

ENDANGERED SPECIES

Technical Bulletin

U.S. Department of the Interior
Fish and Wildlife Service

Endangered Species Protection in the National Parks

by Napier Shelton

Congress established the National Park Service (NPS) in 1916 to conserve the natural and cultural resources in the national parks and similar areas, and to provide for public enjoyment of these areas in ways that leave them unimpaired for the enjoyment of future generations. Today, the 80-million-acre (34-million-hectare) National Park System encompasses more than 360 national parks, monuments, preserves, memorials, historic sites, recreational areas, seashores, and other units spread from Alaska to the U.S. Virgin Islands to American Samoa. In addition to preserving habitats that range from arctic tundra to tropical rainforest, the System protects representatives of more than half of North America's plant species and a large proportion of the continent's animal species.

The NPS has a long history of giving special attention to species in trouble. In the early decades of this century, Yellowstone National Park and several other western parks helped to build up depleted populations of such animals as the bison (*Bison bison*), elk (*Cervus elaphus*), and pronghorn (*Antilocapra americana*). Protection of nesting and wintering trumpeter swans (*Olor buccinator*) at Yellowstone helped bring this species back from the edge of extinction. During the 1950's through the 1970's, the focus shifted to protecting and restoring gray wolves (*Canis lupus*) at Isle Royale National Park, grizzly bears (*Ursus arctos*) in Glacier and Yellowstone, and Hawaiian geese (*Nesochen sandvicensis*) at several of the Hawaiian parks.

With passage of the Endangered Species Act in 1973, the NPS intensified its



photo by Ted Simons

These red wolf pups were reared at Gulf Islands National Seashore in preparation for release at Great Smoky Mountains National Park.

efforts to inventory and protect Endangered species in the parks. Like all Federal agencies, the NPS is required by the Endangered Species Act to conserve Endangered and Threatened species and their Critical Habitats, and to avoid any actions that might jeopardize their survival. The NPS extends this responsibility to protecting Federal listing candidates and to State-listed and candidate species.

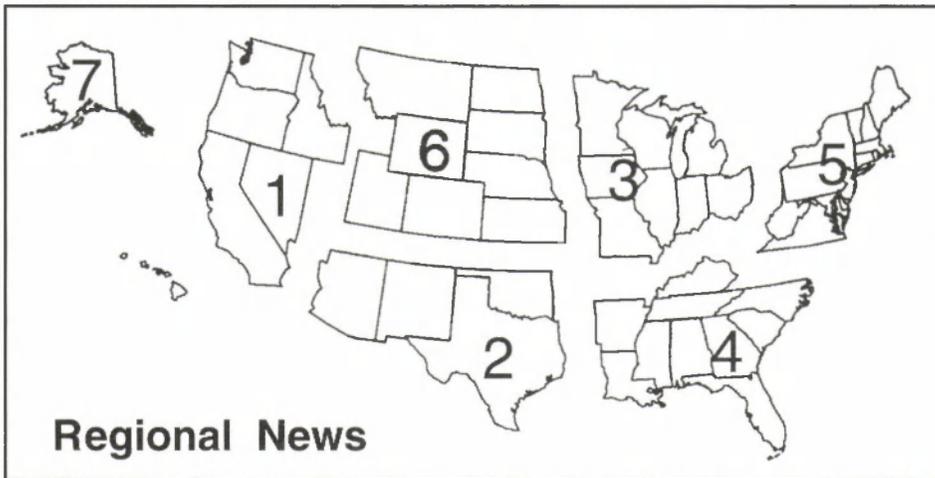
Endangered species protection fits well with the NPS mission. Native ecosystems and natural processes in parks are preserved to the extent possible. Natural areas are managed to control the adverse effects of human influence, which are a factor in the declines of many listed species. The NPS is also working with other

Federal, State, and local agencies to take whatever steps are available to minimize air and water pollution entering parks. Exotic, or non-native, species that are a clear threat to a parks native species are removed or suppressed wherever feasible.

Systemwide Inventory

The NPS initially focused its endangered species efforts on animals of special interest to the public in the parks, although many of the less conspicuous species, such as plants, clams, and fishes, also came under close scrutiny. However, in 1988, the NPS conducted a systemwide survey of Endangered and Threatened

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Regional News

Regional endangered species contacts have reported the following news:

Region 2 - Staff at the Aransas National Wildlife Refuge in Texas are con-

sidering live-trapping and relocating bobcats (*Felis rufus*) from the area where four whooping crane (*Grus americana*) chicks have disappeared. The recently discovered

carcass of a juvenile crane produced the first confirmation of bobcat predation on the species at the refuge. The FWS biologists are continuing air and ground searches for the other young birds, which were reported missing in late November and early December.

Within a few days of the first disappearance, biologists recovered the remains of a juvenile crane in a pile with a great blue heron (*Ardea herodias*) and an American widgeon (*Anas americana*), surrounded by bobcat tracks. Necropsies of the crane and duck at the National Wildlife Health Research Center in Madison, Wisconsin, identified predation as the cause of death. The Center is investigating other factors — such as high lead levels, brain cholinesterase, or disease — that may have predisposed the juvenile to predation.

It is unusual to lose so many young birds. No sick or physically impaired whooping cranes have been noted on aerial surveys. Since the refuge territories from which the birds disappeared are not connected, a transmittable disease simultaneously affecting a large number of birds in different locations seems unlikely. Because juveniles stay with their parents until the spring migration in April, the missing birds are probably dead. The objective of relocating bobcats would be to remove animals experienced in killing whooping cranes, since juvenile birds are naive about predators and depend on the alertness of their parents. A factor contributing to the loss may be that juveniles are ranging farther from parents to find food. The months of drought preceding last December's rains dried up coastal marshes that provide important crane staples, including shellfish and other invertebrates.

The peak count of whooping cranes wintering on the refuge this year was 143, including 16 juveniles. Two families that arrived with one chick each had not been counted during the 1993 spring surveys, when 45 pairs — a record number — nested on the species' Canadian breeding grounds.

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Region 1: California, Hawaii, Idaho, Nevada, Oregon, Washington, American Samoa, Commonwealth of the Northern Mariana Islands, Guam, and the Pacific Trust Territories. **Region 2:** Arizona, New Mexico, Oklahoma, and Texas. **Region 3:** Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. **Region 4:** Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Puerto Rico and the U.S. Virgin Islands. **Region 5:** Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia. **Region 6:** Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, Utah, and Wyoming. **Region 7:** Alaska.

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Progress Toward Recovery Leads to Reclassification Proposal for Unique Virginia Tree

The Virginia round-leaf birch (*Betula uber*), a species of tree endemic to the southwestern part of the State, has been listed since 1978 as an Endangered species. One natural population is known, and it numbers only 11 trees at last count. They are restricted to a narrow band of forest in the Cressy Creek floodplain, a site nearly surrounded by agricultural land. Since 1978, however, a cooperative recovery effort involving State and Federal agencies, arboreta, and private individuals has established 20 additional populations in the area. Several thousand seedlings also have been provided to botanical gardens and other institutions. Because the Virginia round-leaf birch is no longer believed to be in imminent danger of extinction, the Fish and Wildlife Service proposed December 6, 1993, to reclassify this species from Endangered to the less critical category of Threatened.

All 20 of the newly established populations, along with a portion of the single natural population, are on the Jefferson National Forest in the Mt. Rogers area. The U.S. Forest Service is actively involved in the management and protec-

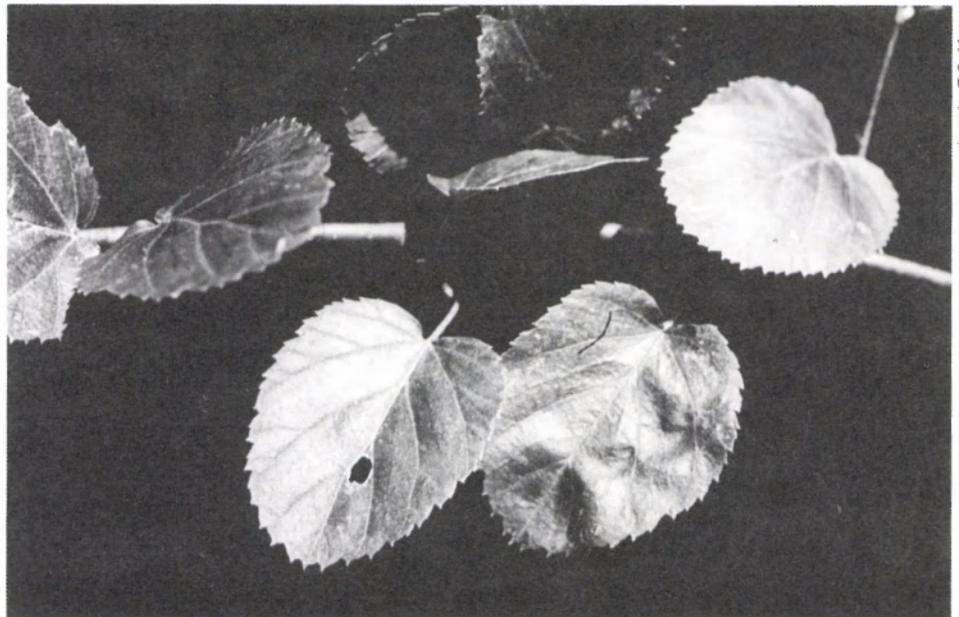


photo by F.G. Meyer

tion of these trees. Additionally, the Forest Service provides a public information exhibit at the site of the largest round-leaf birch. A ramp allows visitors a close-up view of the tree, which is enclosed within a protective fence.

With the dramatic population increase of over 1,400 subadult trees at 20 sites, the outlook for the Virginia round-leaf

birch has brightened considerably. But because of remaining threats from flooding, drought, competing vegetation, browsing animals, and vandalism, the species' future is not yet secure. The recovery program will continue until the round-leaf birch can safely be removed from Endangered Species Act protection.

Regional News

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Region 3 - Researchers from the Missouri Department of Conservation, the FWS, and other organizations spotted 1,707 bald eagles (*Haliaeetus leucocephalus*), 10 golden eagles (*Aquila chrysaetos*), and 7 unidentified eagles during the winter survey from January 3 to 7. At Eagle Bluffs, south of Columbia along the Missouri River in an area inundated during the 1993 flood, 42 eagles were standing on the ground around the edges of a "blue hole" created during the flood. Because no waterfowl or carrion were visible, the eagles were probably attracted to the site by fish trapped in the hole.

* * *

What do you do when 120,000 people are predicted to attend a fireworks show close to a building where nesting peregrine falcons (*Falco peregrinus*) are expecting young to hatch? If you are the FWS, the answer is to involve all interested parties, create public awareness, and develop a solution — in this case, an alternate fireworks display.

During the summer of 1993, a potential conflict between a July fireworks celebration in Cleveland, Ohio, and the needs of a pair of nesting peregrine falcons was resolved through cooperation among the FWS Reynoldsburg, Ohio, Field Office; the Ohio Division of Wildlife (DOW); management and marketing staff from Cleveland's Tower City Center (a metropolitan retail, office, and transit

building); the fireworks company; the City of Cleveland; other private companies; and public citizens.

When it became evident that the celebration, scheduled for July 2, might directly harm the nesting raptors and interfere with the expected hatching of their young on July 4 atop the Tower City Center, team members took action. They created a public relations campaign and developed an alternate fireworks show, cancelling plans to cascade fireworks down the side of the building and moving the launch sites to protect the birds.

In the weeks before July 2, biologists from the FWS and Ohio DOW helped

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Building Economic Incentives into the Endangered Species Act

by Hank Fischer, Bill Snape, and Wendy Hudson

Editor's note: As part of our effort to cover independent views on the endangered species program, we are publishing the following article prepared by Defenders of Wildlife:

Ever since environmentalism became a household word in the 1970's, many conservationists and economists have maintained a healthy suspicion of one another. But America's patron saint of conservation, Aldo Leopold, rejected the notion that economists and ecologists should be at odds. In defining an environmental ethic for the country in his 1949 classic, *A Sand County Almanac*, Leopold offered this suggestion:

"Examine each question in terms of what is ethically and aesthetically right, as well as what is economically expedient. A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise."

It is noteworthy — and certainly not accidental — that Leopold included economic

expediency as part of his environmental ethic. He recognized the limitations of government regulation in achieving environmental quality.

Conservation groups — including Defenders of Wildlife — have long supported a regulatory approach to the recovery of species on the brink of extinction. We have worked actively to establish effective recovery plans and to define scientifically supportable recovery standards. We have urged agencies to implement such plans and standards, and have filed lawsuits when we felt it necessary.

This regulatory approach to endangered species management has been largely successful on public lands, with modest impact on other land uses. As pointed out by a 1992 World Wildlife Fund study, of the approximately 74,000 endangered species consultations conducted by the U.S. Fish and Wildlife Service between 1987 and 1991, only 19 proposed developments or activities were blocked because of Endangered Species Act (Act) considerations.

It's undeniable that, in a handful of instances, endangered species conservation has had significant impact on other land uses, leading to what Secretary of the Interior Bruce Babbitt terms "train wrecks." But it's also irrefutable that, day in and day out, the Act continues to do what it does best: making development compatible with a diversity of life forms.

At the same time, the record of endangered species recovery on private lands points out the limitations of a strictly regulatory approach. Some Americans defend private property rights as vigorously as others champion the protection of endangered species. Progress with endangered species recovery on private lands will require approaches that do not constantly place these deeply held values at odds with one another.

A 1993 publication from the Natural Heritage Data Center Network pointed out how essential private lands are to endangered species conservation. It reported that approximately 50 percent of the 728 domestic species listed at the time were found exclusively on privately owned land. At least half the known occurrences of another 20 percent of the listed species were on private land. The conclusion is inescapable: no matter how well endangered species are protected on public land, we will fail in our efforts to conserve them unless we address endangered species management on private land.

Defenders of Wildlife first experimented with providing economic incentives to private landowners in the Northern Rockies in 1987 with a program that paid livestock producers at market value for all verified livestock losses to wolves. Since that time, Defenders' Wolf Compensation Fund has paid approximately \$12,000 to about a dozen livestock producers.

According to Dr. Steve Fritts, U.S. Fish and Wildlife Service wolf recovery leader for the northwestern United States, "Defenders' compensation program has re-

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RESTORING THE WOLF TO
YELLOWSTONE NATIONAL PARK

This evocative poster, featuring the work of Montana artist Monte Dolack, was produced by Defenders of Wildlife to raise money for its Wolf Compensation Fund. The proceeds reimburse ranchers for livestock losses to wolves in the northern Rockies and the Southwest. Printed on museum-quality paper with fade-resistant ink, the highly-colored poster measures 23 by 32 inches. It can be purchased by writing Defenders of Wildlife, 1101 Fourteenth Street NW, Suite 1400, Washington, D.C. 20005, or by calling 202/682-9400.

Economic Incentives

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duced animosity and made a major contribution to wolf recovery. For a relatively small cash outlay, it appears Defenders has increased cooperation and decreased the likelihood that wolves will be shot on sight."

In 1992, Defenders announced the initiation of a Wolf Reward Program that would pay \$5,000 to any private landowner who had wild wolves breed and successfully rear their pups on private land. The first award from this program was made in February 1994 to a landowner along Montana's Rocky Mountain Front (the geographical area where the northern Great Plains meet the Rockies). It was the first record of wolves denning in this area in more than 50 years.

Defenders' experimentation with economic incentives has brought us into contact with many of the nation's leading economists and endangered species experts. The depth and diversity of interest in economic incentives has been impressive. We have been nothing short of excited by the volume and quality of innovative, incentive-based ideas.

Our enthusiasm for these new concepts has led us to share them with the public and Congress. In early 1993, Defenders contacted many of the nation's leading national experts and asked them to write papers on how to build economic incentives into the Act. Fourteen authors responded, including resource economists, environmental leaders, State and Federal endangered species biologists, developmental interests, a State wildlife agency director, and a U.S. Fish and Wildlife Service regional director. The resulting report, *Building Economic Incentives into the Endangered Species Act*, was published in October 1993. We believe it is the most exhaustive work on this subject published to date. Interest in the publication was so high we had to reprint it within 90 days.

Congress is paying close attention to the incentives discussion. Bills to reauthorize the Endangered species Act offered in the last session by Senator Max

Baucus (D-MT) and Rep. Gerry Studds (D-MA) contain economic incentive provisions. According to Rep. Studds, "Endangered and threatened species do not recognize property boundaries. If we are going to be successful in bringing listed species back to health, we will clearly have to enlist the help of private landowners." Rep. Studds' bill (H.R. 2043) instructs the Secretaries of the Interior and Commerce to actively experiment with incentive approaches and report to Congress on the results. Such pilot projects provide the opportunity to test new methods without weakening existing regulatory protections.

Even the bills introduced by Rep. Billy Tauzin (D-LA) and Sen. Richard Shelby (D-AL), which contain elements opposed by many conservation groups, also contain interesting ideas for using incentives to protect endangered species. Both bills would allow private landowners who have species that are listed, proposed for listing, or candidates for listing proposals to submit conservation plans to Federal agencies. Upon approval, the cost of some private conservation activities could be reimbursed.

At the State level, California has been the trend-setter in examining incentive approaches. Conflicts between real estate interests and conservation of key habitats, such as coastal sage scrub, have intensified the need for finding solutions to the challenge of protecting endangered species on private land.

California is revising its own Endangered Species Act with an eye toward building economic incentives into the law. In late 1993, Gov. Pete Wilson hosted two roundtable discussions in California focused on improving both the State and Federal endangered species laws. Discussions about incentives dominated both meetings.

Defenders is working closely with a coalition of California conservation organizations called the California Biodiversity Alliance on incentives legislation. We believe California may provide a preview of how economic incentives can be incorporated in endangered species conservation.

Although it sometimes seems as if we have been debating endangered species issues forever, the current Federal law is a mere 20 years old. Society is only now taking its first steps toward devising a system that prevents the extinction of various life forms on earth. We are still investigating new techniques and exploring innovative approaches for making endangered species recovery more successful and more acceptable to all citizens.

Legal battles and confrontation dominated endangered species conservation during the first 20 years of the Endangered Species Act. The next major advances may come through incentives and cooperation.

Hank Fischer has been the Northern Rockies Representative for Defenders of Wildlife since 1977, and is the director of Defenders' economic incentives project. He has a long association with endangered species issues, particularly those involving wolves, grizzly bears, and black-footed ferrets. Bill Snape is Defenders' legal counsel on endangered species in Washington, D.C. Wendy Hudson is the coordinator for Defenders' watchable wildlife program in Portland, Oregon, and the editor of Building Economic Incentives into the Endangered Species Act.

The opinions expressed by the authors are not necessarily those of the U.S. Fish and Wildlife Service. Their article is part of an effort by the Bulletin to explore some of today's more challenging wildlife conservation issues by soliciting material representing independent viewpoints. If you would like to contribute by proposing an article, write the Editor, Endangered Species Technical Bulletin, U.S. Fish and Wildlife Service, 320 ARLSQ, Washington, D.C. 20240, or call 703/358-2166. See Bulletin Vol. XVIII, No. 4, for style guidelines, or request them from the Editor.

Defenders' special publication, *Building Economic Incentives into the Endangered Species Act*, is a 130-page report featuring papers from 14 of the nation's leading endangered species experts. To order, send \$10 (shipping and handling included) to Defenders of Wildlife, Northwest Regional Office, 1637 Laurel Street, Lake Oswego, Oregon 97034. For more information, call Hank Fischer at (406) 549-0761 or Wendy Hudson at (503) 697-3222.

The Peregrine Fund: Giving Wing to Recovery

by William A. Burnham and Jeff Cilek

Editor's note: Restoring a rare species is seldom an easy or straightforward task. Government agencies cannot do the job alone; the assistance of the private sector is often crucial for recovery to succeed. To help illustrate this point, we asked The Peregrine Fund — an organization that has worked extensively with the Fish and Wildlife Service — to provide an article on its activities to recover endangered birds.

The Peregrine Fund (Fund), a non-profit conservation organization, was founded in 1970 at Cornell University by then Professor of Ornithology Tom J. Cade to conserve birds of prey. The Fund has cooperated on projects in over 35 countries on 5 continents. Our biologists have participated in efforts to restore the peregrine falcon (*Falco peregrinus*), Mauritius kestrel (*Falco punctatus*), northern aplomado falcon (*Falco femoralis septentrionalis*), bald eagle (*Haliaeetus leucocephalus*), 'alala or Hawaiian crow (*Corvus hawaiiensis*), and California condor (*Gymnogyps californianus*). In all, the Fund has hatched and reared over 4,000 individuals of 22 raptor species, reintroduced 9 species, and conducted research on over 60 species.

Although the Fund's primary focus has been on raptors, we have also conducted research and conservation projects for neotropical migrant and resident songbirds, shrikes, and other non-raptor bird species. The World Center for Birds of Prey, established in 1984 in Boise, Idaho, is the headquarters for the Fund's global research, conservation, and education programs. It also shelters one of the largest collections of endangered birds of prey — more than 200 individuals representing over 10 different species.

The Fund also has a very active public education program, and we anticipate over 50,000 visitors a year at our new Velma Morrison Interpretive Center. Student education is supported through research opportunities and scholarships.

The Fund helped establish a masters degree program in raptor biology at Boise State University, the only such degree program in the world. Over 100 conservationists from throughout the world annually receive training from the Fund.

Peregrine Falcon

Many naturalists would argue that the peregrine falcon is the most dynamic of raptors, with tremendous dives of 200 miles per hour and an impressive defense of its home and young. The declining populations of this charismatic species led to the foundation of the Fund. At that time, breeding peregrines were extirpated east of the Mississippi River and the population had diminished by 80 to 90 percent in the West. Since then, with the cooperation of others, we have released over 3,700 peregrines in 28 States.

The peregrine falcon is making a good recovery, with about 100 pairs known in the eastern United States, 57 pairs known in the Midwest, over 100 known pairs in California, about 100 pairs in the Northwest (Idaho, Washington, Oregon, Montana, and Wyoming), and over 170 pairs known in Colorado and Utah. Additional releases are planned in Idaho, Oregon, Montana, Washington, and Wyoming for 1994 and 1995.

California Condor

California condors, with their wingspans of over 9 feet, are among our continent's most impressive birds. Ten thousand years ago, this species soared over much of North America. However, as the large, ice age mammals gradually became extinct, the California condor's food supply also declined. The birds eventually were restricted to areas along the Pacific Coast, where their diet included beached whales and seals. Shooting, poisoning, and loss of habitat decimated the condor population, which reached a low point of 22 individuals in

1983. (*Editor's note: the population has since been increased to 75 birds, including 66 in captive breeding flocks and 9 that have been released into the wild.*)

In November of 1992, at the recommendation of the California Condor Recovery Team, the Fish and Wildlife Service (FWS) selected the Fund's World Center for Birds of Prey as the site for the third California condor breeding facility. The other two facilities are located at the Los Angeles Zoo and the San Diego Wild Animal Park. Construction of the new Peter and Conni Pfendler California Condor Breeding Facility was completed last summer, and six pairs of condors arrived from the Los Angeles Zoo and the San Diego Wild Animal Park on September 23, 1993. (See *Bulletin Vol. XVIII, No. 4*.)

Young California condors raised at the World Center may someday be released in the Grand Canyon of Arizona, providing spectacular opportunities to view the largest bird in North America.

Aplomado Falcon

When Spanish explorers came to the grasslands of Texas, Arizona, and New Mexico, the aplomado falcon was part of the landscape. It perched atop yuccas and in the crowns of scattered trees that rose from the green and yellow prairies. The falcons sped on flashing blue-grey wings to chase the abundant birds thriving in the seed-grasses that brushed the bellies of the Spanish horses.

Unfortunately, the aplomado falcon population declined drastically by the early 1940's. The major cause appeared to be the loss of native grasslands resulting from changing land uses. Between 1977 and 1988, the Fund and cooperators were able to obtain permission from the Mexican government to collect aplomado falcon nestlings in southern Mexico for captive propagation. At the

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A Successful Year in the Recovery of the Aplomado Falcon

by Chris Perez and Phil Zwank

For the effort to recover the northern aplomado falcon (*Falco femoralis septentrionalis*), a bird of prey classified as Endangered, 1993 was a banner year. From June through August, 26 young birds were released on the Laguna Atascosa National Wildlife Refuge in southern Texas. This single year's record exceeded the total of 24 falcons previously released since the program began in 1985.

Laguna Atascosa was chosen because of its proximity to remnant aplomado falcon populations in Mexico. In addition, much of the refuge's 45,000 protected acres (18,200 hectares) is coastal prairie, which is similar to the native habitat the birds historically occupied in southern Texas.

The released aplomado falcons were young-of-the-year progeny of a captive flock maintained by The Peregrine Fund, a private conservation organization. When nestlings reached approximately 29 days of age, they were flown to the refuge and released through a process known as hacking. This technique, which has worked so successfully in peregrine falcon restoration, includes providing food and protection until young birds fledge and become independent. At the refuge, young birds were first placed in a large wooden box atop a 10-foot (3-meter) tower at one of two hack locations. After a week in the hack box, tarsal-mounted transmitters were attached to each bird and they were set free. While the released falcons became familiar with their surround-

ings, volunteers watched their progress from a blind near the hack tower and monitored their movements with radio telemetric receivers. Food was brought to the hack box until the young birds no longer returned.

In previous aplomado falcon releases, monitoring ended when released birds left the hack site or transmitters stopped functioning. This usually occurred within one month after release. This year, however, fledglings were recaptured after about 3 weeks and tarsal-mounted transmitters were replaced by tail-mounted transmitters with a battery life of about 6 months. These birds were monitored by staff of the New Mexico Cooperative Fish and Wildlife Research Unit, with funding from the FWS Corpus Christi, Texas, Ecological Services Field Office, Laguna Atascosa National Wildlife Refuge, and The Peregrine Fund.

Radio telemetry has provided data on survival, dispersal distances and direction, and the structural characteristics of habitats in which the birds chose to settle. Many of the released falcons have established residence on or near the refuge. Most are in coastal prairie along the refuge's western boundary.

It is not certain exactly how many of the released birds are still alive. We do know, however, that there have only been four confirmed mortalities. Coyotes and owls are suspected, but determining conclusively what caused the deaths is almost impossible.

In spite of the mortalities, we view the 1993 releases as a success. It remains to be seen, however, if these released birds will achieve the long-term goal of establishing a self-sustaining breeding population.

Chris Perez is with the New Mexico Cooperative Fish and Wildlife Research Unit, and Dr. Zwank is Unit Leader.



photo by Steve Bentsen

Aplomado falcon

Giving Wing to Recovery

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request of the FWS, the Fund has taken a leadership role in the species' restoration, and a captive breeding population has been established at the World Center for Birds of Prey.

The Laguna Atascosa National Wildlife Refuge, located near the southernmost part of Texas, was selected as the place in which to begin the restoration effort. However, the cooperation of ranchers to conserve the species on private lands will be important to ultimate success. One of the last known nesting sites of the aplomado falcon in the U.S. was near the wildlife refuge in the 1940's.

Twenty-six captive bred aplomado falcons were released the summer of 1993. (See accompanying article.) In 1994, we hope to release 30 to 35 more falcons at three sites on the refuge and one nearby site on private land. Long-term plans call for releasing 50 aplomado falcons a year for 10 to 15 years, moving westward from Texas into New Mexico, Arizona, and adjacent areas in Mexico.

Hawaiian Crow

The Hawaiian Islands are known as "the endangered species capital of the nation." They have more endangered and threatened plants and animals than any other State, and are home to 19 species of endangered forest birds.

One of these species is the 'alala or Hawaiian crow, of which only 12 wild and 11 captive individuals were known to exist in late 1992. That November, when the FWS asked the Fund to join the 'alala recovery program, we assembled a team of experts to assist. The Zoological Society of San Diego provided for the incubation of 'alala eggs collected from the wild and the rearing of young. Greenfalk Consultants undertook surrogate research on non-threatened corvid species in Idaho. The Fund coordinated these activities and accomplished the release of captive-hatched 'alala into the wild. Biologists with the FWS monitored the wild 'alala

and managed the overall program. Because the birds occur on private property, the participation of landowners has been critical.

Through these efforts, eight first-clutch eggs were gathered from three wild pairs of 'alala nesting on private ranches. From these eight eggs, six young were hatched and reared in captivity. Five of the young were released to the wild, while the other was sent to enhance the captive flock at the State's endangered species propagation facility at Olinda, Maui. In addition, two of the three wild pairs re-nested and hatched young. For unknown reasons, both pairs failed when their young were about two weeks old. One pair re-nested for a third time, and three eggs were removed after the adults abandoned the nest. Only one egg was fertile and hatched, and the young was later sent to the Olinda facility.

Five captive-hatched young were released into the wild in August 1993. (See *Bulletin Vol. XVIII, No. 3.*) Food was provided at the release aviary until late 1993, when the birds were fully independent of human care, successfully foraging for food, and evading predators.

As a result of this success and the extreme needs facing native Hawaiian forest birds, the FWS, State of Hawaii, and others have requested that the Fund cooperatively develop and operate a facility for the 'alala and other endangered birds on the Island of Hawai'i. Construction will begin in 1994.

Harpy Eagle

The harpy eagle (*Harpia harpyja*) is usually considered the world's most powerful eagle, and it is certainly one of the largest. Its talon is similar in size to the claw of a tiger. Harpy eagles occur in lowland tropical forest environments from Mexico to Argentina. As forest habitats have been altered, the species has greatly declined in Mexico and Central America, and populations are falling in South America as well.

We aim to conserve the harpy eagle and its tropical forest environments by (1) working cooperatively with Latin

American governments, organizations, and local people, and (2) by using the Gerald D. and Kathyryn Swim Herrick Tropical Raptor Building to develop captive breeding and release techniques to reestablish the eagle where suitable habitat remains. In the past 2 years, we have investigated the distribution of harpy eagles and their use of habitat in different geographical areas, locating 14 nests. We also examined human-caused mortality. Shooting and habitat destruction are now major problems for this species.

In cooperation with NASA and David Ellis of the FWS, we began following the dispersal of five juvenile harpy eagles in Venezuela, with satellites reading signals from radio transmitters carried by the birds. We are also expanding this cooperative effort to the Darien National Park of Panama. On a roughly monthly basis, we acquire activity data on these young birds from NASA tracking stations. We found that harpy eagles may have the longest rearing period among raptors. For more than a year after they are capable of flight, the fledglings stay within a small area near their nests and rely on their parents for food.

We had the opportunity to rescue juvenile eagles that had been removed from their nests and to salvage birds wounded by shooters. In Venezuela, we enlisted the help of loggers to successfully release a young eaglet whose nest they had destroyed to build a new road, and we were able to keep the bird in its original habitat until it was old enough to become self-supporting. Through cooperation with Latin American governments, six non-releasable birds have been loaned to our captive breeding center in Boise.

The Maya Project

The Maya Project, initiated in 1987, uses birds as an environmental focus for sustaining tropical forests and building local support for conservation. The 2.2 million-hectare project area in the contiguous border parks of Guatemala, Mexico, and Belize is one of the most important biotic reserves in Latin

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Giving Wing to Recovery

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America. Its ecologically diverse forests are critical for the conservation of native and migrant bird species. Our activities directly contribute to management and monitoring of the biological diversity in this large, mostly undeveloped area.

The predominant factor affecting viability of raptors is habitat alteration resulting from rapidly increasing human populations and a growing demand for fuel, fiber, food, and minerals. Survival of most wildlife will depend on its ability to adapt to highly modified environments or on our capacity to establish and maintain preserves of sufficient size and quality. The Maya Project is designed to yield information needed to address those problems.

The study uses raptors as indicators of the nature, complexity, and health of the entire ecosystem. Because many tropical forest raptors require a large undisturbed area to survive, their conservation pro-

vides an "umbrella of protection" for the entire ecosystem, helping to conserve other species of the forest.

In addition, the Maya Project studies neotropical songbirds — species that breed in the U.S. and Canada, and migrate south to winter in Latin America and the Caribbean. The past decade has witnessed growing concern for the well-being of neotropical songbirds. Many, if not most, of these species spend more time in the tropics than they do in their temperate breeding haunts. During the 1991 and 1992 field seasons, the Fund began a major new segment of the Maya Project—a large research effort designed to provide new information on the ecology and conservation needs of neotropical migrant songbirds in the three-nation project area. This constitutes the first detailed look at the importance of the Maya Biosphere Reserve as a wintering area for neotropical migrants.

In the Maya Project, members of the Fund work with Latin American field researchers, trainees, and graduate students.

Since the program began, more than 115 Latin American colleagues have received informal training, with some receiving even more years of involvement in field work. In addition, the Maya Project sponsors formal education. As a result, 18 Latin Americans administer the project and are heading research/conservation teams.

* * *

More and more we are separated from our natural world. But knowledge about nature helps people understand their relationship with the environment. Learning more about birds of prey enhances that understanding. The benefit we receive from the wild beauty of an eagle's flight, a falcon's dive, or the majestic soaring of a condor cannot be measured. Still, nature's inspiration and beauty help fuel the human spirit.

William Burnham is President of The Peregrine Fund and Jeff Cilek is Program Executive. For more information, write Mr. Cilek at The Peregrine Fund, Inc., World Center for Birds of Prey, 5666 West Flying Hawk Lane, Boise, Idaho 83709.

Final Rules

Final rules issued under the Endangered Species Act to reclassify one plant species and list two fishes as Endangered were published in December 1993:

Siler Pincushion Cactus (*Pediocactus sileri*)

A small globose or cylindrical cactus, this species has spines with black/purple tips when young and produces yellow flowers in the spring. It is endemic to parts of northwestern Arizona and southwestern Utah, where it occurs primarily on public lands administered by the Bureau of Land Management (BLM). The Siler pincushion was listed in 1979 as Endangered because of threats posed by livestock grazing, off-road vehicles, mining, road construction, and illegal collecting to the small number of known plants.

Recovery actions carried out in recent years by the BLM include developing a habitat management plan and conducting surveys for other populations. As a result, the status of the Siler pincushion has improved, although it is not yet secure enough to remove from protection under the Act. In recognition of the progress made toward full recovery, the Fish and Wildlife Service reclassified the Siler pincushion on December 27 from Endangered to the less critical category of Threatened.

Two Freshwater Fishes

Two species of freshwater fishes with restricted ranges were listed December 27 as Endangered:

- relict darter (*Etheostoma chienense*) - a small fish endemic to the Bayou du Chien drainage in western Kentucky.

- bluemask darter (*Etheostoma* sp.) - a smaller fish distinguished by the bright blue color displayed in breeding males. This taxon, for which a formal species description is being prepared, is endemic to the Caney Fork River system in central Tennessee.

Both darters are threatened by water quality degradation from a number of sources, including coal mining, gravel mining, and siltation caused by poor land use practices. Habitat has also been altered by impoundments and stream channelization.

Making the Best of Mother Nature: Managing the Puerto Rican Parrot After Hurricane Hugo

by Francisco J. Vilella and Ana B. Arnizaut

The Puerto Rican parrot (*Amazona vittata*) was once extremely abundant and widely distributed throughout Puerto Rico and its satellite islands. During the late 1800's and early 1900's, however, large scale deforestation eliminated most of the habitat upon which this species depends. By 1940, the parrot population had declined to about 2,000 individuals (Rodriguez-Vidal 1959), and was restricted to the rainforests of the Luquillo Mountains on northeastern Puerto Rico, mainly the area encompassed by the Caribbean National Forest.

Efforts to conserve the Puerto Rican parrot began in 1968 when a relict population of 23-24 birds was found in the upper elevations of the national forest. By August 1989, there were 45-47 parrots in the wild and 53 at the aviary in Luquillo. On September 18, 1989, however, Hurricane Hugo struck with sustained winds in excess of 150 miles per hour. Damage to parrot habitat was extensive.

Since 1990, both the Fish and Wildlife Service (FWS) and the Forest Service have been dedicated to restoring the wild population. After the storm, parrot surveys were conducted using canopy-level platforms. The network of canopy platforms has increased from fewer than 10 in 1988 to 40 in 1993. Parrot numbers also have grown consistently since the passage of Hugo. By September 1993, the wild population stood at 41 birds, or 91 percent of the pre-hurricane level.

Habitat and Population Management in the Wild

Puerto Rican parrots nest in tree cavities, and studies have suggested that the availability of suitable cavities may be one of the main factors limiting the species' recovery (Snyder et al., 1987). Since 1990, 47 cavities in palo

colorado (*Cyrilla racemiflora*) trees have been enhanced by Forest Service and FWS personnel. Cavities selected for this treatment were within or adjacent to active nesting territories and within areas where non-breeding pairs were observed searching for nest sites.

All of these cavities were initially unsuitable for parrot nests due to such characteristics as inappropriate cavity depths (too deep or too shallow), excess humidity, and inaccessibility to the cavity interior. Each cavity was evaluated and "improved" as needed to match the characteristics of the natural cavities used by nesting parrots (Snyder et al., 1987). Cavities were modified to suitable dimensions and drainage was provided for nest bottoms. Access doors were constructed to allow the inspection of cavity contents. The last additions were visors to divert rainwater, a perching vine, and camouflaging vegetation. These cavity improvements have contributed significantly to parrot recovery efforts since Hurricane Hugo struck the island.

Since 1991, 6 Puerto Rican parrot pairs have nested in the wild each year, the highest number since a study conducted in the 1950's (Rodriguez-Vidal 1959). It has been suggested that the recent record years were due to the environmental effects of Hurricane Hugo (Meyers et al., 1993). Now, we believe the fact that all parrot pairs have been successful and highly productive since 1991 may be due to several additional factors: (1) the composition of the surviving population, (2) the availability of improved natural cavities, and (3) the effectiveness of the nest management program.

During the 1993 breeding season, a potential seventh pair inspected another improved cavity in a palo colorado tree. Additionally, parrots are nesting in areas at lower elevations and using cavities in

tree species such as tabonuco (*Dacryodes excelsa*) that previously were not known to provide nest sites. However, these new breeding areas were sporadically visited by parrots before Hurricane Hugo and, consequently, before the cavity improvement program.

All of these new breeders are banded birds, and some even wear transmitters from a study conducted in the late 1980's. One transmitter was recovered from the base of a tabonuco cavity in 1992. This bird, a male, was found to have hatched in 1986 in the eastern section of the forest. It was recruited into the breeding population before its fifth year and was nesting less than a mile from where it fledged.

A number of the methods used to manage parrot nests were modified after Hurricane Hugo. One improvement was to better camouflage the nest observation blinds and equip them with large windows of one-way glass. Microphone systems placed inside the nests to monitor activities of the adults as well as their brood have been improved. Also, a commercial wood chipper is providing fresh nesting material, which is being used to reduce the humidity of parrot nests. High humidity can lead to hatching failure due to poor embryonic development or pathogenic microorganisms (e.g., *Aspergillus flavus*). Most important, nest guarding efforts are being allocated by addressing the particular needs of each breeding pair, rather than by trying to cover every nest every day.

The guarding of parrot nests — which includes monitoring of nesting behavior — has been employed as a management strategy for more than 20 years. It is used to detect potential problems and to schedule nest inspections and manipulations. Although some studies have argued that nest guarding should be

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Puerto Rican Parrot

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maximized to improve nesting success (Lindsey 1992), our data for the last 18 nests in 1991-1993 suggest that the intensity of these efforts is not necessarily directly proportional to nesting success. Six parrot nests during 1992-1993 were guarded 36 percent of the time, compared to 4 nests guarded 92 percent of the time before Hurricane Hugo (1987-1988). Nesting success was 100 percent for both post-hurricane years and 26 chicks were produced, more than twice the number produced before the storm. This suggests that increased nesting success and productivity can be achieved with a program that is smaller, yet better allocated and more cost effective.

Nest manipulations such as cross-fostering (where chicks from the aviary are placed into nests in the wild, and vice versa) are conducted during the brooding phase. The temporary placement of captive produced surrogate Hispaniolan parrot (*Amazona ventralis*) chicks in Puerto Rican parrot nests has been successful in reducing chick mortality and increasing nest success. The Hispaniolan parrot chicks take the place of the native parrot chicks until problems at the nest can be resolved and the young Puerto Rican parrots can be returned to their parents or fostered into another nest. Management of Puerto Rican parrot nests has been instrumental in mitigating problems that could have led to nest losses, such as the swarming of nest cavities by honeybees (*Apis mellifera*) and predation of parrot eggs and chicks by the pearly-eyed thrasher (*Margarops fuscatus*).

In 1993, the 6 wild breeding pairs of Puerto Rican parrots produced 13 chicks. One of these young birds was removed from the wild to increase genetic representation in the captive breeding flock, which is maintained at the Luquillo aviary. On the other hand, three chicks from the captive-breeding flock were placed into nests in the national forest. As a result, the 6 wild pairs fledged an all-time record of 15 chicks in the wild.

Managing the Captive Population

Captive propagation efforts for the Puerto Rican parrot began in 1972. This part of the recovery project has been expensive and slow, but a series of modifications to the management program and the aviary facilities were initiated in January 1992.

Information from a population genetics study (Brock and White 1992) helps guide managers in the optimal pairings of Puerto Rican parrots. A pair-bonding cage is used to assemble the targeted breeding pairs. In 1993, 13 genetically and behaviorally compatible pairs were set up for captive breeding. Out of these 13 pairs, 11 laid eggs, 9 laid fertile eggs, and 5 produced a total of 10 young parrots. Nine of the 10 young survived, an all-time record for the Luquillo aviary. Three of the nine parrot chicks produced at the aviary were fostered into nests in the national forest to join the wild population.

For the first time, captive breeding pairs at the aviary were supplied with a nest structure made of PVC material. These artificial nests are reusable and help to keep nesting females in a drier, more sterile environment. The nest entrance, the only part extending into the breeding cage, is covered with a "cap" carved out of coconut palm (*Cocos nucifera*). Also, breeding pairs were monitored by closed-circuit television, which allowed keepers to observe the parrots' breeding behavior while reducing disturbance. Nutritional and microbiology studies of both wild and captive parrots also are in progress.

Most important, during 1993, 6 pairs of captive Puerto Rican parrots were transferred to the Rio Abajo aviary — managed by the Puerto Rico Department of Natural Resources — to initiate a second captive breeding population.

A Challenging Future

The wild population has been increasing since 1991 at a rate of approximately 5 birds per year, about twice the growth rate during the pre-hurricane years of 1975 to 1989. We are extremely encour-

aged to see such a high rate of productivity just 4 years after the storm. The 22 chicks produced in 1993 by both wild and captive populations stand as evidence of the opportunities for recovery. But although the parrot population in the wild has demonstrated a high degree of resilience, it would be extremely difficult to restore from captive-produced birds alone if lost. Hurricanes are a fact of life in the West Indies, and we must strive to increase the abundance and distribution of the wild parrot population before the next storm arrives.

Francisco Vilella and Ana Arnizaut are with the Fish and Wildlife Service's Puerto Rican Parrot Field Office, P.O. Box 1000, Luquillo, Puerto Rico 00773.

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Listing Proposals — December 1993/January 1994

Nine species — four animals and five plants — were proposed by the Fish and Wildlife Service during December 1993 and January 1994 for listing as Threatened or Endangered. If the listing proposals are approved, Endangered Species Act protection will be extended to the following:

Two Puerto Rican Hawks

Two rare subspecies of hawks endemic to mountain forests on the island of Puerto Rico were proposed January 3 for listing as Endangered:

- **Puerto Rican broad-winged hawk** (*Buteo platypterus brunnescens*) — a small brown hawk with a black-and-white banded tail and rufous breast. An estimated population of only 124 birds is restricted to 3 areas: the Caribbean National Forest and the Río Abajo and Carite Commonwealth Forests.

- **Puerto Rican sharp-shinned hawk** (*Accipiter striatus venator*) — another small hawk with a dark gray upper body and heavily barred rufous underparts. A total population of about 155 birds is believed to remain in five forests: the Caribbean National Forest and the Maricao, Toro Negro, Guilarte, and Carite Commonwealth Forests.

The patchy distribution and low numbers of both hawks may be the result of the widespread deforestation that took place in Puerto Rico during the first half of this century. Despite the growth of secondary forests in recent decades, the hawks have not been observed in any of these areas. The birds are restricted to the remnants of mature montane forests that escaped the earlier logging. Any further logging or management practices that would diminish the quality of the remaining mature forests could jeopardize the hawks.

Other threats to the hawks include road construction connected with logging or recreation, human disturbance, and the danger of habitat damage from hurricanes. Additionally, biologists have documented the deaths of sharp-shinned hawk nestlings to parasitism by the warble fly (*Philornis* spp.). One study attributed approximately 60 percent of nestling mortality in the Maricao forest to the fly.

Three Puerto Rican Plants

Many of Puerto Rico's native plants also are vulnerable. Three species were proposed January 3 for listing as Endan-

gered. Their limited range and numbers put these plants in danger of extinction:

- ***Eugenia woodburyi*** — a small evergreen tree in the myrtle family (Myrtaceae). Only 45 individuals are known from 3 areas.

- ***Mitracarpus maxwelliae*** — a low, densely-branching, moundlike shrub in the coffee family (Rubiaceae). Just over 1,400 plants are found at a single site.

- ***Mitracarpus polycladus*** — a related perennial that branches from the base to form erect or spreading stems. This species occurs at two locations, one on Puerto Rico and the other on the island of Saba in the Lesser Antilles. Its numbers are difficult to estimate due to extreme drought conditions in recent years.

Except for *M. polycladus*, all populations of these species are restricted to semi-arid habitat found in the extreme southwestern portion of Puerto Rico. Privately owned land in this region is subject to intense pressure for agricultural and tourism development. Populations of all three taxa are also found within Guánica Commonwealth Forest, but both *Mitracarpus* species grow along infrequently used roads and could be vulnerable to increased traffic or road widening in the future. The sites are near areas that experience heavy recreational use.

Sacramento Splittail (*Pogonichthys macrolepidotus*)

Widescale habitat degradation led the FWS to propose listing the Sacramento splittail, a primarily freshwater fish native to California's Central Valley, on January 6 as a Threatened species. A relatively large fish, the splittail can exceed 40 centimeters (16 inches) in length. It is characterized by an elongated body, distinct hump, and small, blunt head with barbels at the corners of the mouth.

Historically, Sacramento splittail were distributed throughout the waters of the Central Valley, as far north as Redding on

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Puerto Rican broad-winged hawk

photo by James W. Wiley

Listing Proposals

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the Sacramento River and as far south as the present-day site of the Friant Dam on the San Joaquin River near Fresno. Recreational anglers reported catches of 50 or more splittail per day prior to the damming of these and other rivers. The fish was once part of the diet of Native Americans living in the valley.

Today, the Sacramento splittail no longer survives in most of its historical range. It declined as rivers were dammed, water was diverted for agriculture, spawning and nursery habitat was diked and drained, the water became polluted, non-native aquatic animals were established, and all of these factors were exacerbated by drought.

Splittail, which can tolerate some salinity, now are restricted to the Suisun Bay, Suisun Marsh, Napa Marsh, and the San Francisco Bay/Sacramento-San Joaquin Estuary. Even within this reduced range, the species' numbers have fallen more than 60 percent since 1984. Most of the problems that led to the original decline — especially freshwater diversions and increased water pollution from agricultural runoff, municipal effluents, and industrial chemicals — threaten the remaining populations.

Spruce-fir Moss Spider (*Microhexura montivaga*)

Also endangered by habitat degradation is the spruce-fir moss spider. This small arachnid is known only from a few sites in the southern Appalachian Mountains where — as its name implies — it inhabits mature spruce-fir forest communities. These forests are deteriorating rapidly due to air pollution and the infestations of an exotic insect.

The spruce-fir moss spider has a specialized habitat: moist but well-drained moss mats growing on rocks and boulders in well-shaded locations within high-elevation conifer forests dominated by red spruce (*Picea rubens*) and Fraser fir (*Abies fraseri*), a tree that itself is a candidate for listing. The spider requires situ-

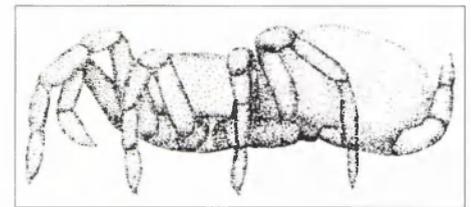


These dead Fraser firs are all that is left of a once productive forest on Roan Mountain, North Carolina. Acid precipitation and an introduced insect are believed to be the main causes for the decline of such conifer stands in the southern Appalachians. Forests like this provided habitat for the spruce-fir moss spider and the rock gnome lichen.

ations of high, constant humidity. Unfortunately, these conditions are changing as the forests decline.

Significant amounts of the high-elevation conifer forests in the southern Appalachians appear to be dying. At one site where the spider is apparently extirpated, the red spruce have lost up to 90 percent of their foliage, possibly due to acid precipitation. Also, spruce-fir forests within the spider's range have been decimated by the balsam wooly adelgid (*Adelges picea*), a pest insect introduced from Europe. The death and thinning of the forest canopy produces drastic changes in associated microclimates, including increased temperatures and decreased moisture. As a result, the moss mats become desiccated and cannot support the spider, and possibly its prey.

Four populations of the spruce-fir moss spider are known to remain. Three are within Great Smoky Mountains National Park near the Tennessee/North Carolina border, but they are very small. The only population considered viable is on private property in Avery and Caldwell Counties, North Carolina, and the landowner has expressed support for the proposed listing. Due to the species' precarious status, the FWS proposed January 27 to list the spruce-fir moss spider as Endangered.



Spruce-fir moss spider

Rock Gnome Lichen (*Gymnoderma lineare*)

Another sign that the high-elevation forests of the southern Appalachians are in trouble is the decline of the rock gnome lichen, a low-growing plant in the reindeer moss family (*Cladoniaceae*). This species occurs in North Carolina and Tennessee, and grows only in areas of high humidity — usually at high elevations, where the habitat is frequently bathed in fog, but also in deep gorges at lower elevations. Within these areas, it is limited primarily to intermittent seeps on rock outcrops and cliffs within forests dominated by red spruce and Fraser fir.

Like the spruce-fir moss spider, the rock gnome lichen declined as air pollution and exotic insects took their toll on the region's forests. Habitat became desiccated as the forest canopy thinned. In addition, lichens generally are very sensi-

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Listing Proposals

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tive to a wide range of air pollutants. Only 32 populations of the rock gnome lichen remain, and most occupy less than 1 square meter. Four of the populations contain 75 percent of the existing plants, and 3 sites are on land administered by the National Park Service and U.S. Forest Service that are subject to heavy recreational use. This disturbance is adding to the other problems facing the species. Accordingly, the FWS proposed December 28 to list the rock gnome lichen as Endangered.

Rock Cress (*Arabis perstellata*)

This rock cress, a perennial in the mustard family (Brassicaceae), is known only from Kentucky and Tennessee. It has a grayish appearance due to the large quantity of hairs on the stems and foliage. Each spring, new stems about 80 centimeters (31.5 inches) tall arise from a basal rosette produced the previous year. The inflorescence is an elongate raceme with numerous flowers containing pale green sepals and white to lavender petals. Rock cress colonies grow at moist sites on steep, wooded slopes with limestone outcrops.

There are two recognized varieties of *Arabis perstellata*: the small rock cress (*A. p.* var. *perstellata*), which occurs within three counties in Kentucky, and the large rock cress (*A. p.* var. *ampla*), known only from one county in Tennessee. These plants face habitat damage or loss due to residential, commercial, or industrial development; logging; grazing and trampling; and the spread of competing plants, especially the non-native European garlic mustard (*Alliaria petiolata*). Because of these threats, the FWS proposed January 3 to list both varieties of the rock cress as Endangered.

Endangered Species in the National Parks

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species on lands and in waters under its jurisdiction. The survey found that over 120 Endangered or Threatened species occurred or were suspected in more than 140 units of the National Park System.

Some listed species occur in many parts of the System. For example, the bald eagle (*Haliaeetus leucocephalus*) nests, migrates, or winters in 71 parks, while the peregrine falcon (*Falco peregrinus*) occurs in 59. But most listed species in the parks are very restricted; the survey found that 74 species occur in only one or two parks each. Some Endangered species are known to occur only in NPS areas, such as the Presidio manzanita (*Arctostaphylos pungens* ssp. *ravenii*), a large shrub, at Golden Gate National Recreation Area, California; the Lee pincushion cactus (*Coryphantha sneedii* var. *leei*) at Carlsbad Caverns National Park, New Mexico; the Shenandoah salamander (*Plethodon shenandoah*) at Shenandoah National Park, Virginia; and the Devils Hole pupfish (*Cyprinodon diabolis*) at Death Valley National Monument, California. Coastal parks in the southeast contain some of the highest numbers of listed species in the System. Everglades National Park and Canaveral National Seashore in Florida support more than any other unit in the continental U.S., with 15 and 14 listed species respectively.

Most parks on oceanic islands also contain Threatened or Endangered species. Native species on these islands are especially vulnerable to competition or predation by introduced species. The problem is acute in the Hawaiian Islands. Haleakala National Park, for example, has 15 listed species and Hawaii Volcanoes National Park has 12. Many plant species in these parks are candidates for listing, and in the State as a whole, 300-400 plant taxa are considered at risk of extinction.

NPS Management Actions

The Park Service takes a variety of measures to monitor, protect, maintain, and restore Threatened and Endangered

species in the parks. For example, the Big Bend National Park staff in Texas annually monitors the park's five known populations of the Chisos Mountain hedgehog cactus (*Echinocereus chisoensis* var. *chisoensis*) to document their condition and status. This Threatened plant numbers only 800 to 1,000 individuals, which occur in the park within a narrow band. Intensive livestock grazing before the park was established seriously degraded the vegetation and may have reduced the numbers of this taxon. Monitoring the populations will enable the NPS to determine if this variety is increasing in number now that livestock grazing has been prohibited in the area.

The NPS faces a different issue in protecting the Endangered Kentucky cave shrimp (*Palaemonias ganteri*), which occurs only in Mammoth Cave National Park, Kentucky. The population of this unique crustacean could be decimated if sewage seeps into the groundwater, which feeds the cave's subterranean streams. The park staff is working with local authorities to develop a regional sewage treatment system to prevent any such pollution.

Some situations call for the protection of Endangered species from predators. At Canaveral National Seashore in Florida, screens are put around the nests of Endangered loggerhead sea turtles (*Caretta caretta*), green sea turtles (*Chelonia mydas*), and leatherback sea turtles (*Dermochelys coriacea*) to prevent raccoons (*Procyon lotor*) from digging up the eggs. At turtle nesting beaches in Virgin Islands National Park, mongooses (*Herpestes* sp.), non-native mammals, are periodically trapped. In Haleakala National Park in Hawaii, rats (*Rattus* sp.), feral cats (*Felis catus*), and mongooses are live-trapped to protect nesting Hawaiian dark-rumped petrels (*Pterodroma phaeopygia sandwichensis*). Nearly the entire known population of this Endangered bird breeds in or near the park's volcanic crater.

Habitat management is another approach taken to protect listed species. Prescribed burning at Big Cypress National Preserve in Florida and Congaree Swamp National Monument in South

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Endangered Species in the National Parks

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Carolina compensates for the loss of natural fire cycles that maintained the open pine stands required by red-cockaded woodpeckers (*Picoides borealis*). At Milagra Ridge in Golden Gate National Recreation Area, California, the park staff has removed non-native pampas grass and replanted 200 acres (80 ha) with native grasses, two nectar-producing species, and the lupines and sedum upon which the Endangered mission blue butterfly (*Icaricia icarioides missionensis*) and San Bruno elfin butterfly (*Callophrys mossii bayensis*) lay their eggs.

Intensive management has been required to keep the Big Bend gambusia (*Gambusia gaigei*), a small fish, afloat. At one time, its population was reduced to a single female and two males, but this Endangered species has been restored to a safer level by captive breeding. It now survives in the wild in an artificial warmwater pond and two recently created ponds in Big Bend National Park, Texas. The warm water in the artificial pond, supplied from a nearby spring by a pump, protects the fish against the threat of cold weather. Constant vigilance is needed to prevent the possible introduction of fish species that would compete with or prey on the still vulnerable gambusia. A back-up population is maintained at the Fish and Wildlife Service's National Fish Hatchery in Dexter, New Mexico, and a few individuals are kept for research and back-up at several other institutions.

Sometimes human activities in the parks must be controlled. Research has shown, for example, that human disturbance is one of the principal factors in the decline of the piping plover (*Charadrius melodus*), a Threatened shorebird. Signs, ropes, and special regulations are used seasonally to restrict beachgoers at some plover nesting areas on Cape Cod National Seashore in Massachusetts, Assateague Island National Seashore in Maryland, and other coastal units where the plover breeds.

Each summer, Endangered humpback whales (*Megaptera novaeangliae*) feed in Glacier Bay National Park in southeast Alaska. In 1978, 17 of the 20 whales present



photo by J. Snyder

The careful use of prescribed burning is a management tool that can compensate for the suppression of natural fires, which once maintained the open habitat needed by some species. This burn at Big Cypress National Preserve in Florida was used to benefit the red-cockaded woodpecker.

abruptly departed, prompting the NPS to consult with the National Marine Fisheries Service (NMFS), which has Endangered Species Act responsibility for this rare marine mammal. Following NMFS's recommendations, the Park Service restricted the number of vessels entering the bay and prohibited close approaches to the whales. When cruise ship and tour boat operators objected to the regulations, the NPS began research on the whales. This showed that loud vessel noise or erratic vessel movement could indeed cause disturbance of whale feeding and social behavior. Regulations in place today limit the numbers and classes of vessels that can enter the bay in summer, establish vessel operating restrictions, provide a mechanism for designating restricted whale waters and vessel limits, and prohibit the harvest of certain species of fish and crustaceans that the whales eat. Researchers are continuing to study the movements and behavior of the whales in the bay.

Recovery Efforts

The NPS is involved in restoring species in many parks. Tennessee purple coneflowers (*Echinacea tennesseensis*) have been successfully planted at Stones River National Battlefield, Tennessee, and have increased their numbers. Peregrine fal-

cons have been hacked at Shenandoah, Isle Royale, Rocky Mountain, and other national parks across the country.

A new endeavor for the Park Service, in cooperation with the Fish and Wildlife Service, is the captive propagation of red wolves (*Canis rufus*). Gulf Islands National Seashore, Mississippi, is one of the island sites now used for captive rearing of these Endangered animals. Some of the red wolves raised at this site were transported to Great Smoky Mountains National Park on the Tennessee/North Carolina border. After an intensive public information effort by the Park Service and Fish and Wildlife Service, which found strong local interest and little opposition, releases of red wolf families into the park began. Several wolves died, but radiocollar monitoring has shown that the animals have found enough wild prey, seldom wander outside the park, and have taken only a few domestic livestock (for which the owners have been compensated). It is too early to predict long-term success, however. (For more background, see *Bulletin* Vol. XV, No. 6.)

NPS Activities in the Future

Although much is being done for Endangered plants and animals in the na-

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Protecting Endangered Species at Canaveral National Seashore

by John Stiner

To many people, the thought of Canaveral National Seashore conjures up images of long stretches of pristine beach or spectacular NASA shuttle launches. Not as well known is the fact that the Seashore contains one of the most productive inshore fisheries on the entire eastern seaboard, over 100 archeological sites, and the second largest number of federally-listed Endangered and Threatened species in the entire National Park System. Fourteen species of protected animals inhabit the 24,000-hectare (59,300-acre) park.

The best known resource management activity at Canaveral National Seashore is the "Night Stalker" sea turtle nest protection program. Between 3,000 and 4,000 sea turtle nests are recorded from the park's beaches each year. Over 90 percent of these nests are from loggerheads (*Caretta caretta*), with the remainder from greens (*Chelonia mydas*) and an occasional leatherback (*Dermochelys coriacea*). Before 1984, more than 95 percent of the nests were destroyed by raccoons, which dig up and eat the turtle eggs. Since that time, the park has initiated night patrols to search out the nests soon after the eggs are laid and cover them with wire mesh screens. This has reduced depredation to less than 20 percent. Last year, about 50 volunteers sacrificed sleep and braved the mosquitoes to donate almost 2,000 hours of labor to protect the nests.

Raccoon removal has been proposed as a solution to the problem. However, the National Park Service discourages single-species management, and the reduction of any im-



photo by David McEwen

Standing 3.3 feet (1 meter) tall, with a wingspan of 5 feet (1.5 m), wood storks are impressive birds. As they wade through muddy or vegetation-filled water, the storks use their massive bill to catch fish.

portant natural predator — such as the raccoon — could have unforeseen effects on the Seashore's ecosystem.

In January, the University of Georgia initiated a 2-year study to gather critical information on raccoon density, age and sex distribution, incidence of disease, seasonal movements, and diet. Also included were experiments on conditioned taste aversion, in which chicken eggs injected with estrogen were placed in the dunes to induce nausea in raccoons, and the implantation of Norplant birth control devices in mature females. These data will be used to assist management in developing a comprehensive long-range program of sea turtle nest protection.

The feral hog (*Sus scrofa*) is an unwelcome non-native predator at the Seashore. This alien species threatens a number of the Seashore's native protected animals. Voracious predators of snakes, the hogs may be harming the park's population of eastern indigo snakes (*Drymarchon corais couperi*), a subspecies already listed as Threatened, as well as other native reptiles and amphibians. Although it has yet to frequent the beach area of the park, the hog has caused major damage to sea turtle nests in areas just to the south. The danger to the Seashore's sea turtle nests is immense.

So far, the hogs have proven impossible to control. The Fish and Wildlife Service is trapping on the adjacent Merritt Island National Wildlife Refuge and in portions of the Seashore. More than 2,500 hogs were removed last year without any visible effect on the population. More stringent measures are being investigated.

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Endangered Species in the National Parks

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tional parks, there is room for improvement. The NPS intends to complete a more detailed inventory of endangered species in the National Park System, provide additional training to its employees on endangered species management and inter-

agency consultation procedures, contribute additional resources to implementing recovery plans for species found in national parks, and increase its efforts to inform scientists and other agencies about the work being done in the parks.

The NPS is committed to maintaining the biological diversity of the National Park System, including Threatened and Endangered species. Its role in protecting

and restoring listed species and their habitats will undoubtedly increase in importance as the number of listed species in the Nation increases.

Napier Shelton recently retired from the National Park Service, where he was a writer with the Division of Wildlife and Vegetation in Washington, D.C.

Canaveral National Seashore

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The smallest of the Seashore's protected species, the southeastern beach mouse (*Peromyscus polionotus niveiventris*), occurs at several locations along the 39 kilometers (24 miles) of dune line. In 1991 and 1992, it was detected north of its previously confirmed range. However, the beach mouse was not found in the northernmost section of the park, probably due to predation by feral cats and possibly competition with house mice (*Mus musculus*). The park is attempting to remove the cats, although they are constantly being replenished from the adjacent developed area. Trash receptacles have been redesigned to prevent raccoons and other animals from scattering litter, in an effort to reduce the likelihood of house mice infestations.

The Intracoastal Waterway, which runs along the western boundary of the park, is a major thoroughfare for West Indian manatees (*Trichechus manatus*) as well as boats. The State of Florida has implemented slow-speed zones in the Waterway to reduce the number of manatee deaths from boat collisions. The State is currently involved in a hotly contested battle over the length and location of these zones.

The presence of one slow-speed zone adjacent to the Seashore has encouraged boaters to detour through the park, threatening manatees using shallow areas adjacent to the Waterway. The park is working with State and county agencies to survey manatee use and distribution to identify critical areas that need speed restrictions.

Habitat Management

One of the most inconspicuous species within the Seashore is the Atlantic salt marsh snake (*Nerodia fasciata taeniata*), which occurs on the mangrove islands of Mosquito Lagoon. Much of this area was ditched and diked for mosquito control prior to the park's creation. This destroyed valuable salt marsh and, as the ditches filled in at the ends, ironically created additional mosquito breeding areas. The park is obligated by deed with the

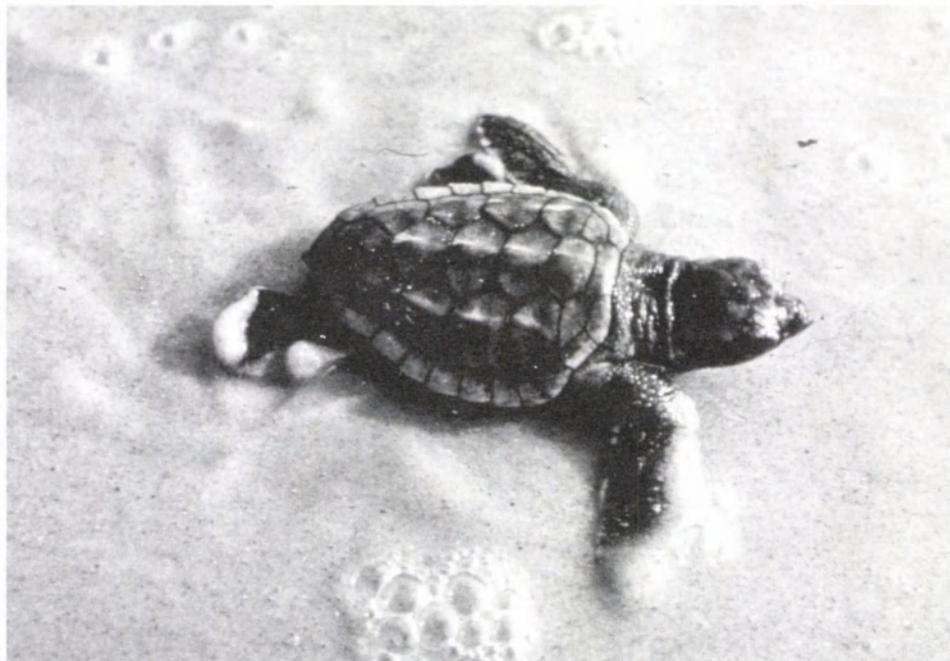


photo by David Goethie

Having thus far escaped predators, this loggerhead hatchling races for the water.

State of Florida to cooperate with the local mosquito control district in its efforts to reduce mosquitos in the most environmentally acceptable manner. Recently, a mosquito growth inhibitor (Altosid) was applied to over 4,000 acres (1,620 hectares) of potholes and ditches within the Seashore.

In consultation with Fish and Wildlife Service, the park is experimenting with Open Marsh Management techniques in highly disturbed (ditched and diked) areas to reduce the need for chemical use and to rehabilitate former marshes. Rotary ditching contours the old ditch networks to simulate natural tidal creeks, thereby enhancing habitat for species of fish that eat mosquito larvae. Salt marsh snakes have also been observed using the contoured ditches, burrowing into the banks and feeding on fish that frequent the ditches.

Another species that could benefit from improved ditching practices is the wood stork (*Mycteria americana*), a large wading bird that feeds on fish in potholes and ditches. Low earthen sills are being installed to prevent complete drainage of the potholes during low tide, which could result in the loss of important foraging sites. The presence of wading birds in ditched versus non-ditched areas will be monitored to determine the effects of Open Marsh Management.

The Seashore also is developing a Fire Management Plan that will allow the use of prescribed burns. The carefully managed use of fire is crucial to maintain habitat for such species as the Florida scrub jay (*Aphelocoma coerulescens*), which lives in open oak scrub. The bald eagle (*Haliaeetus leucocephalus*) also will benefit. A key factor limiting the recovery of the eagle population in the park and the Merritt Island Refuge is the small number of suitable nest trees. Eagles nesting at the Seashore will use only the largest tree in a clump of old pines. Abnormally high fuel loads resulting from past fire suppression policies could result in a large, uncontrolled fire and destroy these trees. A combination of mechanical fuel reduction and managed, low-intensity burns may be needed to protect these trees and maintain suitable eagle nesting habitat.

Other species requiring habitat that is burned periodically, particularly to maintain areas of bare sand, are the eastern indigo snake and a species of special concern, the gopher tortoise (*Gopherus polyphemus*). The tortoise is a keystone species whose burrow provides shelter for dozens of other species, including the indigo snake.

John Stiner is a Resource Management Specialist at the Canaveral National Seashore.

Restoring Endangered Species in Hawaii Volcanoes National Park

by Dan Taylor



photo by R.J. Shallenberger

The nene or Hawaiian goose is associated primarily with upland habitats rather than wetlands.

The unique animals and plants of the Hawaiian Islands represent an eminent example of adaptive radiation. A relatively small number of species made their way to the geographically isolated archipelago, colonized its wide variety of habitat types, and evolved into a diverse biota. The arrival of the first human settlers, however, initiated tremendous changes. People, together with the animals and plants they brought with them, have caused wide-scale alterations in the islands' array of ecosystems. Many of Hawaii's endemic species—especially the birds—have become extinct, and many of those that remain are rare and/or declining.

Hawaii Volcanoes National Park, situated on the island of Hawai'i (the "Big Island"), is well known for its spectacular volcanic eruptions. But it also contains important habitat for many rare native animals and plants, and can play an important role in their conservation.

Birds

The nene, or Hawaiian goose (*Nesochen sandvicensis*), the State bird of

Hawaii, has thus far escaped extinction. Unlike other geese, nene are slightly cumbersome fliers and, as terrestrial birds, they have only a mild penchant for wetlands. Fewer than 600 free-flying nene remain, and they are found on 3 of the State's 7 main islands: Hawai'i, Maui, and Kaua'i.

Nene populations were reduced by predation from introduced animals (primarily mongooses and feral cats), the decline of native food plants due to grazing and competition from introduced plant species, and the loss of natural habitat to agriculture and urbanization. These problems continue to make nene productivity in the wild extremely low. Some adults are killed every year along roadsides by motor vehicles, and we believe this is another significant loss of reproductive potential.

Since the species' decline, nene populations have been sustained by intensive husbandry. The State of Hawaii (Department of Forestry and Wildlife) and two units of the National Park System — Haleakala and Hawaii Volcanoes — maintain captive adult birds, which are used as breeders and/or

foster parents for captive-bred goslings. The State operates an advanced breeding facility on Maui, and donates some goslings to the parks for release in the wild. The parks maintain captive nene pairs in open-topped pens within wilderness thresholds to serve as foster parents for young birds. These young are donated by State brooders or are hatched by captive pairs. Birds that fledge in the pens then become free-flying and wild. Wild nene are also produce some young, but not enough to sustain the population.

Park management emphasizes enhancing backcountry feeding areas for the nene by regularly mowing large plots of senescent alien grasses to produce palatable sprouts. Managers also plan to develop more efficient predator control methods, enlarge and improve conditions inside the open-topped backcountry release pens, and make road corridors safer for nene. Our goal is to achieve a self-sustaining, free-flying population in an environment with manipulated refuges. Scientists from the United Kingdom Wetlands and Wildfowl Trust are advising the parks in this nene management and habitat enhancement effort.

Forest birds have proven a greater challenge to conserve. Most of Hawaii's original endemic forest bird species are now extinct. Some were overcollected early for their colorful feathers, and others have declined due to habitat loss and the effects of exotic species. Currently, there are 19 species of Hawaiian forest birds listed as Threatened or Endangered. The main threats to the survival of forest birds now are avian disease (especially malaria, which is borne by introduced mosquitos), degradation of forests by invasions of alien plants and animals (especially feral pigs), and direct losses of native forests to urbanization, agriculture, and fire. Four forest bird species once known in Hawaii Volcanoes National

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Hawaii Volcanoes National Park

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Park are listed as Endangered, and are now found only in neighboring forests.

Forest conservation is the basis for forest bird conservation. The park's main management effort is to control feral pigs and alien plants. In addition, the park and neighboring land managers are developing a regional forest management strategy for more than 20,000 acres (8,100 hectares) of native montane forest. To address another serious threat, National Biological Survey scientists are studying avian diseases.

Pelagic birds, like forest birds, are threatened because their terrestrial habitat is degraded. Hawaii Volcanoes National Park is visited by the 'ua'u or Hawaiian dark-rumped petrel (*Pterodroma phaeopygia sandwichensis*) and the 'a'o or Newell's Townsend's shearwater (*Puffinus auricularis newelli*), both of which come ashore to nest. They are threatened by disorientation from artificial lights, collisions with overhead wires, predators, and limited habitat. The park's protection strategy includes delineating nesting territories and trapping the non-native predat-

ors within them. Haleakala National Park on the island of Maui has demonstrated success in protecting both petrels and shearwaters.

The State of Hawaii has only two native raptors, the 'io or Hawaiian hawk (*Buteo solitarius*) and the pueo or short-eared owl (*Asio flammeus sandwichensis*). Both occur within Hawaii Volcanoes National Park. They are listed for protection (the hawk federally and the owl by the State), primarily because of habitat destruction and low reproductivity. Both have been able to maintain small populations because they have adapted somewhat to their changed environment. There are no specific plans for management of these birds in the park, but it is expected that the general programs for controlling alien plants and animals will benefit both species.

Sea Turtles

Hawksbill (*Eretmochelys imbricata*) and green (*Chelonia mydas*) sea turtles frequent the park's shores, but only the hawksbill nests here. Hawksbill sea turtles are among the most imperiled marine species. Threats to hawksbill survival in Hawaii include nest predation by mongooses and feral cats, disturbance of nest-

ing territory by people, and incidental take during fishing.

Turtles make their nests on only five or six beaches in Hawaii, and only two of these are within the park. Unfortunately, some people have not learned to share beaches with turtles. Gravid female turtles have been displaced by campers, nests have been contaminated by garbage and crushed by campers, and hatchlings have been disoriented by lights and campfires.

The park's protection efforts consist of intensive monitoring and exotic predator trapping at nesting beaches during the turtles' June-November nesting season. We have also relocated some camping sites to protect turtle nests from disturbance. Persons doing the trapping and monitoring (mostly volunteers) talk to beach-goers and can usually persuade them to modify their behavior if it threatens turtle nests.

Plants

There are 377 native vascular plant species in Hawaii Volcanoes National Park. Five are listed by the Fish and Wildlife Service as Threatened or Endangered, another 14 species are proposed for listing, and yet another 17 species are considered listing candidates (as of January 1994). They became rare after being eaten or trampled by feral ungulates, outcompeted by invasive alien plants, or burned in fires.

The park's protection strategy is to strengthen the native ecosystem by removing alien species, beginning first with ungulates. Non-native species are removed from a large area in order to promote recovery of an entire plant and animal community. This is usually followed by alien plant control, often in smaller units in which native plant communities are relatively intact and species diversity is highest.

Research workers and managers have started mapping the distribution and determining reproductive status and population sizes of some rare species in these units. This will provide the information base needed for managing individual species.

Dan Taylor is Chief of the Division of Resources Management at Hawaii Volcanoes National Park.



photo by Linda Pratt

***Kokia drynarioides*, an attractive but rare tree in the mallow family (Malvaceae), has palmately lobed leaves and large red flowers. Although this species is not known to have occurred naturally within Hawaii Volcanoes National Park, it is endemic to the Big Island, and the Park shelters a transplanted colony.**

Endangered Species Conservation at Big Bend National Park

In western Texas, along the United States/Mexico border, the Rio Grande abruptly changes course, sweeping to the northeast after flowing south and southeast for almost one thousand miles. This large arc gives the region its name, the Big Bend. At the river's very turning point lies Big Bend National Park, which boasts a rich variety of habitats — desert, river floodplains, grasslands, and mountains — in a preserve nearly the size of Rhode Island.

Big Bend National Park is home to a number of plant and animal species protected under the Endangered Species Act. Representatives of this group include the peregrine falcon (*Falco peregrinus anatum*), Big Bend gambusia or mosquitofish (*Gambusia gaigei*), black-capped vireo (*Vireo atricapillus*), Mexican long-nosed bat (*Leptonycteris nivalis*), and Chisos Mountain hedgehog cactus (*Echinocereus chisoensis* var. *chisoensis*). Another species, the Mexican wolf (*Canis lupus baileyi*), no longer occurs in the Big Bend region, but is receiving increasing attention because of possible reintroductions in other parts of its range.

Peregrine Falcon

This remarkable bird of prey was well-distributed in the U.S. until the 1950's, when it began to suffer a severe decline. Contributing factors included shooting, illegal captures, and habitat loss or disturbance, but the main cause was the increasing use of the pesticide DDT. This chemical inhibits calcium metabolism in raptors, resulting in thin eggshells that break prematurely. Most uses of DDT are now prohibited in the U.S., but the pesticide is still applied in some countries.

Big Bend has had moderate success in restoring its falcon population by protecting eyries from disturbance during the breeding season. Sections of several trails in the Chisos Mountains and along the Rio Grande canyon rims are closed at these times, and river runners are limited

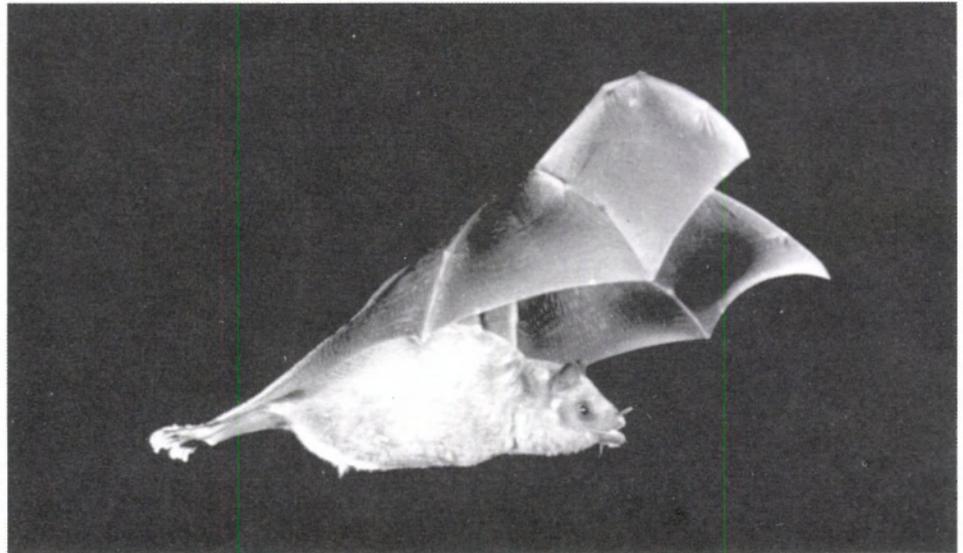


photo by Merlin D. Tuttle, Bat Conservation International

Instead of insects, the Mexican long-nosed bat feeds on the highly caloric nectar and protein-rich pollen of certain cacti and agaves. Its long muzzle and tongue allow the bat to reach deep into the flowers.

to non-motorized craft. Fifteen peregrines fledged in 1991, eight fledged in 1992, and six fledged in 1993.

Big Bend Gambusia

The Big Bend gambusia, or mosquitofish, is a small fish restricted to a warm spring pond system near Rio Grande Village in the southeastern section of the park. It is not only extremely limited in range but also is highly adapted to local habitat conditions, which makes this species extremely vulnerable to fluctuations in water quality, quantity, and temperature. At one time, the population was reduced to one female and two males held in captivity. To ensure the species' future, the artificial refugium was modified to receive piped-in warm water on a day-to-day, year-round basis.

The gambusia population is now stable in the refugium and in two other warm water spring ponds in the area. Park personnel regularly monitor the habitats. Continued threats to the species include proposed campground expansion, floods on the Rio Grande (which could allow invasion of the pond by competing or predatory fish species), and anglers transferring fish to the gambusia habitats.

Captive populations of the Big Bend gambusia are maintained at the Fish and Wildlife Service's Dexter National Fish Hatchery in New Mexico and the University of Texas at Austin as a precaution against extinction of the wild population.

Black-capped Vireo

The black-capped vireo is a summer resident of Big Bend, where it is found in brushy canyon areas. Aside from habitat loss, one of the biggest threats this species faces is brood parasitism by the brown-headed cowbird (*Molothrus ater*), which is known for its reproductive strategy of laying eggs in the nests of other bird species. Cowbirds often lay their eggs before the vireo clutches are completed, and their eggs hatch sooner. By the time the vireos do hatch, the cowbird nestlings are larger and more competitive, and the vireo parents raise them as their own. Sometimes cowbirds will even "kick out" the vireo eggs. This behavior has obviously led to reduced reproductive success of vireos.

In 1987, the same year the black-capped vireo was listed as Endangered, Big Bend National Park initiated a study

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Big Bend National Park

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of the park's population. Since the studies began, vireo numbers have fluctuated between 12 and 16, and their nest locations vary from year to year. Brown-headed cowbirds were trapped for 5 years, but efforts to correlate taking of cowbirds to fledging success of vireos were not conducted. For now, vireos are being monitored annually to determine population status and reliable breeding areas. Black-capped vireos also nest at scattered locations in central Oklahoma, central and western Texas, and northern Mexico.

Mexican Long-nosed Bat

As its name indicates, the Mexican long-nosed bat is primarily a Mexican species. Its sole known roosting site in the U.S. is a cave near Emory Peak in the Chisos Mountains. The bats migrate south through Mexico and into Central America. One of this species' distinctive features is its long tongue, which at 3 inches (75 millimeters) almost equals its entire head and body length, and is an adaptation to feeding at flowers. The diet of these small bats consists mostly of nectar, but they also ingest pollen, which is rich in protein.

There is an apparently close interdependence between these bats and their

food plants. Annual bat migrations seem to be associated with the times that agaves and cacti flower in certain areas. The plants benefit, too; long-nosed bats are important pollinators of some cactus and agave species. In Big Bend, the bats rely almost exclusively on the flowers of agaves, including the well-known century plant (*Agave harvardiana*).

The long-nosed bat was once very common in Mexico, but recent surveys have revealed massive population declines. In Big Bend, 10,650 bats were counted in 1976, yet during 1980-1984 only 1,000 were estimated each year. Several factors have contributed to this severe loss, including the undeservedly poor public image many bats still have, which leads to incidents of vandalism and mass killing at roost sites. Perhaps the biggest problem, however, is the intensive harvesting of wild agaves in Mexico by "moonshiners" for the small-scale production of tequila and other alcoholic beverages. This practice has resulted in a loss of food sources along the bats' migratory routes, a serious problem when one considers that the high metabolic rate of this mammal requires it to feed very frequently.

Annual population counts are needed to assess the species' local status in Big Bend, but typical bat censusing techniques have several major drawbacks. One method of counting bats is to set up a video camera at the opening of a known roosting cave and visually record the flight of the bats when they leave the cave. However, unlike some other bat species, *Leptonycteris nivalis* tends to leave and re-enter a cave several times before leaving the roost site to feed, making visual counts questionable. Long-nosed bats also share their roosting caves with other bat species, making census accuracy even more difficult.

Even if the roosting site at Big Bend is protected, efforts are needed in Mexico to curtail the destruction of bats and agaves if the species is to recover.



National Park Service photo

The Chisos Mountain hedgehog is a small, barrel-shaped cactus with deep green to bluish-green stems, and produces attractive red, white, and fuchsia-colored flowers.

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Big Bend National Park

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Threatened and Endangered Plants

One rare plant unique to Big Bend National Park, the Chisos Mountain hedgehog cactus, was listed in 1988 as Threatened. It grows amid sparse Chihuahuan Desert vegetation on alluvial flats near the Chisos Mountains, the local range from which the plant takes its name. Severe overgrazing prior to World War II eliminated most of the native short grass cover, which may have altered the preferred habitat conditions for establishment of Chisos hedgehog cactus seedlings. Recovery of overgrazed desert rangelands is a slow process, and some desert plant communities never return to their former composition.

Park biologists and resource managers monitor the cactus population, and con-

duct surveys prior to such activities as road maintenance and trail construction. In 1989, 10 specimens were removed from the shoulder of one park road and sent to the Chihuahuan Desert Research Institute in Alpine, Texas, for propagation. The rescued plants were scarred to produce extra stems, and up to 350 cuttings have been rooted. However, because the offsets were produced clonally, they have the same genetic makeup. The original plan was to transfer them to the park, but genetic swamping of the natural population has become a concern. Methods for how at least some of the rooted cuttings can be reintroduced are under review.

Chisos Mountain hedgehog cacti, like all plants in the park, are protected. They may not be collected without a permit, although "cactus rustling" remains a threat. Other cacti listed as Threatened

that are found in the park include the bunched cory cactus (*Coryphantha ramillosa*) and Lloyd's mariposa cactus (*Neolloydia mariposensis*).

Several other plants in the park are candidates for listing under the Endangered Species Act. Recent field studies have addressed the status, distribution, and reproductive biology of such species as the little-leaf brongniartia (*Brongniartia minutifolia*), which belongs to the pea family (Fabaceae); tall paintbrush (*Castilleja elongata*), a plant in the family Scrophulariaceae; Guadalupe fescue (*Festuca ligulata*), a member of the grass family (Poaceae); and Chisos agave (*Agave glomeruliflora*).

Material for this story was provided by Carol Benzing, Interpretive Park Ranger, and Michael Fleming, Environmental Protection Specialist, at Big Bend National Park.

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arrange construction activities — for example, mounting launching sites, television cameras, and mirrors for the laser light show. During late June, July, and August, the Tower City Center used a closed circuit camera and two TV monitors, provided by a local company, to show customers the nesting peregrines and, finally, their two chicks.

The fireworks celebration incorporated images of flying falcons in the laser show. At one point in the program, the Cleveland orchestra played a lullaby, while tens of thousands of people, taking on the role of peregrine caretakers, sang for the soon-to-hatch falcons.

* * *

A meeting between the FWS Bloomington, Indiana, Field Office and the Office of Surface Mining to discuss how the pending Federal listing of the northern copperbelly water snake (*Nerodia erythrogaster neglecta*) might impact Indiana's coal mining industry resulted in the decision to develop a habitat

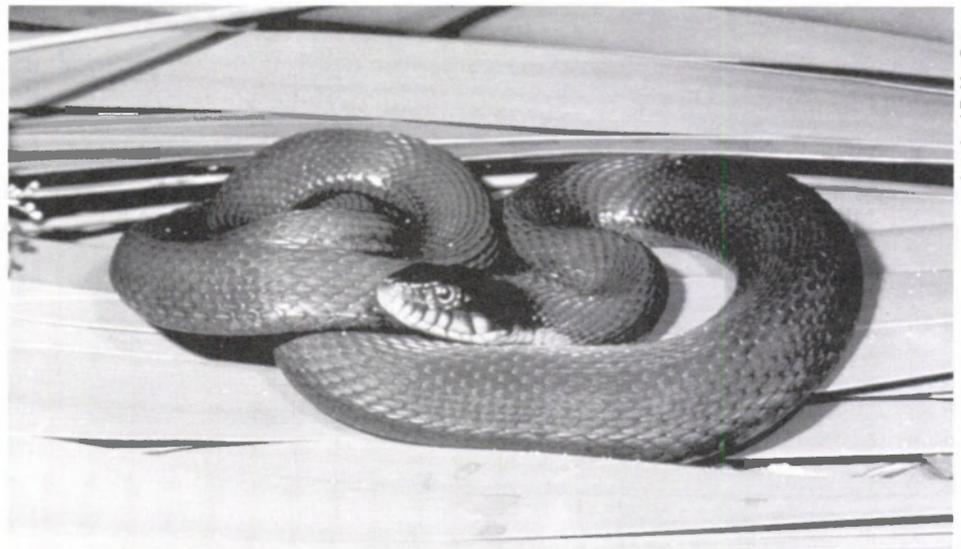


Photo by J.R. MacGregor

The northern copperbelly water snake is the subject of a habitat conservation plan to be developed with coal mining interests in Indiana.

conservation plan. The snakes live in lowland swamps or other warm, quiet waters and use upland woods as winter hibernation sites.

* * *

The Minnesota Department of Agriculture is conducting a voluntary landowner herbicide use agreement program to protect federally listed plant species. The program focuses on establishing no-

use buffers around plants such as the Minnesota dwarf trout lily (*Erythronium propullans*), prairie bush clover (*Lespedeza leptostachya*), western prairie fringed orchid (*Platanthera praeclara*), and Leedy's roseroot (*Sedum integrifolium* var. *leedyi*). Funded as a pilot by the Environmental Protection Agency, the program has the

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Regional News

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support of Region 3 and the Minnesota Department of Natural Resources.

* * *

Region 4 - Despite their discovery of two new occurrences of the Tar spiny mussel (*Elliptio steinstansana*) in 1993, biologists with the North Carolina Wildlife Resources Commission and the FWS regard this mussel as one of the most critically endangered North American species. Named for the Tar River system in eastern North Carolina, where it is endemic, the Tar spiny mussel is one of only three species of freshwater mussels in the world with spines. Biologists found the 1993 specimens in Little Fishing Creek and Shocco Creek, two small tributaries.

The Tar spiny mussel is believed to have existed historically throughout much of the Tar River system. By 1985, however, habitat deterioration resulting from sedimentation and water pollution dramatically reduced the species' numbers and range, and it was listed as Endangered. By 1990, the species was rarely found. At that time, only one reproducing population, restricted to Swift Creek — another small tributary — was known to survive.

Biologists consider the newly discovered population in Little Fishing Creek relatively healthy, based on the evidence of recent reproduction from shells found in muskrat middens. However, the population is known to occur only within a short reach of this small creek, making it vulnerable to any habitat alteration or degradation. The other new record is a single specimen, also collected from a muskrat midden, in Shocco Creek. Portions of the creek have been degraded severely in recent years.

* * *

Region 5 - Biologists searching for remnant populations of the once-widespread American burying beetle (*Nicrophorus americanus*) increased the knowledge of this secretive insect but added only one area to its range:

McCurtain County, Oklahoma, adjacent to known habitat.

The American burying beetle is known to occur only in Rhode Island, Massachusetts (in a small reintroduced population), several counties in eastern Oklahoma, a nearby part of Arkansas, and two counties in Nebraska. Several of the county occurrences are represented by a single or few specimens.

Biologists conducted the 1993 surveys in selected localities in Maine, Massachusetts, Pennsylvania, New Jersey, North Carolina, Arkansas, Mississippi, Ohio, Oklahoma, and Nebraska. Despite the surveys in 10 States within the historic range of the species, no new areas (aside from the one county) were added to the current range.

The American burying beetle has been federally protected since July 1989, when the magnitude of the species' decline became apparent. Says FWS biologist Michael Amaral, "We haven't unlocked the mystery yet of just what caused the reduction in numbers. This is still an enigma, but we think several factors relating to habitat alteration and its effect on both food availability and competition for limited food (carrion) resources are responsible."



photo by Christopher Rathel, Rhode Island Department of Fish and Wildlife

One of nature's most efficient recyclers, the American burying beetle eats carrion, converting animal protein to soil nutrients. Historically distributed in 35 States, the District of Columbia, and 3 Canadian provinces, this insect declined drastically in number and range even before the widespread use of DDT. Carrion availability may determine where the species can survive today; changes in land use have reduced its food supply (small-to-medium birds and mammals) and increased the competition for carrion, a limited resource. There is also speculation that even the extinction of the once ubiquitous passenger pigeon may have had a ripple effect on the status of the beetle.

Measuring 1-1/2 inches in length, this species is the largest of the North American carrion beetles. It has a black "patent-leather" body complemented by bright red-orange scallops. After burying the remains of a chipmunk or dove, the beetle strips the fur or feathers and coats the carcass with secretions to preserve it.



photo © Richard Biggins

The Tar spiny mussel is a freshwater mollusk endangered primarily by sedimentation and water pollution from a variety of point and non-point sources. This photo was taken in Sandy (Swift) Creek, Nash County, North Carolina.

BOX SCORE LISTINGS AND RECOVERY PLANS

Category	ENDANGERED		THREATENED		LISTED SPECIES TOTAL	SPECIES WITH PLANS
	U.S.	Foreign Only	U.S.	Foreign Only		
Mammals	56	251	9	22	338	37
Birds	73	153	17	0	243	73
Reptiles	17	63	18	14	112	30
Amphibians	6	8	5	0	19	9
Fishes	62	11	39	0	112	62
Snails	12	1	7	0	20	26
Clams	50	2	6	0	58	40
Crustaceans	11	0	2	0	13	4
Insects	17	4	9	0	30	15
Arachnids	4	0	0	0	4	0
Plants	352	1	82	2	437	178
TOTAL	660	493	190	38	1,386*	474**
Total U.S. Endangered	660	(308 animals, 352 plants)				
Total U.S. Threatened	194	(112 animals, 82 plants)				
Total U.S. Listed	854	(420 animals, 434 plants)				

* Separate populations of a species that are listed both as Endangered and Threatened are tallied twice. Those species are the leopard, gray wolf, grizzly bear, bald eagle, piping plover, roseate tern, chimpanzee, Nile crocodile, green sea turtle, and olive ridley sea turtle. For the purposes of the Endangered Species Act, the term "species" can mean a species, subspecies, or distinct vertebrate population. Several entries also represent entire genera or even families.

** There are 377 approved recovery plans. Some recovery plans cover more than one species, and a few species have separate plans covering different parts of their ranges. Recovery plans are drawn up only for listed species that occur in the United States.

Number of CITES Party Nations: 120

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