removed exotic plants, and collected native seeds.

The second grant came from the Great Lakes National Program Office of the U.S. Environmental Protection Agency (EPA) for Karner blue butterfly habitat restoration and corridor establishment. Averaging one inch in size, the Karner blue is a small, yet charismatic, endangered butterfly. Currently, the lakeshore is home to two distinct populations of the species, representing the largest concentration of the butterfly within

Indiana. This two-year grant will assist the national lakeshore in restoring degraded savanna and prairie habitats and in connecting the currently isolated populations of the species within the park. Restoration activities in 1997 included establishment of vegetation monitoring plots, Karner blue butterfly counts, exotic vegetation removal, limited use of prescribed fire, and native seed collection.

An important component of the EPA grant focuses on environmental education. Resource managers, working with the park Division of Interpretation, have developed an on-site program for elementary school children discussing endangered species, habitat loss, and restoration. As part of this program, school groups assisted with native seed collection and will be growing native grass and forb species

Currently isolated from one another, two small populations of the endangered Karner blue butterfly will have an opportunity to interbreed following restoration of a corridor between their habitats at Indiana Dunes National Lakeshore. The restoration project was one of two funded through grants received during 1997.



Indiana Dunes National Lakeshore

over the winter in their classrooms. All supplies for plant propagation were purchased from the grant. A native plant propagation brochure has also been produced to assist teachers and students in growing and caring for their plants. School groups will return in the spring to transplant the seedlings to the restoration site.

Overall, school groups responded in great numbers during 1997, with over 350 students and numerous volunteers participating in restoration projects at the national lakeshore. Although it is too early to judge the actual success of the restoration activities, both grants

have proven successful in providing environmental education opportunities and in assisting in the development of a volunteer workforce essential to the long-term completion of these projects.



Indiana Dunes National Lakeshore, P. Benjamin

As part of the environmental education portion of the EPA restoration grant, school groups collected native seeds at the park. This winter, the students are raising grasses and forbs in the classroom, which they will transplant to the restoration site during spring.

Workforce Diversity

Partnership brings Native American employees into Park Service family

by Ron Hiebert

In 1990, the National Park Service entered into a long-term relationship with Haskell Indian Nations College to help the college develop natural resource management curricula and to encourage Native Americans to join the National Park Service. Seven years later, Haskell is developing a four-year degree in natural resources and the Park Service now has two Haskell graduates as employees.

Started in 1884 in Lawrence, Kansas, Haskell has grown from 22 students to over 900 from 130 tribes from 40 states. Begun primarily as a grade school with a focus on agriculture, the university now offers numerous associate degrees and a bachelor of arts degree in teacher education, providing tuition-free higher education to federally recognized tribal members and their descendants. The university wants to become a national center for research, education, and cultural programs that support the educational needs of Native Americans.

In 1988, the university recognized the need for Native American natural resource managers and formed an advisory board to provide advice and assistance on curriculum development and other issues as

needed. The National Park Service is one of eight agencies on the board.

In addition to aiding the university, the National Park Service wishes to add well-trained Native Americans to the Park Service family. Towards this end, the Park Service provides lecturers and instructors, a regular presence at career days, and recruiters on campus. The Park Service also provides summer jobs and internships, and Haskell students can also enroll in the Student Career Employment Program (SCEP), which allows them to go to school and work at the same time. To further help the students, the Park Service provides funding for students enrolled in the SCEP. In 1996, the NPS Associate Director for Natural Resources dedicated \$8,000 per year to support two SCEP enrollees in cooperation with two parks. The Natural Resource Stewardship Directorate also provides \$11,000 per year to fund part of the natural resource instructor and recruiter position on the campus.

In spring 1998, our first SCEP student will graduate with a B.S. in Environmental Studies from Florida International University in Miami. Marnie Loonsberry (Onondaga) has been with Everglades National Park for the last four years. She plans a career with the Park Service and wishes to pursue an advanced degree in wildlife toxicology. Adrienne Ricehill (Potawatamie) will be stationed at Apostle Islands National Lakeshore (Wisconsin) and attending the University of Kansas. The Park Service hopes to place an additional student at Theodore Roosevelt National Park, North Dakota, this summer.

ron_hiebert@nps.gov

Associate Regional Director for Natural Resource Stewardship and Science, Midwest Regional Office; Omaha, Nebraska.



Park Service involvement in the Chesapeake Bay Initiative is maturing if 1997 is any indication. Emphasis has shifted from individual accomplishments to a strategic sense of how parks can support the overall ecological restoration of the bay. With interpretation a strong point, parks are now educating constituents about the partnership and helping to shape the conservation agenda. The partners are also developing the concept of riparian forest buffers as a preferred means of protecting water resources in the bay's tributary streams and rivers.



Campground
Closed

RESTORATION

Restoration of natural systems is a growth area of resource management today. Wolves in Yellowstone; water supply in Everglades; prairie grasses in the Midwest; sea turtles on the Gulf Coast; prescribed fire in many parks—the list of current projects is impressive, even though the tasks themselves may be daunting. Costly, complex, and labor-intensive, ecological restoration requires a sound understanding of natural processes and interrelationships. It also requires follow-up to determine if goals are being met. A recent trend is the timely evaluation of resource damage and restoration action following natural disturbances, such as fires and floods. An example is the Burned Area Emergency Response Team, designed to assess and mitigate impacts from fire and fire suppression activities. It has succeeded in being funded by the fire incident command structure, thus allowing for restoration to begin during wildfires. Despite the successes, ecological restoration is still costlier and less certain than prevention of resource degradation in the first place.

Facilities & Resource Impacts

Yosemite flood provides opportunity to realize resource protection goals

by Bill Jackson, Jerry Mitchell, and Louise Johnson

A 1997 New Year's Day flood in Yosemite National Park (California) was the largest in over an 80-year period of record on the Merced River. Water backed up in the central part of Yosemite Valley and inundated park offices, roads, lodging units, and other developments. In steeper reaches of the river the force of the flowing water ripped up roads, sewer lines, and campgrounds. The park was closed for over three months while the basic infrastructure was repaired or cleaned up.

Interestingly, the Yosemite flood occurred less than nine months after a man-made flood was prescribed for the Colorado River in Grand Canyon to rejuvenate

ecosystem processes impacted by dam-induced reductions in flooding. However, unlike the Grand Canyon flood, the significance of the Yosemite flood as a natural ecosystem event was tempered somewhat by the impacts to human developments in the floodplain. Also, some natural resource damage occurred when flood flows interacted with infrastructure or floodplains that were vulnerable to erosion due to heavy visitor trampling. For example, the Lower Pines Campground, which was severely damaged by the flood, occupies a natural point bar located on the inside of a large river meander. The point bar eroded excessively during the flood partly because a road and undersized bridge forced floodwaters across the bar, and partly because soil compaction had eliminated most vegetative ground cover.

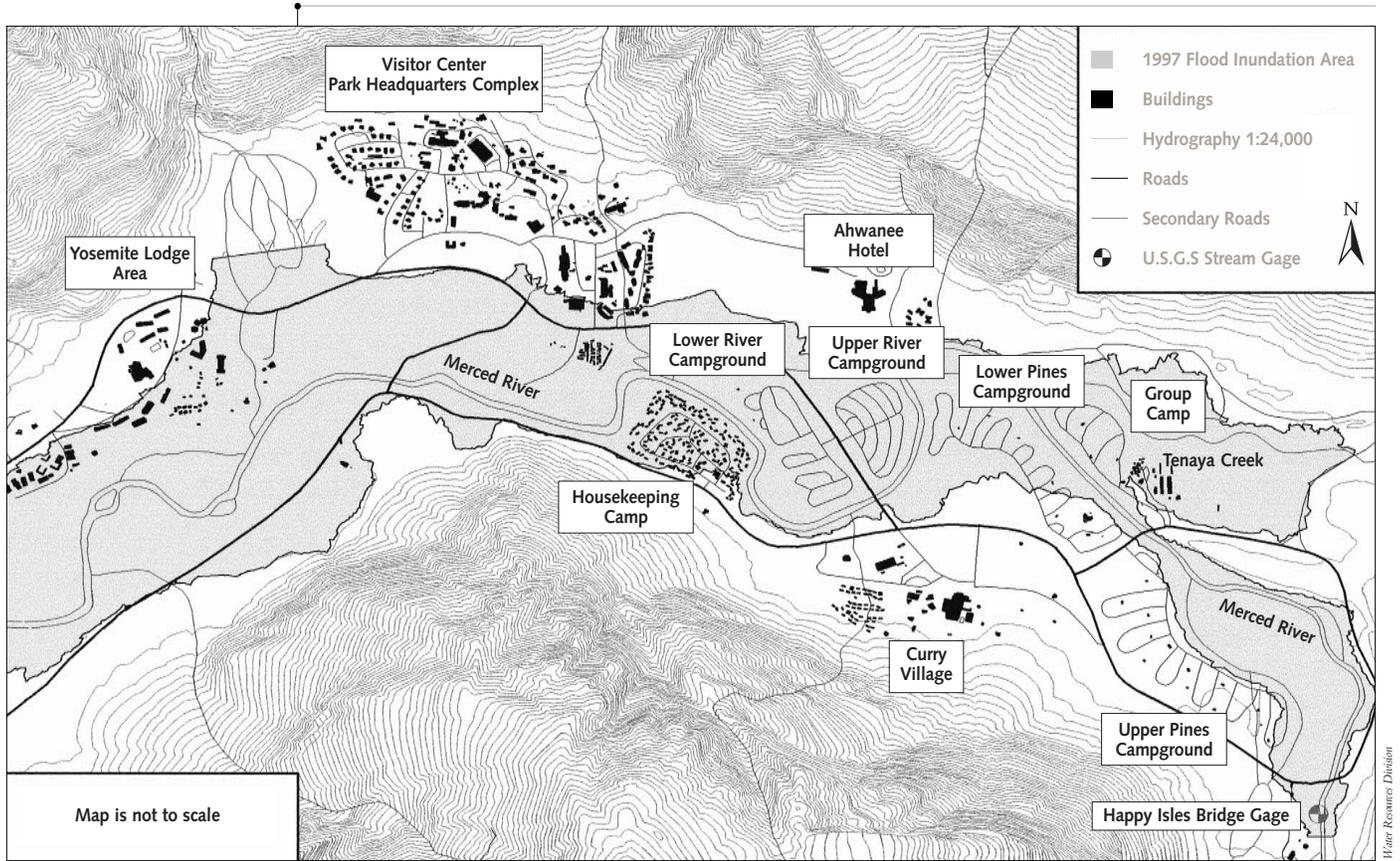
Whereas the Grand Canyon flood demonstrated the importance of flooding in natural ecosystems, the Yosemite flood highlighted the problems associated with human occupation and development of floodplains.

jerry_mitchell@nps.gov
Chief, Office of Valley Planning Implementation; Yosemite National Park, California.

louise_johnson@nps.gov
Restoration Geologist, Yosemite National Park, California.

bill_jackson@nps.gov
Chief, NPS Water Operations Branch; Water Resources Division; Natural Resource Program Center; Fort Collins, Colorado.

Sign of the times—warm weather and rains combined to melt the alpine snowpack in Yosemite National Park (California) in early 1997. The resulting 100-year flood caused widespread damage to park facilities, including the Lower River Campground in Yosemite Valley.



Resource managers mapped the extent of the floodwaters (shaded area) in Yosemite Valley, giving park managers information they needed to move ahead with plans to relocate facilities outside the floodplain.



Yellowstone National Park

Yellowstone wolves are causing “an explosion in species diversity” according to private research. An institute called “Yellowstone Ecosystem Studies” concludes that coyote populations are down fifty percent in the Lamar Valley, a benefit to predators of rodents such as foxes, hawks, owls, and eagles. Despite the ecological good news, a U.S. district court ruled in December that the ongoing restoration is illegal and that the wolves must be removed. The United States will defer any action to remove the wolves until all appeals of the court’s decision are final.

Park planners recognize this fact, and restoration of the Merced River and its floodplain is a cornerstone of the draft Yosemite Valley Implementation Plan (VIP). The plan’s proposed alternative is to remove flood-prone activities out of the floodplain and restore natural floodplain conditions and processes. It calls for wide (50–75 meter) buffer zones on both sides of the Merced River and Tenaya Creek, a tributary of the Merced. Three historic bridges interfere with river flows and processes during floods and are proposed for removal. All campsites in the river management zone of the Merced River are proposed for removal and restoration to natural conditions. This includes 107 sites at the Lower Pines Campground and all sites at the Upper and Lower River Campgrounds. Finally, though being dealt with separately from the public draft VIP, flood recovery actions include removing most of the overnight lodging and concessioner housing units in the Yosemite Lodge area from the floodplain.

Ironically, the January flood assisted the valley planning process in several ways. First, the flood (which approximated a 100-year flood) permitted a far more accurate delineation of flood-prone areas than existed previously. Second, observations by park staff during the flood and a post-flood analysis conducted by the NPS Water Resources Division provided a better understanding of the hydraulic characteristics of the flood (depths, velocities), and a more precise understanding of the causes of infrastructure and resource response to the flood. Finally, flood recovery funds approved by Congress allowed the park to take action on many of the proposals in the plan.

Although initially presented in the press as a major natural disaster, after reconsideration, the New Year’s Day flood in Yosemite Valley can now be viewed as a significant natural ecosystem process and as a major boon to river resource restoration and management in Yosemite Valley.

Demolishing the past and restoring the future

by Athena Demetry

In the early part of this century, visitor facilities were placed in the most spectacular areas of national parks in order to attract people to the parks. In Sequoia National Park (California) a small city complete with gas station, market, hundreds of cabins, campgrounds, and a sewage treatment plant sprang up beneath the towering giant sequoia trees in the Giant Forest Grove, Sequoia's main attraction. By the 1930s, park managers understood the damage such intense use could cause to sensitive ecosystems and began to call for removal and relocation of visitor facilities from the Giant Forest. After decades of management efforts, the first phase of ecological restoration began in August 1997, with the demolition of buildings, roads, parking lots, and utilities from the Giant Forest Lodge.

Such restoration projects, which are becoming more common throughout early national parks, present a challenge to natural resource managers. Managers must determine if a site can recover on its own or whether it requires human intervention. In Giant Forest Village, soils are highly compacted relative to natural soils, soil seed banks are absent or depleted, and there is little tree or shrub regeneration. Formerly developed sites in the area that have been abandoned for over 30 years show little natural recovery. Clearly, human intervention is needed, but how much? Through adaptive management, in which increasing degrees of active restoration are applied in a coherent, well-designed manner, resource managers can determine the least intrusive but still effective means of restoring the area. Sequoia's experimental restoration treatments include: (1) mitigating soil compaction; (2) mitigating soil compaction and burning to release canopy-stored seed of giant sequoia; and (3) mitigating soil compaction, planting propagated trees, shrubs, grasses and forbs, and irrigating.

More parks are now using well-defined natural models to decide on plant species, densities, and spatial



A backhoe demolishes the amphitheater at Sequoia's Giant Forest during 1997 as part of the first phase of the restoration project. Resource managers will begin ecological restoration during 1998.

arrangement. In planning and designing the Giant Forest restoration, resource managers looked to the ecosystem surrounding the developed area for a natural disturbance condition that resembled the human disturbance. Forest canopy openings, or gaps, caused by prescribed fire were of similar scale to canopy openings caused by tree removal for buildings and parking lots. The shrub and tree regeneration within fire-caused gaps serves as a model to prescribe what to plant within restoration gaps and as a reference to evaluate the success of all the restoration treatments.

In 1997, the park began the transition from planning and design to demolition. As ecological restoration begins in the coming year, the long-awaited goal of correcting past development mistakes and preserving the giant sequoia ecosystem will enter its concluding phase.



athena_demetry@nps.gov
Ecologist; Sequoia National Park, California.

Sequoia and Kings Canyon National Park, A. Demetry

Built early this century beneath towering sequoias, Giant Forest Village in Sequoia National Park (California) has led to ecological problems such as soil compaction, seed bank depletion, and little tree regeneration. A large-scale effort has begun to relocate facilities and restore natural conditions to the area.

Sequoia and Kings Canyon National Park, A. Demetry

dave_steensen@nps.gov
Geologist, NPS Geologic
Resources Division; Natural
Resources Program Center,
Lakewood, Colorado.

The Right Expertise Military engineers invade the parks!

by David Steensen

Bulldozers and military personnel are striking contrasts to the serene beauty and pristine resources found extensively in the national parks. Yet through innovative partnerships, engineering units of the U.S. Army National Guard and Reserve helped restore 25 acres of disturbed lands in three parks during the last two years: Sleeping Bear Dunes National Lakeshore (Michigan), Mount Rainier National Park (Washington), and El Malpais National Monument (New Mexico).

Throughout the national park system over 315,000 acres of lands exist in disturbed condition in 195 parks. Abandoned roads, mines, dams, campgrounds, and other unwanted facilities impair natural and cultural resources through erosion, sedimentation, metals contamination, habitat alteration, and exotic plant invasion, and create visual scars on the landscape. Scarce project funding severely limits the number of restoration efforts that can

be undertaken, especially for larger sites that require the use of heavy equipment to correct soil and land-form problems.

Despite limited funds, partnerships with U.S. Army National Guard and Reserve engineering units have facilitated the completion of important restoration work. Conducted under interagency agreement, these partnerships link park projects to annual training for military engineers. Usually two-week exercises, annual training requires intensive operation of heavy equipment. During these skill-enhancing exercises, engineers have reestablished original land contours, eliminated erosion problems, and salvaged and placed topsoil, all essential elements for successful reintegration of disturbed areas into the surrounding ecosystem. Usually, parks pay only for fuel and other support costs for the heavy equipment work.

The range of capabilities available to the National Park Service has been impressive. During the pilot project in 1995, the 1436th Engineer Company of the Michigan National Guard completed the reclamation of two sand and gravel pits at Sleeping Bear Dunes, which totaled 7 acres. During 1997, the 898th Engineer Battalion of the Washington National Guard removed 1.2 miles of abandoned campground road located in a subalpine meadow on Mount Rainier, and partially restored an additional half-mile of road. At El Malpais, the 52nd and 387th Engineer Battalions of the Army Reserves reclaimed a 5-acre sandstone quarry, constructed 1 mile of new access road, and graded an area for a future visitor overlook. Oversight by NPS staff trained in physical restoration techniques and the application of heavy equipment assured that park restoration goals were met. At the same time, the military achieved its training goals.

Partnerships with the military enable the National Park Service to accomplish significant restoration projects in the absence of funding that is commensurate with the scale of the problem. Through these partnerships, limited funds are leveraged, allowing for the completion of restoration work that otherwise would not be undertaken. Future projects are scheduled at two additional parks.



Army National Guard and Reserve engineering units restored an abandoned road and an unused portion of a campground at Mount Rainier National Park (Washington) during 1997. The process involved removing the oiled road surface (top), returning soils to their original horizons (middle), and reestablishing the original contour (above), creating the best conditions for revegetation.

(2) Geologic Resource Division, David Steensen

Issue Update

A new twist in the Elwha River ecosystem restoration

by Brian Winter

The Elwha River Ecosystem and Fisheries Restoration Act (P.L. 102-495) authorizes the Secretary of the Interior to acquire and remove the Elwha and Glines Canyon Dams on the Elwha River (Washington) if that action is needed to fully restore the ecosystem and native anadromous fisheries. In a report to the Congress and in an environmental impact statement (EIS), the Secretary concluded that the removal of both dams is necessary.

Through fiscal year 1998, \$11 million has been appropriated for Elwha Dam acquisition. Additional funds to acquire the dams may be available from the Land and Water Conservation Fund. Washington Senator Slade Gorton, a previous opponent of dam removal, now supports acquisition of both dams, removal of the lower dam (Elwha), and determination of the upper dam's (Glines Canyon—within Olympic National Park) fate following documentation of salmon restoration for 12 years after removal of the Elwha Dam.

Meeting Senator Gorton's proposal will require the development of a supplemental EIS; the "phased removal" option was rejected originally because of the added environmental impacts from two distinct dam removal periods as opposed to simultaneous removal, additional cost, and the delay in meeting the goal of the act. Removal of just the lower dam (outside the park) will result in, at most, the restoration of 30,000 salmon and steelhead compared to the 392,000 that can be restored with both dams removed. Nevertheless, Senator Gorton's proposal would allow the restoration process to move forward. Funding to complete acquisition and removal of the Elwha Dam will be decided in early 1998.



Olympic National Park

Removal of the Glines Canyon Dam (shown) and its downstream companion, the Elwha Dam, is necessary to fully restore the native salmon and steelhead fishery in the Elwha River drainage within and adjacent to Olympic National Park (Washington). Funding for the project will be decided in early 1998.

brian_winter@nps.gov
Elwha Project Coordinator;
Olympic National Park,
Washington.



Padre Island National Seashore, Darril Edwards



For the third consecutive year, the world's most endangered sea turtle, the Kemp's Ridley, returned to nest in record numbers at and near Padre Island National Seashore in Texas. The continuing increase in the number of nests at the park—nine during 1997—may signal the success of a two-decade, international, multiagency effort to establish a secondary nesting colony of this species at the seashore.

jake_hoogland@nps.gov
Chief, Environmental Quality
Division; Natural Resource Program
Center; Washington, D.C.

Paying for Restoration

Damage assessment procedures lead to resource restoration

by Jake Hoogland

The Washington D.C. area experienced its worst oil spill in memory when a major pipeline burst in a Sugarland Run suburb during March 1993. The spill released 408,000 gallons of diesel fuel into the environment, and despite the best efforts of responding agencies to contain it, much of the fuel entered the Potomac River. The river was at flood stage and the vegetation along its banks was oiled. This damage included resources of the George Washington Memorial Parkway and the Chesapeake and Ohio Canal National Historical Park. Portions of the parks were closed to visitation and even those areas that remained open were negatively impacted.

The National Park Service together with other federal agencies, the Commonwealth of Virginia, and the District of Columbia sought to recover damages from the pipeline owner under the provisions of the Oil Pollution Act (1990) and related statutes. During 1997, the responsible party and the federal, state, and District of Columbia governments entered into a consent decree, a legally binding agreement, to settle the matter. The decree provides for compensation to the National Park Service by the pipeline owner of approximately \$1.5 million for use in projects designed to restore, enhance, or replace the resources lost to the public as a result of the spill.

Negotiated for the Park Service by the Environmental Quality Division, the settlement represents a positive outcome for all of the involved parties. It provides funds for the restoration of lost resources and clearly establishes the role of the National Park Service as an advocate for compensation when resource access is denied to the public. Projects planned under the restoration include boardwalks and wildlife viewing platforms at the Dyke Marsh area of the parkway, refurbishment of visitor



use facilities along the C & O Canal, and rehabilitation of a scenic overlook at Great Falls Park, which provides additional accessible pathways to existing viewing areas.

Now in the restoration planning phase, Sugarland Run represents successful recovery of damages under the provisions of the Oil Pollution Act. In 1996, Congress passed the Omnibus Parks and Public Lands Management Act, amending the Park System Resource Protection Act of 1990. As a result, the National Park Service is now authorized to seek com-

Award Winner Profile

Resource manager receives new award

For the first time, the Director's Awards for Resource Stewardship, given during the summer, included the Trish Patterson-SCA Award. This award recognizes excellence in natural resource management in small parks, where staff is often especially limited. Patterson was a Southeast Region resource manager who was killed in a 1995 car accident; she was well known for her efforts to assist small parks in her region. Sponsored by the Student Conservation Association, the award provides extra assistance to the winning park by supplying

continued



Zandy-Marie Hillis-Starr, winner of the first Trish Patterson-SCA Award for natural resource management.



National Park Service

A 1993 diesel fuel spill 18 miles upstream of Washington D.C., entered the Potomac River and spread to four units of the national park system, damaging resources. The slick is visible on the Tidal Basin waters near the Jefferson Memorial. Damage assessment procedures facilitated recovery of \$1.5 million during 1997 for park resource and facility restoration.

pensation from third parties for any resource damage in any park. Thus, the amended statute provides another means for seeking compensation and provides broader protection to park resources than the Oil Pollution Act.

Still, the methods and processes used in the Sugarland Run case may be applicable in future settlements under the recently amended law. In order to

develop a unified approach to implementing the Park System Resource Protection Act, coordination of recoveries has begun with the Department of Justice, Office of the Solicitor, and the Environmental Quality Division. Implemented correctly, and supported by scientific resource inventories, the statute has the potential for significant restoration to park resources damaged by third parties.

continued from pg. 38
 a seasonal resource assistant to help complete important resource management projects.

The first Trish Patterson-SCA honoree is Zandy-Marie Hillis-Starr, Biological Technician at Buck Island Reef National Monument in the Caribbean. The sole resource manager at Buck Island Reef, Hillis-Starr has established an internationally renowned sea turtle monitoring program at the park and nearby Christiansted National Historic Site; she also has established coral reef monitoring at Buck Island Reef. Her preparation of the Buck Island hawksbill turtle research program manual has standardized data collection methods for endangered turtles and reef monitoring. Information derived from the sea turtle program has been used to protect the hawksbill sea turtle under the Endangered Species Act. With a knack for getting things done, Hillis-Starr instituted a program with volunteers and visiting scientists to document the effects of Hurricane Hugo (1989) and monitor subsequent reef recovery. She also arranged cooperative agreements with government and private organizations to assist in reef and turtle projects.

tony_pernas@nps.gov
Vegetation Management
Specialist; Big Cypress National
Preserve, Florida.

Mitigation funds boost melaleuca control efforts

by Tony Pernas

An unusual partnership between Big Cypress National Preserve and Dade County (Miami) has provided NPS resource managers in south Florida with funds to fight the spread of the invasive nonnative plant, melaleuca. To mitigate the effects of the development of a new jail facility, Dade County contributed \$1,581,000 to be used for treatment, retreatment, and subsequent monitoring and evaluation of melaleuca infestations occupying 35 square miles in the preserve. In 1997, private contractors completed the initial treatment of the project area. The second phase of the project, retreatment, will begin in early 1998.

Melaleuca is an Australian tree species that was introduced into South Florida in the early 1900s as an ornamental and a possible source of lumber. An aggressive, invasive plant, it has now spread throughout the region, displacing native plant communities with dense single-species forests that provide little value to wildlife. Experts agree that the spread of melaleuca constitutes one of the most serious threats to the greater Everglades ecosystem, which includes Big Cypress National Preserve and Everglades National Park.

Melaleuca has several characteristics that have helped it spread throughout South Florida. Rapid growth, fire-insulating bark, a damage-triggered seed release mechanism, storage of millions of seeds on

a single tree, the ability to sprout from stumps and stems, and a lack of insect pests are all hallmarks of its remarkable success. Natural and prescribed fires in South Florida also favor the proliferation of the species. Fire promotes seedling establishment, and high fire intensities lead to the demise of less fire-adapted native species.

In 1979, varying densities of melaleuca infested an estimated 60 square miles of Big Cypress. By 1992, systematic reconnaissance flights revealed 186 square miles of infestations. In 1984, the preserve initiated a nonnative plant control program, with primary emphasis on melaleuca. From 1984-95 NPS crews spent nearly all of their time treating outlying populations of the invasive species. The goal of this strategy was to limit the further spread of melaleuca. This strategy did not address the dense single-species melaleuca forests, which are extremely costly to treat.

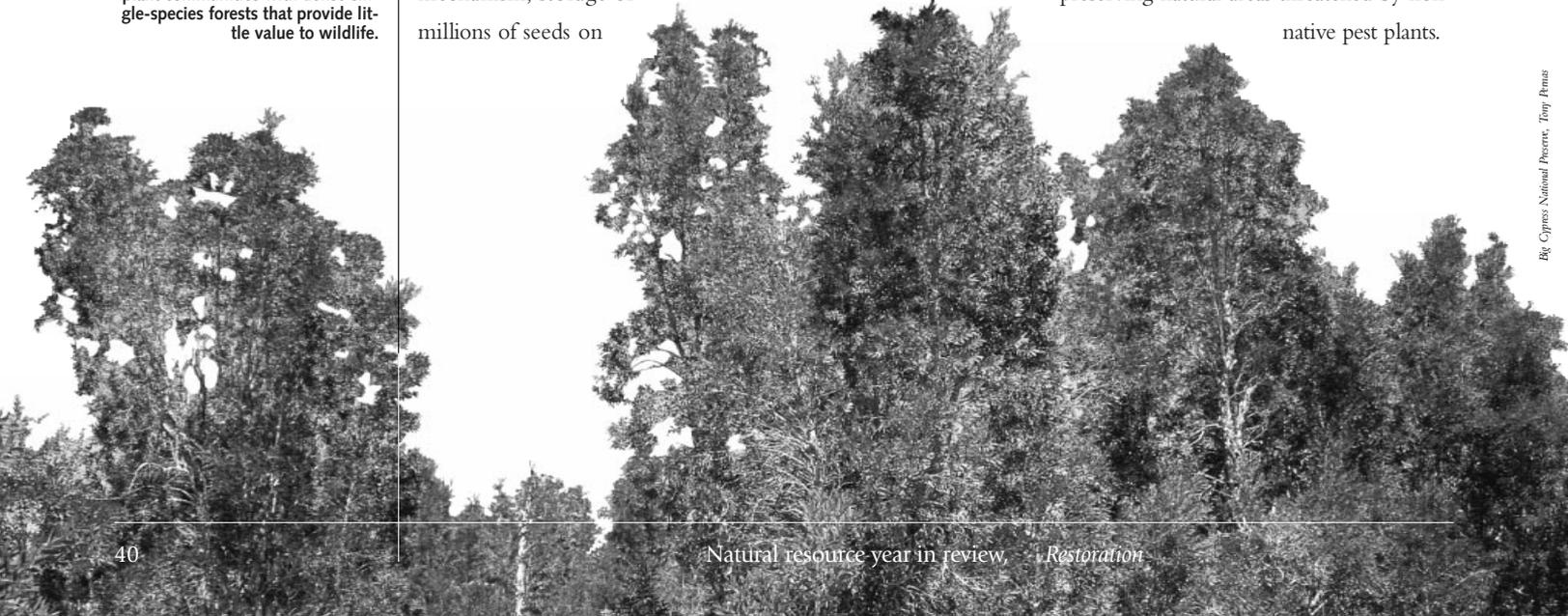
With the new funding source from the Dade County partnership, Big Cypress has been able to pay private contractors. This approach has reduced the cost of treatment from 66 cents per tree to 24 cents each and has allowed the park to deal with a much larger area of infestation. The first phase of the new project resulted in the treatment of 3,420,741 trees and 957,539 seedlings at a cost of \$900,000 in an area of nearly 34 square miles. To date, through the combined efforts of NPS crews and private contractors, over six million melaleuca trees on over 100 square miles have been treated. Habitat restoration projects on a scale such as this are essential to preserving natural areas threatened by non-native pest plants.



Big Cypress National Preserve, J. Smyler

Crews hired during 1997 cut and treated more than 3.4 million melaleuca trees in Big Cypress National Preserve. Retreatment, the second phase of the melaleuca control project, will begin in early 1998.

An invasive tree species, melaleuca is widespread in Big Cypress National Preserve and throughout South Florida. Unchecked, the aggressive species displaces native plant communities with dense single-species forests that provide little value to wildlife.



Big Cypress National Preserve, Tony Pernas

Issue Update

Good science fundamental to Everglades restoration

by Bill Walker

A commitment to base ecosystem restoration decisions on scientifically sound information from the full range of natural and social sciences is the guiding principle of the South Florida Ecosystem Restoration Task Force and its working group. As the interagency coordinating body for the South Florida restoration, the task force demonstrated a renewed commitment to science in 1997 when it chartered the interagency Science Coordination Team to serve as a scientific advisory group to both bodies.

The new team is made up of a broad mix of federal, state, local, and tribal scientists and managers, with the responsibility of achieving multidisciplinary integration of the scientific activities needed to support South Florida ecosystem restoration. The team replaces the former federal interagency Science Subgroup (which provided science support during the initial years of the restoration). In 1993, the subgroup developed the initial *Federal Objectives for South Florida Ecosystem Restoration*, and in 1994, developed a comprehensive *Science Information Needs* report, defining critical science gaps throughout the region. In 1998, the Science Coordination Team will complete an updated *Strategic Science Plan*, to integrate the ongoing interagency science initiatives with the critical management decisions needed to implement the restoration.

In addition, 1997 was the first year of a five-year Critical Ecosystem Studies Initiative (CESI) that brought an increase of over \$7 million to the

Everglades National Park

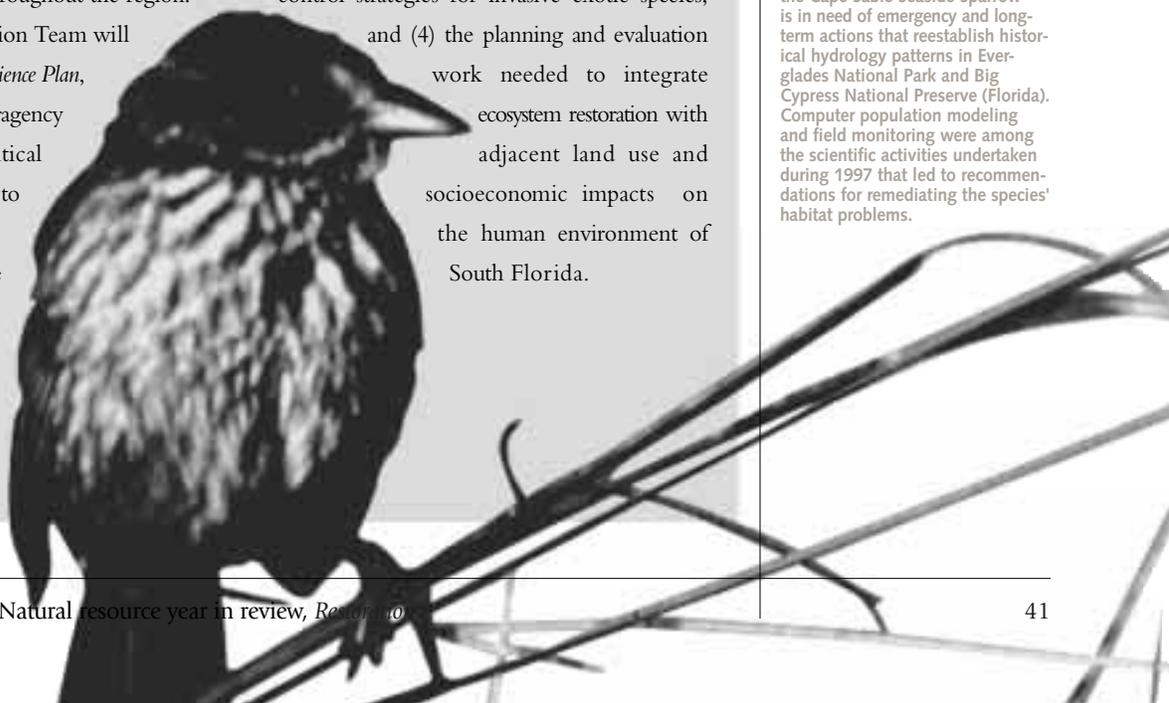
South Florida Department of the Interior science programs to fund high priority projects. The fiscal year 1997 funds were used to accelerate numerous ongoing projects that focus on: (1) the development of a key set of environmental performance measures (restoration success indicators) needed to evaluate and track ongoing and proposed restoration initiatives; (2) the collection of baseline topographic, water flow, and water quality information in remote areas (principally in Big Cypress National Preserve, lands held in trust for the Miccosukee and Seminole Indian tribes, and the mangrove and estuarine areas of Everglades and Biscayne National Parks); (3) detailed ecological process studies that link changes in the water flows and nutrients to their impacts on critical habitats and their associated wildlife communities; and (4) the development of hydrological and ecological simulation models to predict the impacts of proposed restoration alternatives.

Fiscal year 1998 CESI funding will continue these programs and add the following efforts: (1) planning and design studies of water quality improvement technologies needed to treat storm water runoff before it enters the protected, public wetlands and estuaries; (2) regional-scale landscape ecology studies to look at the linkages between the broader landscape units (Everglades marshes, developed uplands, coastal mangroves, estuaries, etc.); (3)

control strategies for invasive exotic species; and (4) the planning and evaluation work needed to integrate ecosystem restoration with adjacent land use and socioeconomic impacts on the human environment of South Florida.

william_walker@nps.gov
Coordinator, Washington Program
Office; NPS Water Resources
Division; Natural Resource Program
Center; Washington, D.C. 0

Dangerously close to extinction, the Cape Sable Seaside Sparrow is in need of emergency and long-term actions that reestablish historical hydrology patterns in Everglades National Park and Big Cypress National Preserve (Florida). Computer population modeling and field monitoring were among the scientific activities undertaken during 1997 that led to recommendations for remediating the species' habitat problems.





NEW HORIZONS

Natural resource management is an evolving science. As park management needs change or come to light, so do the techniques used by resource managers to address them. New experiments are designed, research results are applied in new ways, and new technologies are developed to accomplish resource protection goals. Park and central office resource specialists are key to this process. During 1997, staff at Sequoia and Kings Canyon National Parks developed a GIS application that analyzes ecological needs and economic considerations to identify priority areas for prescribed burning. At Yellowstone, resource managers took steps to institutionalize greater protection of natural resources through new models for agreements with researchers who collect microbe samples from geothermal features. Also this year, the National Park Service developed a stronger presence on the World Wide Web, increasing the amount of technical information available about various natural resource programs and activities. Innovations such as these advance the state of resource management and provide building blocks for the next complex challenges.

First bioprospecting agreement targeted in Yellowstone

by Tami Blackford and Sue Consolo-Murphy

Units of the national park system are available for research that is compatible with resource preservation. Such research benefits park management by providing key information about park resources, processes, and visitors. Park-based research also contributes knowledge to the basic and applied research communities in the United States and around the world. Occasionally, the commercialization of products or processes derived from park-based research has returned profits to private industry. Until now, no administrative mechanism has existed by which parks could share in the financial benefits from research activities.

As global diversity declines, parks provide increasingly important repositories of unique resources for scientific studies and products that may benefit humankind. "Biotechnology," the practical application of biochemical processes, brings researchers to places like Yellowstone, where thermophiles (heat-loving microorganisms) have been found to contain heat-stable enzymes and other bioactive molecules. The first commercial application of these enzymes was in laundry detergent. Then major advances in molecular biology and genetic engineering brought another use. A technique invented in part by using a microbe collected in Yellowstone, *Thermus aquaticus*, makes DNA fingerprinting possible. Annual sales of this process now reach \$200 to \$500 million, which has led to even greater interest in Yellowstone's geothermal habitats. Of more than 50 microbiology projects currently permitted to collect samples, about half are sponsored by biotechnology companies or are academic research funded by the private sector.

sue_consolo-murphy@nps.gov
Resource Naturalist, Center for Resources; Yellowstone National Park, Wyoming.

tami_blackford@nps.gov
Secretary, Natural Resources; Center for Resources; Yellowstone National Park, Wyoming.

Researchers collect heat-loving microorganisms from a hot spring at Black Sand Basin during a 1995 research conference in Yellowstone National Park (Wyoming). An administrative mechanism was being developed during 1997 to allow the park to share in the financial benefits that can come from the commercialization of products or processes derived from park-based research.

In late 1997, Yellowstone National Park, the Natural Resource Directorate, and the Office of the Solicitor were working to complete a precedent-setting agreement that would close the loophole now allowing private entities to be the sole beneficiary of publicly owned resources. The agreement is expected to serve as a model that will benefit park resources, the companies involved, and the American public by returning a portion of profits from commercially valuable research to parks for conservation and related scientific and public education activities. The agreement will contain the same protections for park resources that govern all park research activities. Only collection of small quantities of research samples will be permitted, with a strict prohibition on "mining" the parks by returning repeatedly for new samples.

In August 1997, the Diversa Corporation of San Diego, California, signed a draft document, which when completed will be the first cooperative research and development agreement with the National Park Service. Under permit conditions, researchers may collect small samples of microorganisms and take them back to their

lab. The microbes themselves remain in federal ownership; they cannot be sold or given away. By law, an entire natural organism may not be patented. However, components of an organism discovered in the course of research, such as genetic code or novel enzymes, may become the intellectual property of the researcher. Under the terms of the draft agreement, if Diversa develops a profitable product from research based on Yellowstone microbes, the park is entitled to royalties. Whether or not the company makes a useful discovery, the company will supply money and services to advance Yellowstone's resource conservation program. Scientists estimate that less than one percent of the park's thermophiles have been identified to date. Without private research, much of Yellowstone's microbial diversity will remain unknown.

Dozens of parks may harbor commercially useful organisms in geothermal features, caves, springs, and even in ancient seeds left in the dwellings of prehistoric peoples. This new agreement attempts to provide a reasonable return to the public from park science while helping parks protect their unique resources in perpetuity.

john_burghardt@nps.gov
Geologist, NPS Geologic Resources
Division; Natural Resource Program
Center, Lakewood, Colorado.

Safety

Safe conduct of bat surveys in abandoned underground mines

by John Burghardt

With the current national emphasis on abandoned mine reclamation, the National Park Service and other agencies have become increasingly concerned with assessing and preserving critical wildlife habitat that many mines provide. Most often this concern focuses on bats, which are becoming more dependent on abandoned mines for habitat as recreational caving and deforestation diminish their natural habitat.

External and internal surveys are both used to gain information on mine-dwelling bat species. External surveys can be conducted during seasons when bats are

active from dusk to dawn. However, internal surveys are the only way to obtain reliable data on hibernating bats, and they yield much more information on roost characteristics and bat behavior during active seasons. Winter underground surveys are most useful, as hibernating bats can be identified, and uneaten insect parts, guano, and urine-stained walls attest to spring, summer, and fall use. Ideally, surveys are conducted in all four seasons of the year before a mine is closed, as various species will use different portions of a mine for varying purposes through the course of a year.

Wildlife biologists conducting underground surveys are subject to the same hazards for which the mines are being closed. Oxygen-deficient air, toxic gases, unstable rock, vertical drop-offs, abandoned explosives, and hazardous waste are some of the hazards typically encountered. Abandoned underground mine specialists are therefore being linked with biologists to conduct underground habitat surveys. These specialists are equipped



Geologic Resources Division, Dave Shannon

Biologists may encounter "bad" air during underground surveys. Here, a specialist monitors for oxygen, carbon monoxide, methane, and alpha radiation.

to detect and experienced to deal with underground mine hazards, and they assume responsibility for the training and safety of inexperienced members of underground survey teams.

In 1997, several federal agencies collaborated to establish abandoned mine entry policies and safety training programs for employees who now find abandoned mine entry a routine part of their jobs. The NPS Geologic Resources Division is considering language for a policy, and has conducted numerous safety sessions with the general admonition to stay out of abandoned mines unless accompanied by a qualified safety specialist. The USDA Forest Service requires a qualified mineral examiner to lead abandoned underground mine research groups. With the assistance of NPS and BLM mining specialists, the Forest Service has developed a week-long mine safety course that has been attended not only by wildlife biologists, but also specialists in cultural resources, hazardous materials, law enforcement, search and rescue, and minerals management. The Bureau of Land Management is just developing an official policy, and is considering offering a



Geologic Resources Division

training course through their national training center. All three agencies are conferring on official criteria to certify individuals as “qualified” for leading underground surveys. These efforts will ensure that wildlife surveys and other important work in abandoned underground mines will be accomplished with maximum safety for all federal employees.

Mine safety specialists are now being linked with biologists to conduct underground wildlife surveys. Here, a specialist “bars down” a loose slab of rock at Lathrop Mine in Canyonlands National Park (Utah).

Resource Economics

Floccinaucinihilipilification or Pricing priceless mineral resources

by Phil Cloues

When mineral resources are vandalized or stolen, law enforcement professionals must determine a monetary value so that Department of Justice attorneys may seek punishment for the perpetrators. Floccinaucinihilipilification means the “estimation of something as valueless” and is often used as an argument by the defense counsel to reduce the charges for destruction of mineral resources such as cave speleothems like gypsum crystals, calcite stalactites, and stalagmites to a misdemeanor and small fine.

Park rangers, scientists, resource managers, cave specialists, attorneys, and mineral appraisers can team up in

an effective manner to bring about justice and send a message to potential vandals that the National Park Service takes its stewardship responsibility very seriously. By documenting an appraised value following government and private sector standards based on supply and demand economic market transactions, a real dollar value can be applied to a “priceless” natural resource. The use of a seasoned practitioner experienced in the field of mineral appraisal and tempered on the witness stand by the pounding of cross examination may result in a felony conviction that will serve as a deterrent to future acts of vandalism and theft. Managers can call upon the specialists of the Geologic Resources Division to give them court-supportable mineral appraisals or reviews of contracted third-party appraisal estimates of fair market value.

Two recent cases in which the Geologic Resources Division was involved may send this message. In May 1996, U.S. District Judge Thomas B. Russell sentenced

phil_cloues@nps.gov
Mining Engineer/Mineral Economist, NPS Geologic Resources Division, Natural Resource Program Center, Lakewood, Colorado.



Recognizing the interdisciplinary nature of solving natural resource crimes, the NPS Law Enforcement Program invited participation of natural resource and environmental protection specialists in an environmental crimes investigations course last September. Law enforcement and natural resource personnel learned options for jointly addressing park environmental crimes such as hazardous waste and ocean dumping, water pollution, pesticides violations, and environmental contamination of wildlife.



Geologic Resource Division

Resource manager Rick Olson points to gypsum sheets destroyed by vandals in Crystal Cave at Mammoth Cave National Park (Kentucky). Park rangers, scientists, resource managers, cave specialists, attorneys, and a mineral appraiser recently teamed up to build a successful court case against the vandals.

three men to 21–33 months in federal prison for destruction of cave features in Crystal Cave at Mammoth Cave National Park (Kentucky). The judge said that the defendants had “stolen yesterday’s time,” destroying delicate crystal formations that took hundreds of years to form. Visitors will never again be able to view these wonders of nature. At the end of 1997, resolution is pending in another case on theft charges of selenite crystals by professional mineral dealers caught excavating specimens in Capitol Reef National Park (Utah). The value of the stolen crystals and damage to the earthen mound collection site, which contain highly sought-after clear “Utah Ice” crystals, is documented in a mineral appraisal that will be used in legal restitution of the case.

pat_lineback@nps.gov
GIS Coordinator, Sequoia and Kings
Canyon National Parks; California.

Prioritizing fire planning needs through GIS

by Pat Lineback

Land and management agencies use fire for many reasons including fuel reduction for protection of human safety and to encourage natural ecological processes. Recently, the National Park Service and other federal agencies have begun to reemphasize the return of fire to the ecosystem. As land stewards with limited funding, parks need to carefully define and select the areas most in need of burning. During 1997, Sequoia and Kings Canyon National Parks (California) developed a process that integrated complex criteria to evaluate prescribed fire within a Geographic Information System (GIS) framework. Our goal was to identify high priority areas for future prescribed burning to optimize the use of funds and restore fire to those areas with the most ecological need.

Park staff developed models based on hazard, value, and risk criteria and integrated them within a GIS. The value model consisted of two parts: (1) ecological need and (2) infrastructure, human life, and safety. The ecological need component provided a rating index to rank areas on the need for fire. To gauge need, we considered

the historic cycles between fires (pre-1860) within major plant communities. The longer that the current time interval without a fire exceeded the maximum historic cycle, the greater the need. The analysis showed that Sequoia and Kings Canyon’s 30-year-old prescribed fire program has been insufficient in restoring fire to its pre-European frequency. For the infrastructure, human life, and safety component, we gave greater weight to areas of high visitation and those areas with buildings or other facilities.

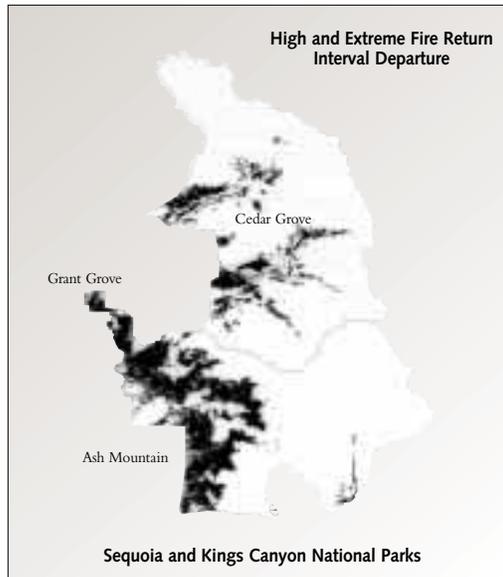
The hazard model considered key factors (fuel, slope, aspect, elevation) that affect human limits to control fire, or a fire’s resistance to control. Each factor was divided into three categories: high, moderate, or low hazard. Applying this model using GIS indicated that the largest portion of the parks was in the low hazard category and the smallest portion was in the high category.

Finally, for the risk model, we identified the risk of potential ignitions by examining the historic occurrence of both human and lightning-caused fires. We compared the number of fires as a ratio of fires per 1,000 acres for the 13 major watersheds within the two parks.

Although each model can be output as a separate analysis, we combined the models in various ways depending on the specific questions we were attempting to answer. Simple, color-coded park maps provided the

information for each fire analysis. The areas with the highest priority ratings based on value, hazard, or risk can be viewed in simulated 3-D when determining areas to focus planned ignitions. As these models evolve, improvements will include: better quality spatial and attribute data, incorporation of additional variables such as local topography, dynamic updating through further automation, and interagency cooperation and development of common analysis models that cross jurisdictional boundaries.

As severe wildfires increase in North America the use of fire for fuel reduction and ecosystem management will become more important. GIS will be an essential tool for planning and implementing such landscape-scale management programs.



The GIS application developed at Sequoia and Kings Canyon National Parks (California) can answer many important fire planning questions. This map shows where fire should be restored (dark area) based on greatest ecological need. Most of the areas are in the mixed-conifer forest and often coincide with heavily used areas of the parks.

Lake Mead “SWAT” team attacks tamarisk

by Curt Deuser, Jennifer Haley, and Ian Torrence

Lake Mead National Recreation Area’s newly established tamarisk control team is eliminating tamarisk from parks throughout the NPS Pacific West and Intermountain Regions. Funded through a Natural Resource Preservation Program (NRPP) grant, the team helps parks implement high-priority tamarisk control projects by providing expert staff and training. In 1997, the first season of operation, the crew of five traveled 6,497 miles and spent 2,005 hours removing tamarisk and other weeds from 160 acres at nine units of the national park system.

Tamarisk (*Tamarix ramosissima*), or salt-cedar, occupies approximately one million acres of public and private lands in the Southwest and threatens many park

ecosystems. Introduced into this country from Eurasia in the late 19th century, tamarisk escaped cultivation and invaded damp areas along riparian corridors that provide rare and important habitats in the arid West. Native plant species have difficulty germinating in dense tamarisk stands due to a lack of light and high soil surface salinity under the thick tamarisk leaf duff. Dense tamarisk stands preclude wildlife access, and the thirsty plant uses large amounts of water, sometimes drying up critical water sources.

curtis_e_deuser@nps.gov
Natural Resource Specialist; Lake Mead National Recreation Area, Nevada.

jennifer_s_haley@nps.gov
Vegetation Ecologist; Lake Mead National Recreation Area, Nevada.

ian_torrence@nps.gov
Biological Technician; Lake Mead National Recreation Area, Nevada.

In its first year, the Lake Mead tamarisk crew traveled to nine parks, removing some 160 acres of the aggressive plant and other weeds. The team will continue its work for three more years.



Award Winner Profile

Superintendent honored for resource management

Winner of the 1996 Director's Award for Superintendent of the Year for Natural Resource Stewardship is Alan O'Neill of Lake Mead National Recreation Area, Nevada. O'Neill is a visionary who has built a professional resource management program at the Arizona-Nevada park. His commitment to resource protection is evident from his support of the park's burro management program, the razorback sucker recovery plan, and desert tortoise habitat protection endeavors. O'Neill also excels as a leader. He helped bring together numerous partners during the initial phases of the California Desert Ecosystem Management Initiative, a complex interagency framework for managing over 25 million acres of public lands. As chairman of the Pacific-West Region resource management and science task force, he leads by example, providing support to parks engaged in strategic planning efforts. His leadership has enhanced the NPS role in cooperative ecosystem management and sets an excellent example for all land managers.



Lake Mead National Recreation Area

Alan O'Neill, winner of the 1996 Director's Award for Superintendent of the Year for Natural Resource Stewardship.



(Both) Lake Mead National Recreation Area

Tamarisk removal is labor intensive, but can be effective in controlling isolated stands of the invasive species, such as this one along Sulphur Creek (above) at Capitol Reef National Park (Utah). To keep the area free of tamarisk (below), the park will need to treat the area periodically using techniques taught by the crew.

Over the years, many parks have struggled to control tamarisk, with varying degrees of success. Removal efforts are labor intensive and involve the use of chain saws, herbicides, and occasionally prescribed fire. Parks have had difficulty in gathering enough skilled and equipped crews to attack the plant. Additionally, standardized control methods needed to be developed to improve results and increase efficiency.

With the NRPP grant, Lake Mead NRA (Nevada and Arizona) developed protocols and trained staff to act as an expert "SWAT" team to help other parks deal effectively with their tamarisk problems. For each project in a park, the team involves local park staff, teaching them established control methods. Each park also

receives a tamarisk control manual developed by the crew. The crew then removes exotic plants from the park's highest priority area. In the first season, the average cost for tamarisk removal, including labor and herbicide, was \$687 per acre. The team has also controlled other nonnative plants that threaten riparian systems including Russian olive, ailanthus, Siberian elm, and ravenna grass.

The tamarisk removal crew, now increased to ten people, will continue to work in numerous parks for the next three years. Lake Mead staff and others believe this may be the best approach for managing weeds on a larger scale and will be looking for ways to continue funding for the team after the NRPP funding ends.



Education

Discovery station: Interpreting science for park visitors

by Neil Mackay

Scientific research is a vital, ongoing activity in the National Park Service. Unfortunately, many visitors are unaware of its importance in understanding and preserving parks. Traditionally, Harpers Ferry Center, the NPS interpretive design center, designs park exhibits to be “permanent.” But long-term exhibits are not always suited to interpreting natural resource issues where scientific research, inventory, and monitoring lead to continuing discoveries.

The situation is compounded by the difficulty of communicating science to visitors (especially younger visitors) in accurate, yet engaging, ways. Sharing scientific concepts frequently requires dynamic presentations, such as showing video footage or interacting with three-dimensional exhibits. Yet, typically these techniques have been limited to permanent exhibit installations. Clearly, parks need a new media approach to interpret current scientific research and natural resource issues effectively.

This challenge was explored in 1996 in a meeting of natural resource scientists and media specialists at Harpers Ferry Center. As a result, an interdisciplinary media team created the prototype for a new exhibit system called the “discovery station.” The station consists of standardized hardware that can be easily customized to accommodate several interpretive media, such as poster boards, television monitors, and interactive devices. This allows park staff to concentrate on developing the content for interpreting natural resource issues.

Big Thicket National Preserve (Texas) joined the team in 1997 to serve as the test site for a prototype station. Interpretive and resource staff chose “prescribed fire” as their first topic. Geared primarily for children, the media explain fire basics, describe vegetation types and the natural fire cycle, and explore how prescribed burning is a resource management tool. The station

presents profiles of David McHugh (Fire Management Officer at the park), Dr. Paul Harcombe (Professor at Rice University who has studied Big Thicket ecology for many years), and some of their colleagues. In this way, young visitors also see natural resource stewardship and science as interesting careers, an important message in its own right.

Big Thicket resource and interpretive staffs have already discussed future discovery station topics. These include: the preserve’s role as a global climate change monitoring site, an ongoing lepidoptera study, and the park program for the endangered Red-cockaded Woodpecker. To learn more about the discovery station, please visit the web site at www.nps.gov/discover.

neil_mackay@nps.gov
Exhibit Planner, Harpers Ferry
Center; Harpers Ferry, West
Virginia

A newly designed “discovery station” allows parks to interpret science and resource management issues with great flexibility. The station accommodates bulletin boards, large-format graphics, scientific instruments, specimens, interactive devices, publication racks, and video and computer monitors.



Harpers Ferry Center

daniel_tardona@nps.gov
West District Supervisor;
Timucuan Ecological and Historic
Preserve, Florida.

Conserving native wildlife in northeast Florida

by Daniel R. Tardona

Wildlife conservation has many faces, from zoos protecting animals in order that they may safely increase their numbers to national parks protecting wildlife habitat and animals in their natural surroundings. During 1997, the Timucuan Ecological and Historic Preserve and the Jacksonville Zoological Gardens developed an educational program aimed at conservation of the native wildlife of northeast Florida. The program educates the public on native wildlife issues and explains how these two different entities—national parks and zoos—both advance the goals of wildlife conservation.

With this unique partnership, both groups hope to raise awareness of native wildlife issues and to generate a new understanding of the role of zoos and parks in wildlife conservation.

Zoological facilities, like the national parks, grapple with the challenge of providing a recreational environment while conducting ongoing research, resource management, and education that promotes wildlife conservation. A principle objective of the Association of Zoological Parks and Aquariums is to link zoos with in situ conservation.

This joint wildlife education program between

Timucuan and the Jacksonville Zoo provides the zoo with an opportunity to make such a link. For the park, this program provides a new and different kind of audience for the NPS conservation message.

When presentations are made at the zoo, the Timucuan Preserve can reach a more diverse ethnic and socioeconomic audience than normally visits national park sites. When presentations are made within the preserve, the audience typically is more conservative with regard to conservation and dubious of the zoo's commitment to wildlife conservation. Audiences in both locations are provoked to explore their preconceptions and expand their views about modern wildlife conservation.

This fast-paced program explains the necessity of conserving native species in northeast Florida and the roles played by the zoo, the park, and the public. Zoo animals are displayed, including federal and state listed endangered species as well as nonnative species. Program participants learn about the animals' habitat needs, behavior, and ecology, interspersed with information contrasting the differences and similarities of park and zoo contributions to wildlife conservation. Although systematic formal evaluation is needed, initial responses from the public at both sites have been extremely favorable.

Staff from the Jacksonville Zoo and Timucuan Ecological and Historic Preserve developed a novel education program during 1997. With presentations taking place at both the zoo and park, both organizations reached new audiences and explained their respective roles in native wildlife conservation.



Daniel R. Tardona

Park Operations

Information exchange fosters sustainability

by Judy Geniac

Throughout the national park system, employees are creating innovative ways to protect park resources. Paul Stoehr, Chief of Facility Management, improved the water quality at Everglades National Park (Florida) by switching to citrus-based cleaners, which break down quickly and do not add petroleum to the groundwater. In Organ Pipe Cactus National Monument (Arizona), Facility Manager Bill Mikus has been involved in replacing underground storage tanks with aboveground tanks. This approach allows employees to monitor the tanks for corrosion before any spills occur, avoiding disastrous and expensive damage to soil resources. Rick Olson, Ecologist of Mammoth Cave National Park (Kentucky), is currently working with park operations to replace most of the wooden boardwalk in the cave with plastic "wood." Real wood introduces a food source to the cave that supports introduced species, allowing them to out-compete the native cave species; if treated, wood can also leach copper, chromium, and arsenic into the water of the cave.

Like Paul and Bill and Rick, many other park employees find creative solutions to commonly occurring resource problems, often saving the park money with "green" products. Recognizing that these solutions should be acknowledged and shared, the Servicewide Maintenance Advisory Committee created the Environmental Leadership Subcommittee in 1996. The subcommittee is made up of park and central office staff.

In 1997, the subcommittee focused efforts on fostering communication between the Washington Office, service centers, regions, support offices, parks, industry, park contractors, and visitors. The newly reopened Green Alert electronic bulletin board encourages NPS employees to share their sustainability problems and solutions in an informal setting. A new web

site will focus on improved solid waste management techniques in parks, energy management, and other operational needs by linking to online government databases, full of product information. Parks will also post some of their success stories. The web site will be up and running in spring 1998.



The subcommittee is also helping parks by developing partnerships, providing information for the interpretation of recycling and other park operations, and creating signs. For example, the subcommittee has just launched a partnership called Partnership for Energy Conservation, which encourages universities to conduct park energy audits. The first audit, for Shenandoah National Park, was recently completed by the James Madison University Integrated Science and Technology Program. Alliance to Save Energy, a Washington, D.C., nonprofit group, secured a grant for the audit through the Department of Energy Federal Energy Management Program.

Working with the NPS Concessions Division, the Environmental Leadership Subcommittee is creating a course that will teach the concepts of sustainability and how they apply to the daily operations of park facilities. The subcommittee is also working closely with the NPS staff of the Hazardous Waste Management Program to increase awareness in the parks of hazardous substances and to minimize use of products containing such substances. The subcommittee's efforts during 1997 raised the awareness of sustainability and promoted practical, resource-friendly solutions in parks.

judy_geniac@nps.gov
Environmental Protection Specialist,
NPS Geologic Resources Division;
Lakewood, Colorado.

This popular trail at Rainbow Bridge National Monument (Utah) has been stabilized with Road Oyle®, a nonpetroleum bonding emulsion that improves trail durability and reduces erosion. Environmentally appropriate solutions to park natural resource problems are being recognized and adopted more and more, in part because of the recent activities of the NPS Environmental Leadership Subcommittee.

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DEALING WITH DILEMMAS

Many issues regarding the preservation of natural resources in parks do not have easy answers. Meeting air quality mandates, for example, involves multiple parties, each with an interest that may need to be considered. Other issues, such as the overabundance of white-tailed deer, are so emotional that despite the application of scientific information, public opinion may have a stronger bearing on the outcome. In each case, resource specialists play a critical role in sharing their expertise with managers to guide the National Park Service through the complex process of resolution. Often, the law must be interpreted or applied. Interests of other affected parties need to be evaluated. International negotiations may be needed. Stakeholders, including the public, may need to participate. At times, expertise or precedent may not exist within the Park Service, making the process of resolving an issue particularly uncertain. Resolution may take years and the outcome may not be the most desired for natural resource preservation in parks. In 1997, park managers had to deal with these realities of natural resource management on several fronts.

Clean air versus prescribed fire: A burning dilemma

by Jeff Manley

Public land managers in the Sierra Nevada (California), including those at Sequoia and Kings Canyon National Parks, are increasingly being squeezed between the need to increase prescribed burn programs to meet ecosystem health and hazard fuel objectives, and the need to maintain healthy air quality. The giant sequoia (*Sequoiadendron gigantea*) is dependent on fire for reproduction, and much of the park vegetation consists of fire-adapted species that have steadily degraded due to fire exclusion for the past 90 years. However, the parks are designated Class I areas under the Clean Air Act, affording them greater legal protection for air quality. They are also situated at the southern end of the San Joaquin Valley, a heavily

polluted area that exceeds the National Ambient Air Quality Standard (a human health standard) for fine airborne particles.

In 1994, the parks began to significantly increase the size and scope of their joint fire management program to address the critical backlog of hazard fuel and ecosystem health burning projects. At the same time, adjacent federal land managers, particularly the USDA Forest Service, also began to take serious measures to increase their burn programs to meet resource objectives. Altogether, the federal agencies were proposing to increase burn activity up to five times recent levels, which could seriously hamper the efforts of the local air quality district to meet its responsibility to the public and the Environmental Protection Agency to reduce fine particulate levels.

During 1997, Sequoia and Kings Canyon took several steps to address the conflict, including beginning to develop a comprehensive smoke management plan. The

jeff_manley@nps.gov
Natural Resource Specialist;
Sequoia and Kings Canyon
National Parks; California.

Where there's smoke, there's fire—and the potential for air quality standards violations in Sequoia and Kings Canyon National Parks (California). Legal requirements for the maintenance of healthy air and the ecological need for fire in maintaining a healthy forest present a problem with no simple solution. During 1997, managers from the park began developing a smoke management plan that addresses the dilemma.



(Bob) Sequoia and Kings Canyon National Parks

plan minimizes smoke through careful timing of burns during favorable wind and fuel moisture conditions. It also provides for smoke monitoring in sensitive areas to document impacts and provides a basis for health advisories if needed. A public information program is designed to give early warning to sensitive individuals and to explain to local communities the need for the burn programs.

The parks also joined with the San Joaquin Unified Air Pollution Control District and representatives from other federal and state land management agencies to

form the Interagency Smoke Advisory Council, whose purpose is to define the common issues and to work together to find solutions. The group drafted a memorandum of understanding that provides a framework for cooperation in meeting the dilemma head-on. The agreement recognizes the need for increased burning, and incorporates the five-fold increase in burning. It also includes a work plan (under development) that will ultimately become the best available control method required by the fine particulate standard.

The group has also coordinated other actions to manage the smoke-air issues. These include the development of software to track all burns within the area and the development of air quality monitoring standards and protocols. Based on fuels to be burned, an emissions database allows evaluation of the effects of a prescribed burn or alternatives, such as suppression (which can lead to larger, uncontrolled fires), on air quality.

While these cooperative activities have yet to provide a perfect solution to the conflict between the fire programs and preservation of air quality, they have moved all participants forward in understanding the issues, identifying strategies, and taking steps to manage the issues creatively and cooperatively.

A prescribed burn research plot at Sequoia known as Upper Tharp's shows some of the effects of fire on the forest. Before the burn (above), fuel loads are high and little tree regeneration is evident. Four years after the burn (right), fuels are reduced and trees are resprouting.





Voyagers National Park

Lost Bay, a wildlife protection area within Voyageurs, shows evidence of snowmobile use despite posted notices requesting visitors to voluntarily stay out during the 1996-97 winter season. Monitoring data suggest that wolves do not use frozen bays in the presence of snowmobiles.

Preservation & Law

Voyageurs challenge: Protect wildlife and provide visitor access

by *Jim Schaberl*

For almost a decade, Voyageurs National Park (Minnesota) has struggled to come up with a management plan that protects wildlife habitat while providing snowmobile access to frozen lakes. The park's efforts have been hampered by controversy, litigation, and a lack of scientific information. Planned biological and social science research may provide further insight on wolf-human interactions, but the complexity of the issue continued to challenge NPS scientists and managers during 1997.

In Voyageurs, approximately 110 miles of groomed snowmobile trails provide access to over 80,000 acres of frozen lake surface (nearly one-third of the park). A proposal for a new cross-park snowmobile trail in the park's 1989 trail plan (which was never implemented) triggered both environmental compliance and legal

challenges concerning the effects of visitor activity on park wildlife, particularly the threatened gray wolf and Bald Eagle. In addition to providing seasonal nesting and foraging areas for Bald Eagles, the windswept frozen lakes appear to provide an advantageous surface for wolves to forage for deer and moose. Anecdotal evidence indicates that wolves have abandoned captured prey when snowmobiles approached some areas. This information raised a concern of the cumulative effects of repeated disturbances over a winter season on the well-being of wolves, particularly during seasons of reduced prey.

In 1989 and 1991, the U.S. Fish and Wildlife Service (USFWS) engaged the park in an Endangered Species Act Section 7 Consultation and issued a biological opinion on the effects of human activity on threatened species. In accordance with that opinion, Voyageurs closed 17 lake bays (or approximately 8% of the area formerly open) to snowmobiles in 1992. The Minnesota United Snowmobilers sued, challenging the authority for closures and claiming the park and USFWS lacked evidence of harm to the wolves. (The suit did not contest the

jim_schaberl@nps.gov
Biologist; Voyageurs National
Park, Minnesota.



park closures surrounding Bald Eagle nests.) In January 1996, the district court remanded the case to the Department of the Interior with direction to obtain more information on wolf-human interaction and ordered the bays opened.

That same year, the park evaluated four years of data from the aerial monitoring of bay closures. Wolf and snowmobile tracks were frequently seen in many bays, but the patterns appeared to indicate exclusive

use; that is, wolf activity did not occur in the same time intervals as when snowmobilers used the closed bays. Park managers proposed some of the 17 bays should be closed for the 1996-97 season in light of the wolves' apparent avoidance of human activity, despite the judge's ruling. Following a series of public meetings with intense political and public debate, 11 of the 17 bays were posted as wildlife protection areas and visitors were asked to voluntarily avoid them. Observation



Snowmobiling and wolf protection are at the heart of a long-standing dispute over winter use in Voyageurs National Park (Minnesota). During 1992, the park closed 17 frozen lake bays to snowmobiling, resulting in a lawsuit brought by the Minnesota United Snowmobilers.



© 1985, Jeff Seltzer

showed that voluntary compliance did not work; in some cases, more snowmobile activity took place in the protection areas than areas open to winter use.

In 1997, an appeal by a coalition of environmental groups resulted in the district court of appeals reversing the lower court's decision. The court affirmed National Park Service authority to manage for wildlife on the best available information. Existing information will be used to justify 1998 closures to protect all wildlife,

including wolves. To unravel the intricacies of this issue, additional studies will begin in 1998. Biological research will assess wolf population demographics and the influence of visitor activities on individual wolf movements and behavior. To address long-standing disputes with various segments of the public, social scientists will survey visitor attitudes and perceptions toward NPS mandates and assemble focus groups to attempt conflict resolution.

 Agreeing to study bison movements for up to three years, Yellowstone National Park settled a lawsuit in October brought over the effects of winter use and road grooming on wildlife. Together with Grand Teton National Park and John D. Rockefeller, Jr., Memorial Parkway, Yellowstone will prepare a new winter use plan and environmental impact study. Some scientists have proposed that the packed roads may enable bison to save energy, increase in number over several years, and wander from the park in search of winter range. During the severe winter of 1996-97, nearly 1,100 bison were slaughtered outside of the park for fear of spreading brucellosis to cattle.

julia_f_brunner@nps.gov
Natural Resource Protection
Specialist; NPS Geologic Resources
Division; Natural Resource Program
Center; Lakewood, Colorado.

Mining in wilderness?

by Julia Brunner

As contradictory as it seems, the Wilderness Act of 1964 allows commercial enterprises, such as mining operations, associated structures and access roads, to occur in wilderness—including national park system wilderness—if part of a preexisting private right. The National Park Service first confronted this dichotomy several years ago when the owner of patented mining claims in North Cascades National Park (Washington) wilderness requested permission for motorized access to his claims. Based on its interpretation of the Mining Law of 1872 and the Wilderness Act, the Park Service denied the request. Today, the Park Service must decide whether to approve a proposal to reopen an inactive underground talc mine in Death Valley National Park (California) wilderness. Intense public scrutiny of this proposal forced the park, the Pacific West Region and the NPS Geologic Resources Division to spend much of 1997 analyzing the legal authorities and agency policies applicable to mining in park wilderness.

The first step for any mining proposal, including proposals in wilderness, is verification that the owner possesses a preexisting right to mine. On unpatented mining claims (the owner does not own the surface of the land), this means that NPS mineral examiners must

conduct an exacting examination to determine whether the claims are “valid;” that is, the mineral deposit would support a profitable mining operation. The examination of the Death Valley talc claims found the claims valid. Owners of patented mining claims (the owner owns the surface, in addition to the right to extract minerals) have already passed a validity examination, but they must demonstrate clear chain of title.

To eliminate the threats posed by mining operations to wilderness character, NPS Management Policies (1988) require park managers to “seek to acquire” preexisting mining rights in wilderness. If limited budgets render acquisition infeasible, the Code of Federal Regulations (36 CFR Part 9A—minerals management regulations) must be applied to the operation. The Park Service has concluded—with Office of the Solicitor’s concurrence—that proposed mining operations in units of the national park system can not lawfully be denied simply because of the land’s status as wilderness. Instead, mitigation measures or outright denials of the proposed operation must be based on well-documented projections of resource impacts identified through the NEPA (National Environmental Policy Act) process, and imposed through the Part 9A regulations so as to preserve the wilderness character of the area. Obviously, this is a difficult task that demands substantial staff time and resources. To assist in this effort, the forthcoming NPS Director’s Order on wilderness management will include minerals management guidance.

If 1997 was any indication, the Park Service’s handling of mining proposals in wilderness will continue to be conducted under the critical eye of both pro-mining and environmental organizations. Several rules of thumb emerged in 1997, including the need to: (1) verify property ownership, (2) become familiar with the pertinent laws and regulations, (3) analyze all environmental impacts, and (4) document compliance with applicable laws, regulations, and policies. Following these steps should enable the National Park Service to withstand criticism and effectively contend with the hundreds of mining claims still remaining in park wilderness, particularly in the California desert.



Geologic Resources Division, John Bingham

Located in designated wilderness at Death Valley National Park (California), this talc deposit (diagonal white layer) may once again be mined. The Wilderness Act allows mining in wilderness under certain conditions, and the National Park Service is evaluating a proposal to reopen the inactive underground mine.



Geologic Resources Division, John Bingham

A headframe and an ore storage bin are reminders of some of the aboveground activity associated with past underground talc mining. If approved, the proposed mine must comply with federal requirements so as to preserve the wilderness character of the area.



Big Bend National Park, Jeff Scheck

Classic scenic views, such as this of the Chisos Mountains, have been diminished in Big Bend National Park (Texas) on account of air pollution. Cooperation between the National Park Service and Mexico is aimed at identifying the regional sources responsible for air quality degradation at the park.

Issue Update

Tracing the sources of Big Bend's air pollution

by Miguel Flores

During 1996, the National Park Service with the U.S. Environmental Protection Agency (EPA) and Mexico's Procuraduría Federal de Protección al Ambiente (PROFEPA) investigated the causes of poor visibility at Big Bend National Park (Texas). As part of this investigation, the Park Service and PROFEPA coordinated a joint U.S.-Mexico preliminary fine-particle field sampling study conducted during September and October of that year over a large region in northern Mexico and southern Texas. Recent visibility data collected at the park show visibility conditions worsening over the last several years. Fine particles, particularly sulfates, are the primary cause of the regional haze causing visibility degradation there.

In 1997, United States and Mexican environmental scientists completed the laboratory analysis

of samples from the 19 sites deployed during the 1996 study. The analysis of sample results showed that sources in both the United States and Mexico are responsible for Big Bend's visibility problem. However, due to the limited duration of the preliminary study (five weeks) and the season in which it was conducted, scientists were unable to determine how much and how frequently each of the source regions identified contributed to the park's visibility problem. To determine the contributions from specific sources and source regions impacting Big Bend more precisely, the U.S. and Mexico have agreed to conduct more intensive studies, now scheduled for the summer-fall of 1999. The results of the preliminary study, which provided valuable information on pollution gradients across northern Mexico and southern Texas, will be used to design these future studies. The studies are likely to include the release of inert tracers from several sources (or regions) in the U.S. and Mexico. The issue of Big Bend's air quality will be tracked closely as part of the U.S.-Mexico Border XXI Program, which focuses on environmental problems along the U.S.-Mexico border.

miguel_flores@nps.gov

Strategic Planning Coordinator;
NPS Air Resources Division;
Natural Resource Program Center;
Lakewood, Colorado.



Two California parks experienced ozone concentrations during 1997 that exceeded the National Ambient Air Quality Standard. Joshua Tree National Park exceeded the standard four days each in May and July and one day each in June and August; Sequoia and Kings Canyon National Parks exceeded the standard one day each in May and June. These episodes are attributed to pollution blown in from urban areas.



Legislation Update

International site recognitions

by Jared Ficker

Legislation limiting international recognition of U.S. sites was addressed in both authorizing and appropriations processes in Congress during 1997. The American Land Sovereignty Protection Act (H.R. 901) passed the U.S. House of Representatives in October. Nearly identical to its predecessor legislation in the 104th Congress (H.R. 3752), the bill would severely limit U.S. participation in international environmental agreements such as the World Heritage Convention, the Ramsar Convention, and the U.S. Man and the Biosphere Program. Deputy Director Galvin testified in strong opposition to the legislation in a June hearing before the Committee on Resources noting that despite assertions, the United Nations does not have the authority to affect land management decisions in the United States. The testimony also made clear that international agreements have not been used to exclude

Congress from land management decisions, and do not have the ability to do so. The Senate will consider H.R. 901 and a similar bill (S. 691) in February 1998.

In the appropriations process, a number of amendments were proposed mostly in the House to strike any funding for the U.S. Man and the Biosphere Program. Despite these unsuccessful efforts to remove program funding, the final language adopted by Congress in the Interior Appropriations Act (P.L. 105-83) prevents funding for the designation of new biosphere reserves until new explicit organic legislation is in place that more clearly defines the biosphere reserve designation process and its implications.

The U.S. Man and the Biosphere Program has been heralded as a model for local sustainable development and resource conservation primarily because of the increased cooperation that occurs locally when federal, state, and local agencies, private organizations, and private citizens voluntarily join together in biosphere reserve partnerships. In addition, the program has fostered cutting-edge and cost-effective interdisciplinary research across the country.

Tradition & Science

Agency culture: A dilemma for natural resource preservation

by Richard West Sellars

Editor's Note: In October 1997, Yale University Press published Preserving Nature in the National Parks: A History, culminating extensive research and writing by NPS Historian Richard Sellars. The book's long-term influence on cultural change within the National Park Service is not yet known; however, it has already succeeded in stimulating dialogue about agency traditions rooted in tourism and the need to increase the role of science in park management today. The following is a summary of some of the book's main themes, concluding with the author's thoughts on how natural resource management could be improved.

One of the most challenging dilemmas that the National Park Service faces is the difficulty of living up to its rhetoric and its self-image that it is an agency whose primary mission is resource preservation. Although preservation constitutes essentially half of the Park Service's original mandate, natural resource preservation has consistently been underemphasized and conducted with insufficient scientific knowledge. By contrast, from the beginning visitor enjoyment has clearly been the primary management concern. This imbalance has deep historical roots and is closely tied to the dominant perceptions and values long held by national park leadership.

The dominant managerial assumptions of the Park Service are derived in large degree from the demands of recreational tourism and the desire for the public to enjoy the parks. Since the nineteenth century, park managers have had to deal not only with planning, development, construction, and maintenance of park facilities,

but also with increasingly demanding political, legal, and economic matters such as concession operations, law enforcement, visitor protection, and the demands of tourism interests. Especially since the 1960s, greater involvement in urban parks, greater drug and crime problems, more development on lands adjacent to parks, and the escalating political strength of concessioners and other commercial interests have added to the pressures on managers.

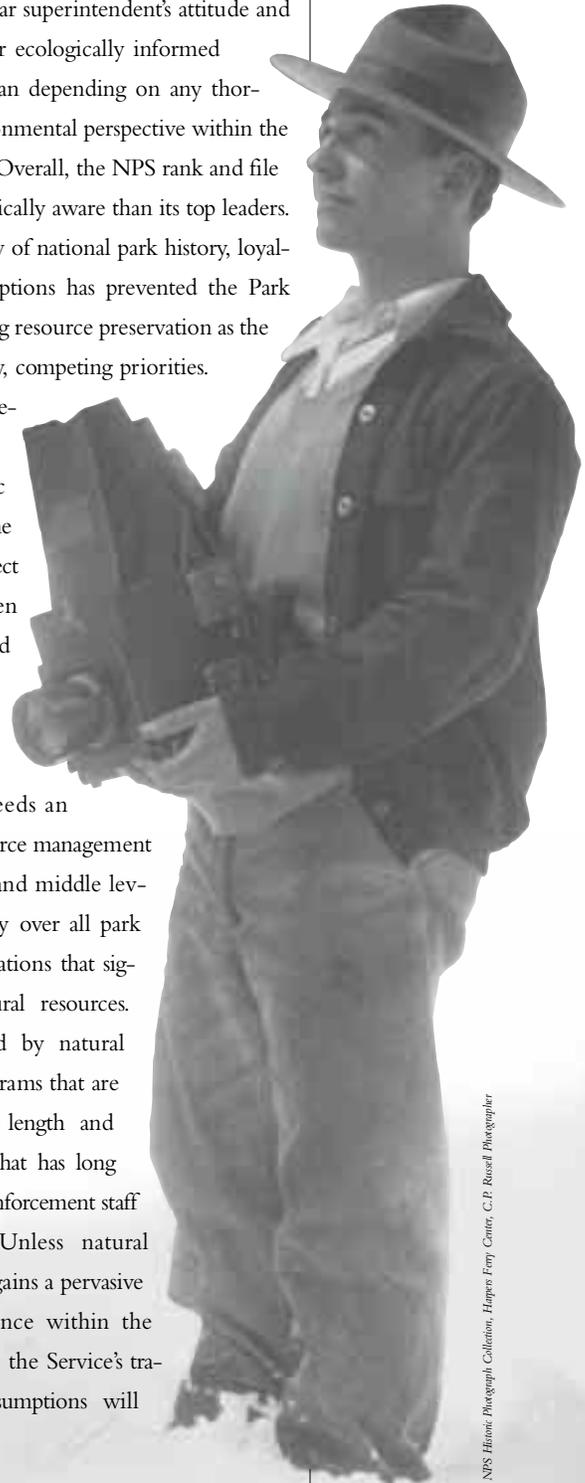
Out of these evolving circumstances, certain shared basic assumptions began to emerge even before the Park Service was created. A close consideration of eight decades of NPS history reveals that the following assumptions have long reflected the perceptions and attitudes of the NPS leadership culture: With the public's enjoyment of the parks being the overriding concern, park management could be conducted with little or no scientific information. Appearance of the parks mattered most. Even management of vast natural areas did not require biological science—the untrained eye could judge park conditions adequately. Moreover, scientific findings could restrict managerial discretion; and park managers needed independence of action. Each park was a superintendent's realm, to be subjected to minimal interference. Similarly, the Park Service was the right-thinking authority on park management—it could run the parks properly with little or no involvement from outside groups. In this regard, environmental activism was often unwelcome; and legislation such as the Wilderness Act or the National Environmental Policy Act should not interfere unduly with traditional management and operations. Overall, then, the dominant NPS culture developed a strongly utilitarian and pragmatic managerial bent. It adopted a management style that emphasized expediency and quick solutions, resisted information gathering through long-term research, and disliked interference from groups inside or outside of the agency.

Primarily concerned with varied aspects of recreational tourism, NPS leadership has been very reluctant to abandon traditional assumptions, even when faced with repeated criticism. Much of the criticism has come from within, especially from biologists from the

1930s on, very often with support from naturalists and interpreters in the parks. Some superintendents have also been openly critical: the uniformed, “green blood” groups within the NPS family have not always been of one accord. Still, advances in furthering the application of science in management have largely depended on the chance of a particular superintendent's attitude and willingness to strive for ecologically informed management, rather than depending on any thoroughly pervasive environmental perspective within the National Park Service. Overall, the NPS rank and file have been more ecologically aware than its top leaders. But in the ebb and flow of national park history, loyalty to traditional assumptions has prevented the Park Service from establishing resource preservation as the highest of many worthy, competing priorities.

Scientific natural resource management does not at all preclude public use and enjoyment of the national parks. To correct the imbalance between tourism management and informed resource management that has existed for 80 years, the Park Service needs an infusion of natural resource management expertise at the upper and middle levels, with line authority over all park and central office operations that significantly impact natural resources. This should be backed by natural resource training programs that are at least equivalent in length and scope to the training that has long been required for law enforcement staff within the agency. Unless natural resource management gains a pervasive and authoritative presence within the National Park Service, the Service's traditional managerial assumptions will prevail, as in the past.

NPS biologist George Wright (shown in Yosemite in 1929 or 1930) briefly succeeded in bringing a biologist's viewpoint to park management. Using personal funds, Wright initiated the first professional wildlife research in the National Park Service. His accidental death in 1936 weakened NPS biology programs during an era of park development and construction.



NPS Historic Photograph Collection, Hapner Ferry Center, C.P. Russell Photographer



LOOKING AHEAD

Perspective on the future

by Bruce Kilgore

I have always liked NPS Senior Scientist Gary Davis's four-word summary of the resource stewardship part of the NPS mission: know, restore, maintain, and protect. Gary's point is that we must first know what resources we have in our parks and their condition before we can restore natural processes that are out of whack and maintain systems and protect resources that are still in good shape. Although the approach is straight forward and at the heart of our resource preservation work, we have struggled to implement it fully.

Throughout my career, more than a dozen reviews of NPS research and resource management programs have noted the extreme importance of knowing about parks and their resources before taking management action. The 1963 Leopold report, for example, pointed out the folly of tinkering with natural processes without understanding them. Unfortunately, a 1992 review of the NPS science program concluded that both the Leopold and Robbins (also 1963) reports remain as relevant today as they were three decades ago, because few of their recommendations have been implemented effectively.

My philosophy of NPS natural resource research is based on those two important 1963 reports. First, the Park Service needs a permanent research program, which it should plan and administer itself. Second, most of the research should be mission oriented. Third, the results of the research should be publishable and be published! The advent of the National Biological Service in 1993 (now the Biological Resources Division of the U.S. Geological Survey), and the recent NPS reorganization have greatly shifted responsibilities for acquiring and conducting natural resource research. Now, to meet the future needs of park resources, park superintendents, resource managers, NPS senior scientists, and research

scientists of the Biological Resources Division must play key team roles.

Because of their unique experience as credible scientists who have earned the trust of park managers, certain NPS senior scientists are needed—at least on an interim basis—to bridge the gap between the Park Service and the Biological Resources Division. They must serve as analysts, consultants, and advisors to both superintendents and regional directors. In time, professional resource managers will likely take on more of the functions of science advisor, strategic planner, program oversight, and liaison. But during this transition period, senior scientists must ensure that a strong team effort between the two agencies successfully meets the real needs of park superintendents.

Also vital are adequate staffing and funding. Several years ago, the Western Region developed a system to accurately determine the professional natural resource management staff needs of each unit in the national park system. The first phase of an initiative known as “Stewardship Today for Parks Tomorrow” was based on these efforts and aimed to double NPS professional staff by the year 2000. Achievement of this goal and other current initiatives is essential to the future of natural resource preservation in parks.

As a strong advocate of resource management and research programs in national parks and wilderness, I feel we need to clarify our hands-on approach to restoring natural processes and conditions in national parks. This is a big challenge for the future and applies, for example, to the use of prescribed fire where fire has been kept out for many years and even decades. In the end, we must approach the assignment of restoring natural environmental conditions with humility and great ecological sensitivity. Our guiding principle should be the maintenance of naturalness. And whenever and wherever possible, the best way to restore a semblance of native America may be to let natural forces run their own course.

Bruce Kilgore

Retired; Associate Regional Director for Natural Resource Stewardship and Science; Pacific West Region; San Francisco, California.



Natural Resource Information Division

Editor's Note: Dr. Bruce Kilgore retired from the National Park Service in March 1997, capping an influential 40-year career in natural resource management. Kilgore pioneered fire ecology research in Sierra Nevada parks in the 1960s, leading the way to the first prescribed natural fire program in the national park system. As a research administrator with the Pacific West Region since 1985, he built programs for professional research and resource management that became models for the National Park Service. Most recently he has been the driving force in returning key staff to the Park Service as Senior Scientists. His vision has often proved to forecast the future, and his legacy will be felt for many years. These are his thoughts at retirement.

