

ENDANGERED *Species* BULLETIN

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The Endangered Species Act gives the Fish and Wildlife Service a responsibility breathtaking in scope: nothing less than restoring our Nation's imperiled plant and animal species to a secure status and conserving the ecosystems upon which they, and all of us, depend. Many of these species have been declining for decades or even centuries. A few benefit right away from the Act's legal protection. For most, however, the road to recovery is a long one, filled with obstacles and uncertainty. Many animals, for example, require years of research, captive breeding and reintroduction, the removal of competing non-native species, and wide scale ecological restoration for recovery. Significant progress in stabilizing and restoring listed species is being made, as this edition of the Bulletin illustrates.



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On the Cover

Robust gray wolf populations in the upper Great Lakes area and a successful wolf reintroduction in the northern U.S. Rocky Mountains prompted a recent proposal to reclassify wolves in most of the U.S. from endangered to the less critical category of threatened.

Corel Corp. photo

The Endangered Species Bulletin welcomes manuscripts on a wide range of topics related to endangered species. We are particularly interested in news about recovery, habitat conservation plans, and cooperative ventures. Please contact the Editor before preparing a manuscript. We cannot guarantee publication.

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Restoring Our Wildlife Legacy



Bald eagle
Corel Corp. photo

Recovery of endangered species involves many scientific and societal challenges. The continued success of our recovery program in meeting these challenges will require research, innovation, partnerships, sufficient resources, and time.

Focusing this edition of the *Bulletin* on the Fish and Wildlife Service's endangered species recovery program is appropriate when we consider the significant accomplishments achieved over the past year. A fitting place to begin is the delisting of the American peregrine falcon (*Falco peregrinus anatum*) in 1999. Recovery of the peregrine across North America epitomizes what is typically needed to bring a species back from the brink of extinction. Protection of this magnificent bird and its habitat under the Endangered Species Act (ESA), research, environmental restoration, and captive breeding and reintroduction required a commitment by numerous agencies, organizations, and individuals for more than 25 years. Similar cooperative efforts were needed to recover two other bird species proposed for delisting in 1999, the bald eagle (*Haliaeetus leucocephalus*) and Aleutian Canada goose (*Branta canadensis leucopareia*).

We met another important recovery milestone on July 13, 2000, when we proposed to reclassify the gray wolf (*Canis lupus*) in the lower 48 states from endangered to the less critical category of threatened (except for wolves in the southwest, which remain endangered). Gray wolves once ranged over most of the lower 48 but were nearly eliminated by eradication efforts that spanned more than 200 years. By the time the gray wolf was listed as an endangered species in the conterminous U.S., its breeding range had been reduced to a small corner of northeastern Minnesota and Isle Royale, Michigan. Recovery efforts have since restored the wolf in two key areas, the Rocky Mountains and the western Great

Lakes region, and reintroduction efforts are underway for the Mexican gray wolf (*C. l. baileyi*) in the southwest. A key factor in the success of the wolf program involved the adoption of a flexible management strategy that controlled problem wolves preying on domestic livestock. The depredation of livestock by wolves is a learned behavior, and removing those few wolves in a population that have learned to kill livestock promotes the recovery of the remaining population that relies on native prey, such as deer and elk. Restoration of the gray wolf is just one example of how using the flexibility of the ESA to apply adaptive management can be effective in achieving recovery.

Incentives and Partnerships

The recovery of listed species cannot be accomplished solely on our national wildlife refuges, national forests, national parks, and other federal lands; many species occur primarily or solely on private lands. Achieving recovery for most threatened and endangered species therefore requires cooperative conservation efforts on private lands. The Service is committed to enhancing opportunities for private landowners to participate in the conservation of imperiled species. Over the past year, we have initiated two important programs to help meet this challenge. In June 1999, we finalized our "Safe Harbor" policy, setting in motion a program to provide regulatory assurances to non-federal landowners who voluntarily implement measures that contribute to the conservation of listed species. Safe Harbor agreements eliminate landowners' concern that



"Wolves are a living symbol of the regard Americans have for things wild," said Interior Secretary Bruce Babbitt recently. "We as a people have made the choice to do the right thing and bring these animals back from the brink of extinction. We have weighed the cost of saving an irreplaceable part of our world and found it to be worth our effort."

Corel Corp. photo

restoring habitat and allowing the return of listed species to their property might result in future land use restrictions under the ESA.

The ESA Landowner Incentive Program, also initiated by the Service in 1999, provides financial assistance to private property owners that are interested in starting conservation projects for listed, proposed, and candidate species. After only two years in operation, the program has provided funding for over 57 projects on private lands across the nation. Ranchers, farmers, and other landowners, in cooperation with the Service and other partners, will use these funds to implement conservation actions benefitting a wide variety of species. Our ability to provide targeted technical and financial assistance to private property owners through the ESA Landowner Incentive Program has generated new and

important recovery opportunities while gaining the support of landowners.

Over the past year we cultivated many new recovery partnerships. For example, a new national partnership was forged when we signed a Memorandum of Understanding with the Center for Plant Conservation in June 2000 at the World Botanic Gardens Congress in Asheville, North Carolina. Founded in 1984, the Center is supported by a consortium of 29 botanical gardens and arboreta throughout the United States. With approximately one out of every 10 plant species in the United States facing potential extinction, the Center is the only national organization dedicated exclusively to conserving rare U.S. plants. The expertise and resources provided by the growing network of recovery partners like the Center will be essential to for restoring

the more than 1,200 listed plant and animal species in the U.S.

Reintroductions

The ability to propagate threatened and endangered species in controlled environments for later release into the wild continued to grow during the past year, resulting in major contributions to species recovery. Our national fish hatcheries, fish technology centers, and fishery assistance offices play a critical recovery role in producing, stocking, and developing new aquacultural techniques for threatened and endangered aquatic species. As of July 2000, there are 43 listed aquatic species (fish, freshwater mussels, and amphibians) being held in national fish hatcheries, where Service biologists are investigating methods for species propagation or are already producing individuals for release into the wild. An increasing



The Oregon silverspot is just one species that is being propagated in zoos for reintroduction into the wild.

Photo by Paul Opler

number of zoos and aquariums have propagation/reintroduction programs for many listed species, such as the Wyoming toad (*Bufo hemiophrys baxteri*), Puerto Rican crested toad (*Peltophryne lemur*), Karner blue and Oregon silverspot butterflies (*Lycaeides melissa samuelis* and *Speyeria zerene hippolyta*, respectively), desert fishes, and American burying beetle (*Nicrophorus americanus*). An added benefit of these recovery projects is the ability to educate millions of zoo and aquarium visitors about endangered species.

The reintroduction of listed species, which is promoted under a special provision of the ESA, has become an increasingly important recovery tool. Section 10(j) of the ESA allows us to reintroduce species as “experimental populations” into specific areas of their historic range while providing increased management flexibility. This flexibility often involves exempting certain activities that would normally be prohibited with listed species, resulting in reduced regulatory burdens and greater community support for reintroduction. So far, we have established experimental populations for 12 species. Some of these, like the California condor (*Gymnogyps californianus*), Mexican wolf, red wolf (*Canis rufus*), and black-footed ferret (*Mustela*

nigripes), were on the brink of extinction and were being maintained only in captive breeding facilities before they were reintroduced back into historical habitats. One of the best known and most successful experimental populations to date involved the reintroduction of the gray wolf into Yellowstone National Park and central Idaho in 1995. In 2000, we will complete plans for several additional experimental populations, including one for the grizzly bear (*Ursus arctos*) in the Selway-Bitterroot Wilderness in Idaho and Montana and another for the black-footed ferret on the Cheyenne River Sioux Reservation in South Dakota (the species’ seventh experimental population).

Recovery Planning

Recovery plans provide the comprehensive recovery strategy for a listed species, including a prioritized list of conservation measures needed to identify and address threats, reverse declines, and achieve recovery. Over the past year, we’ve made significant progress in improving our recovery planning process. In 1999, we began a collaborative effort with the Society for Conservation Biology to conduct a comprehensive review of our recovery plans. The Society selected more than 180 plans for in-depth analysis and is expected to complete its evaluation in 2001. We expect that this study will provide us with valuable information to improve the efficiency and effectiveness of our recovery plans. We continue to increase the integration of state-of-the-art conservation biology, ecosystem management, and innovative restoration actions into our recovery plans and are expanding the use of multi-species plans. In accordance with our 1994 policy on recovery planning, we are broadening the participation of stakeholders in the preparation of virtually every new plan. Many recovery teams drafting new plans now have members that bring unique perspectives and expertise to the recovery effort, such as private landowners, representatives from

local communities, agricultural organizations, corporations, water management agencies, public utilities, and conservation organizations.

The Road to Recovery

We continue to make steady progress in the recovery of listed species. However, some critics of the ESA disagree with this assessment and claim that the law has failed because we have not delisted many species due to recovery. Although we have delisted only 11 species so far due to recovery, this number alone is neither an accurate nor fair measure of our success. The recovery of critically imperiled plants and animals is one of our nation's most difficult natural resource challenges. In many cases, restoration activities must reverse declines that have occurred over centuries. Years of scientific research, restoration, protection, and active management are generally needed to achieve successful recovery. For many listed species, it will take a minimum of 50 to 100 years before their survival is secure. This is especially true for species that need a decade or more to reach sexual maturity and have high juvenile mortality, such as sea turtles, or those that have a naturally low reproductive rate, such as grizzly bears.

Since enactment of the ESA, only seven species have been removed from the list of threatened and endangered species due to extinction. Some of these species, such as the blue pike (*Stizostedion vitreum glaucum*) and Santa Barbara song sparrow (*Melospiza melodia graminea*), were probably extinct prior to being listed but were added to the list in the hope that some survivors might be found. Preventing the extinction of the remaining 98 percent of listed species is perhaps the ESA's biggest success. Indeed, a recent independent scientific analysis¹ suggests

¹ "Choosing the Appropriate Scale of Reserves for Conservation," Mark W. Schwartz of the Department of Environmental Science and Policy, University of California-Davis, in *Annual Review of Ecological Systematics*, 1999.



that without the protection and recovery programs of the ESA, 192 species might have become extinct between 1973 (when the ESA was passed) and 1998.

While recovery takes time, we are seeing tangible results. A steady number of listed species are moving from the status of declining to stable or improving. We anticipate preparing several additional delisting or downlisting actions due to recovery in the coming year. These include species like the Gulf Coast population of the brown pelican (*Pelecanus occidentalis*), the Douglas County population of the Columbian white-tailed deer (*Odocoileus virginianus leucurus*), and the Tinian monarch (*Monarcha takatsukasae*).

Growing challenges that face the Service's recovery program will require innovative approaches, expanded use of partnerships, and increased funding if we are to increase the progress achieved so far and ensure a future for all listed species.

Charlie Scott is Chief of the Branch of Recovery and Delisting, Office of Consultations, HCPs, & Recovery, in the Service's Arlington, Virginia, headquarters.

Habitat conservation, restoration, and protection are restoring the Missouri bladderpod (*Lesquenella filiformis*) and other plants to a more secure status.

Photo by Jim Rathert/Missouri Department of Conservation

by Joanna Behrens and
John Brooks

Wind In Their Wings: The Condor Recovery Program



Photos by Scott Frier/Nikon Inc.

The California condor (*Gymnogyps californianus*) once soared over much of the North American continent. Its range extended from British Columbia, Canada, down the Pacific coast to central Mexico, across the southern United States, and up the Atlantic coast to New York. During the Pleistocene Epoch, which ended about 11,000 years ago, this scavenger dined on the carcasses of mastodons, giant sloths, primitive horses, and other megafauna of the time. As these species became extinct, the giant birds switched to bison, elk, and deer. With the advance of settlers, the condor added cows and sheep to its diet, but its numbers declined as the human population increased. People decimated and poisoned their food sources, strung power lines across flight paths, and occasionally shot condors just for sport. It is estimated that 600 condors existed in the wild in 1890. By 1982, however, that number had plummeted to 22, and the extinction of this magnificent bird was on the horizon.

The California Condor Recovery Program was established in 1975 to reverse this alarming decline. The condor program is a cooperative, multi-agency effort with the U.S. Fish and Wildlife Service as the lead agency; cooperators include the U.S. Forest Service, Zoological Society of San Diego, Los Angeles Zoo, California Fish and Game Department, Peregrine Fund, and Ventana Wilderness Society. The goal of the recovery program is to establish two separate wild populations of 150 individuals, each with at least 15 breeding pairs.

The captive rearing program began with the removal of a chick from the

wild in 1982. At that point, the species' total population was only 22 birds. Disaster struck in 1985 with the disappearance of six wild condors, including four members of the last five known breeding pairs. With only a single breeding pair remaining, the Fish and Wildlife made the controversial decision to capture all remaining wild condors for safety and captive breeding. AC9, the last free-flying condor, was trapped in 1987 and transported to the San Diego Wild Animal Park.

Thus began an odyssey that has met with unanticipated success. The captive condors began producing chicks as early as 1988. In 1992, when the first efforts to reintroduce condors to the wild began, the total population of California condors (all in captivity) stood at 63. As of April 2000, there are a total of 157 condors, 62 of which soar once again over the mountains and canyons of California and Arizona. Ninety-five California condors are being held to produce chicks for future release into the wild.

As the recovery program works towards its goal of establishing two separate wild populations, the number of release sites has grown. There are now three active release sites in southern California managed by Hopper Mountain NWR Complex, one in central California managed by the Ventana Wilderness Society, and two in Arizona administered by The Peregrine Fund.

Although captive California condors have proven that they will breed successfully in captivity, the recovery program has been plagued with other difficulties. In the early years of the reintroduction, for example, five condors died after collisions with power

lines. Experts worked to address this problem and made several changes in the rearing methods. Among the most successful was the initiation of a power pole aversion training program for all condors scheduled for release. This training involves the use of a mock power pole placed inside the flight pen where the young condors are kept prior to release. The power pole emits a small electrical charge whenever a condor attempts to land on it. Young condors quickly learn to avoid perching on these poles and move on to natural perches. This program has greatly reduced condor mortalities from power line collisions.

Lead poisoning historically was a problem for condors and continues to be a serious concern. At least three condors died due to heavy metal poisoning in the 1980s. W5, a captive-bred condor released in 1995, was recaptured in 1998 after exhibiting extreme signs of illness. Blood tests revealed the highest blood lead levels ever recorded in this species. Condors will feed on any dead animal that is shot and left behind, or on gut piles from field dressed game, which can contain bullet fragments. Strong stomach acids break the shot down into lead salts, which are absorbed into the bloodstream. The digestive tract then becomes paralyzed and starvation results. As part of the condor recovery program, hunters are being encouraged to bury all gut piles and to use nontoxic bullets when they become available. A new bullet non-toxic to wildlife has been developed; it is composed of tungsten and tin but has the desirable ballistic properties of lead. It should be on the market within about one year.

A more perplexing problem is the attraction that some condors have to human activity and housing areas. As captive-bred birds return to the species' ancestral roosting sites, they often find that people have taken over their habitat. With no wild parents to show them how to behave, these juveniles often settle in on roof tops and balco-



A juvenile condor prepares to take flight

nies, risking the dangers of close contact with humans. As the birds reach breeding age, some biologists speculate that this behavior may disappear. Perhaps the rigors of raising their own chicks will better occupy their time. This season, biologists have observed pair bonding behavior for the first time since condors were reintroduced into the wild. Time will tell if the aging and breeding processes will alleviate the undesirable behaviors that bring the birds into close contact with humans. On the other hand, some biologists fear that the misbehaving birds will influence the behavior of newly released birds and perpetuate the problem.

With breeding in the wild just around the corner, it should not be too long before we can evaluate the success of another step in the California Condor Recovery Program.

Joanna Behrens is a Field Biologist at Hopper Mountain NWR and John Brooks is the refuge's Information and Education Specialist.

Lead Poisoning a Continuing Threat

After this article was written and the *Bulletin* approached press time, word arrived that the problem of lead poisoning continues to plague the California condor. This summer, five of the condors that had been released into Arizona died of lead toxicity after apparently feeding on one or more animal carcasses containing lead shotgun pellets. In response, biologists with The Peregrine Fund temporarily captured the remaining 16 condors for testing and treatment. Most of the recaptured condors did turn out to have high lead levels. After successful chelation treatments to remove the lead, the condors are being re-released. The source of the poisoning is unknown but biologists hope that this episode will prove to be an anomaly. We will have more information on the impacts of lead toxicity in a future edition of the *Bulletin*.

Return to the Wild

by Jane Hendron



Photos by Scott Frier/Nikon Inc.

Since its inception in the 1970s, the California Condor Recovery Program has faced repeated challenges, controversies, and setbacks, but it remains focused on one goal: reestablishing healthy, self-sustaining populations of California condors (*Gymnogyps californianus*) in the wild. This spring, high atop a ridge in the Los Padres National Forest's Sespe Condor Sanctuary, the recovery program ushered in a new chapter in its effort to secure the future of the California condor when it released one of the founding members of the captive-breeding flock back into the wild.

The female condor, identified as AC-8, was captured in 1986 in Kern County, California, and taken to the San Diego Wild Animal Park. After her capture, AC-8 was paired with AC-5, another original member of the breeding flock. The pair produced nine offspring. Two of AC-8's chicks were released to the wild in southern California, while the remaining offspring carried on her genetic line as part of the permanent captive-breeding population. AC-8 has not produced any additional fertile eggs since 1995, and staff at the Wild Animal Park's Condor Project suspect that she is now beyond breeding age. Although no one knows her exact age, she may be about 40 years old. The Fish and Wildlife Service and the Condor Recovery Team determined that AC-8 should be allowed to return to the wild to live the remainder of her time as a free-flying condor.

On March 28, 2000, AC-8 was flown by helicopter from the Los Angeles Zoo to a temporary enclosure in the Sespe Condor Sanctuary. Two captive-bred

juvenile condors that were being released to the wild were placed into the enclosure with her. On April 4, the door to the enclosure was opened and AC-8 took to the sky for the first time in 14 years. The two younger condors were released at the same time.

AC-8's return to the wild is more than a sentimental nod in recognition of her years of service to the recovery program; it is an opportunity for captive-bred, reintroduced condors in the southern California population to interact with a wild, adult condor and to learn important skills necessary to survive in the wild. Greg Austin, Deputy Project Leader for the Service's Hopper Mountain National Wildlife Refuge Complex in Ventura, California, hopes that AC-8 "will do what she used to do and that the young birds will encounter her." But he acknowledges that her role as a mentor is not guaranteed. "Some of these birds will catch up to her," says Austin, "but we don't know what will happen as a result."

What recovery program biologists hope is that AC-8 will function as a guide bird for reintroduced condors inhabiting the mountains of southern California, teaching the young birds proper behaviors and leading them to historical roosting, feeding, and watering sites. AC-8 can no longer help her species in a breeding role, but as a potential mentor for young, inexperienced condors, she can help these reintroduced birds successfully adjust to life in the wild.

According to Austin, AC-8 was taking two-hour flights around the Sespe within four days of her release; after six days, she left the Sespe and biologists temporarily lost track of her. When refuge biologists reestablished contact with her, she was foraging in the Tehachapi Mountains in Kern County, close to the area where she last lived as a free bird.

Fifty-nine California condors now fly free in the wild, 34 in California and 25 in Arizona. It has been about 40 years since there were this many condors in the wild, but seeing condors in their natural habitat remains a hit-or-miss prospect, one often involving difficult hikes into rugged backcountry. However, people will soon have a better opportunity to observe these magnificent birds. This spring, the San Diego Wild Animal Park became only the second institution in the world to have California condors on display for public viewing. (In 1997, the Peregrine Fund's World Center for Birds of Prey in Boise, Idaho, became the first institution to place condors on display since the bird was listed as endangered in 1967.)

The Wild Animal Park's "Condor Ridge" exhibit focuses on native North American wildlife, with the endangered California condor as the centerpiece species. According to Mike Mace, Curator of Birds at the Wild Animal Park, "the exhibit will not only educate the public, it's also a functional unit of the captive-breeding program." The aviary will allow mature, non-releasable birds to interact socially with juveniles,

helping the young birds prepare for the time when they reach sexual maturity and are incorporated into the captive-breeding program. With more than 1.8 million visitors annually, Mace says "Condor Ridge will help keep the recovery program in the forefront."

Other species in the exhibit for which the Service is involved in restoration efforts include thick-billed parrots (*Rhynchopsitta pachyrhyncha*), northern aplomado falcons (*Falco femoralis septentrionalis*), black-footed ferrets (*Mustela nigripes*), and desert bighorn sheep (*Ovis canadensis*). Mace says the exhibit emphasizes the partnerships involved with conducting endangered species recovery programs and illustrates the importance of all species, regardless of their status.

The California Condor Recovery Program still has a long way to go, but thanks to the many partners in the effort, the future of this magnificent bird looks brighter all the time.

Jane Hendron is an Information & Education Specialist in the Service's Carlsbad, California, Office.

To learn more about the condor and ongoing recovery efforts, check out the websites of some of the partners in the California Condor Recovery Program:

U.S. Fish and Wildlife Service:
www.fws.gov

Zoological Society of San Diego:
www.sandiegozoo.org

California Department of Fish and Game:
www.dfg.ca.gov

Arizona Game and Fish Department:
www.gf.state.az.us

Los Angeles Zoo:
www.lazoo.org

The Peregrine Fund:
www.peregrinefund.org

Ventana Wilderness Sanctuary:
www.ventanaws.org

AC-8 flies to freedom in the wild.



Fire on the Mountain

by Nora Murdock



Mountain golden heather

Photo by E. LaVerne Smith/USFWS

In the spring of 1816, pioneering botanist Thomas Nuttall made an arduous 3,900-foot (1,190-meter) climb up to the rim of a deep gorge in North Carolina. From the rocky, windswept ridge, he could see for miles in all directions as the horizon stretched away into the misty mountains that would later be called the Blue Ridge.

The vegetation of the rocky ledges where he stood was sparse. In fact, the French botanist Andre Michaux had visited the same vicinity in 1794 and described it as “very barren.” Among the few plants that braved the elements on this desolate summit was a tiny, golden-flowered shrub only 6 inches (15 centimeters) tall. Nuttall knew it was something he had never seen before. Two years later, he described the plant as a new species and named it *Hudsonia montana*. It came to be known by the common name “mountain golden heather.”

A century and a half later, this amazing little plant still clung to existence in the same place where Nuttall found it. Despite intensive searches by many botanists, no other populations had been found. All of the plant’s habitat was within a federally designated Wilderness Area in the Pisgah National Forest of North Carolina. Surely, under these circumstances, life would be secure for the golden heather.

However, the opposite appeared to be true. In fact, the numbers of plants dropped so low that, by the 1960s, the species was reported to be extinct. More intensive searches in the 1970s by The Nature Conservancy, the U.S. Fish and Wildlife Service, the U.S. Forest Service, and others revealed a small number of survivors in colonies scattered along the gorge rim. We took immediate action to list the plant as threatened and desig-

nated Critical Habitat for the species. The North Carolina Department of Agriculture soon gave the plant state protection as well. Nevertheless, it continued to decline. One problem was that the wilderness area where the mountain golden heather grows is spectacularly beautiful and very popular, being within a short drive of several major cities. Visitation is extremely heavy, and the use of signs or artificial barriers is restricted under official wilderness regulations, a situation that makes it very difficult to control habitat destruction caused by human overuse. The fragile habitat occupied by mountain golden heather was in danger of being unknowingly trampled by a public that was loving the area to death.

In addition, biologists discovered that the Critical Habitat designation, including the required maps published in local newspapers, was actually contributing to the plant’s decline. The local Forest Service office reported that numbers of people who had never before visited the gorge appeared the day after the newspaper publication with the published maps in their hands, inquiring about the best route to the remote site where the plants grew. Mountain golden heather had never been known as a target for collectors, and was not offered for sale in any native plant catalogues, but plants began to disappear from the wild.

Biologists found that the holes where plants had been dug were carefully refilled with soil and covered over again with leaf litter so that no one would be the wiser. If not for the fact that all the plants had been individually marked and mapped in permanent monitoring plots, the thefts would have gone undetected. The population at the type locality eventually declined to only two reproducing plants.

In addition, biologists studying the species suspected another factor in its decline: fire suppression. Although wildfires were probably never common in the mesic forests of the southern Appalachian Mountains, these forests do contain pockets of more fire-prone habitats, such as the rocky rims of steep gorges. The highly effective fire suppression efforts of the past half-century have virtually prevented catastrophic forest fires, but they have also eliminated smaller fires from open areas within the forest that once burned on a routine basis. Although these once-open sites have now been closed in by heavy tree and shrub growth, there are still indications that fire and other natural disturbances played a role in shaping the historic landscape of this region. Many of the plants growing alongside mountain golden heather, including pitch pine (*Pinus rigida*), Table Mountain pine (*Pinus pungens*), and sand myrtle (*Leiophyllum buxifolium*), are known to be fire-adapted species in other parts of their range.

After the plant's listing, the North Carolina Department of Agriculture's Plant Conservation Program began intensive research into the life history of mountain golden heather with funding from the Service under the ESA's section 6 State Grant-in-Aid Program. By analyzing soil cores and tree rings, biologists discovered that, in the first half of the 20th century, lightning fires occurred in mountain golden heather habitat approximately once every 5 to 10 years. In the artificially induced absence of these regular fires, the entire plant community had changed, with

more fire-intolerant species crowding out mountain golden heather and other species that were adapted to the open, sunlit ledges. In addition, the bare mineral soil required for germination by the golden heather was no longer available, since it was covered by leaf litter from the encroaching trees. Therefore, successful reproduction had become quite infrequent.

Armed with this information, the Service and the state approached the Forest Service with a proposal to conduct a small, experimental burn in

The fire-adapted mountain golden heather survives on this windswept ridge overlooking a deep gorge in the Blue Ridge Mountains.

Photo by Nora Murdock/USFWS





Carefully controlled prescribed burns help to restore a mountain golden heather site that had become overgrown due to fire suppression.

Photo by Nora Murdock/USFWS

mountain golden heather habitat. The local Forest Service office was agreeable, but the proposal was opposed by environmental groups. Setting fires on purpose in the Appalachian Mountains? Unthinkable. Nevertheless, in 1987 we gained final approvals for a prescribed burn in 10 small experimental plots. The results were excellent. Encroaching trees and shrubs were set back, and the mountain golden heather rebounded. We also discovered that a seedbank existed for mountain golden heather in the soil, where seeds had lain dormant for at least 5 years. Once fire was reintroduced, the dormant seeds germinated and grew on the newly revitalized habitat. By the time of the first prescribed burn, Heller's blazing star (*Liatrix belleri*), another declining species within the same habitat, had been listed as threatened. This plant also responded positively to the prescribed burns. Yet another species seemed to benefit from the reopening of the ledge habitats as well; the peregrine falcon (*Falco peregrinus*), which nests on the sheer cliffs below the golden heather, began to hunt their prey in the open, shrubby habitats.

After the success of the initial experiments, biologists from the Fish and Wildlife Service, the Forest Service,

and the state designed a 10-year management plan that included regular prescribed burns. The mountain golden heather has responded and is now making a slow but steady comeback, but it is not "out of the woods" yet. While fire does control encroaching vegetation, it also makes those newly-opened ledges much more attractive as camping sites for hikers. Tremendous mortality of golden heather has resulted from campers inadvertently setting their tents on the plants, moving rocks on top of them, and trampling the habitat. The Forest Service has erected interpretive displays at the border of the wilderness area, describing the problem to visitors and directing them to more appropriate campsites. With the tremendous use this area receives, however, effective control of all visitors is virtually impossible.

After the experimental burns, botanists collected seeds of mountain golden heather. The difficult germination techniques were eventually developed, and the first seedlings were transplanted back into the wild at the type locality in 1991. Survival of the transplants was good, with many starting to produce seeds in the second year following their planting. The population at the type locality has steadily increased to 56 plants, with 75 percent of these now reproducing. Biologists also have discovered a second population on Forest Service land. Fire at this site had long been suppressed and only about two dozen mountain golden heather plants survived. The Forest Service has taken vigorous action to manage this newly-discovered population, which is outside of the designated wilderness. Trails have been permanently re-routed to eliminate trampling of this site by hikers and campers, and it is now on a regular schedule for prescribed burns.

For a species once headed for extinction, recovery may now be in sight.

Nora Murdock is a Biologist in the Service's Asheville, North Carolina Office.

Whooping Crane Recovery Update

by Ben Ikenson

In 1941, a group of just 15 whooping cranes took wing across the Central Flyway, a migratory route that stretches from the prairie provinces of Canada to the Gulf Coast of Texas. It was the same migratory route their ancestors had followed for countless seasons. These birds were the last of their species; the others had disappeared as people shot them and drained their nesting areas for agriculture. Recovery efforts for this nearly extinct species have brought slow but steady progress. Today, there are two main wild populations of whooping cranes with 267 birds, plus another 151 birds in captivity, for a grand total of 418 birds.

“The backbone of recovery efforts has really been the Aransas/Wood Buffalo flock,” said Tom Stehn, the U.S. Fish and Wildlife Service’s National Whooping Crane Recovery Coordinator. The flock is so named for the 2,500-mile (4,000-kilometer) journey it makes every April and October between its wintering grounds at Aransas National Wildlife Refuge (NWR) on the Gulf Coast of Texas and its nesting grounds at Wood Buffalo National Park in the Northwest Territories, Canada. The direct descendants of the original 15 or 16 birds typically depart in pairs or small family groups for their northward migration. “This particular flock has been making considerable progress, growing in numbers at around four percent annually, and is now at a record 187 birds.”

The other wild population is the non-migratory flock established in Florida. Since 1993, 20 to 30 juvenile captive-raised whooping cranes have been soft-released onto the Kissimmee Prairie of central Florida each year. These birds

are raised by handlers wearing crane costumes so that the birds do not imprint on people but learn the behaviors they need to survive in the wild. Whooping crane pairs in Florida first laid eggs in 1999, and two chicks hatched out in 2000 but did not survive to fledging. Bobcat (*Felis rufus*) predation remains the primary threat to this population, which currently numbers about 78 birds.

Recovery biologists now are planning to introduce a third flock of whooping cranes into the wild. An ultralight aircraft will give the birds their first lesson in migration. Once the cranes are taught a migration pattern their first fall, they should follow the same route for the rest of their lives. The plan is to have the birds summer at the Necedah NWR in central Wisconsin and winter at Chassahowitzka NWR on the west coast of Florida. Biologists hope that a migratory flock of about 125 whooping cranes can be established over the next 12 years.

The Service’s recovery efforts would have been fruitless without the help of the Canadian Wildlife Service, which has five members on the international whooping crane recovery team. Both countries have been working together ever since they realized how close the whooping crane was to extinction. Starting in 1966, Canadian biologists collected the eggs from Wood Buffalo National Park that made the captive propagation program possible. In 1985, both countries signed a Memorandum of Understanding to improve coordination and cooperation. Canada houses a flock of cranes at the Calgary Zoo as part of the recovery plan.



Photo by John and Karen Hollingsworth

Whooping cranes formerly bred within a range bordered by central Illinois, northern Iowa, western Minnesota, northeastern North Dakota, southern Manitoba, and Saskatchewan. Some wintered along the coast in New Jersey, South Carolina, and possibly other southeastern states. Establishing an eastern migratory flock and the Florida non-migratory flock would meet the recovery goals for downlisting by the year 2020: two self-sustaining flocks besides the Aransas/Wood Buffalo flock, each with 25 nesting pairs, that persist for at least 10 years. Requirements for delisting have not yet been determined.

Ben Ikenson is a Public Affairs Specialist with the Service’s Albuquerque Regional Office.

Ferrets Home on the Range

by Mike Lockhart,
Paul Marinari, and
Pete Gober



Tom Jones and Rose Stoneberg release a ferret from its transport box through a plastic hose to a new home in the wild.

Fort Belknap Fish & Wildlife Dept. photos

The reintroduction of black-footed ferrets to the wild began in the Shirley Basin, Wyoming, in 1991.

Additional reintroductions have taken place at the Conata Basin/Badlands area of South Dakota in 1994; Charles M. Russell National Wildlife Refuge, Montana, also in 1994; Aubrey Valley, Arizona, in 1996; Ft. Belknap Reservation, Montana, in 1997 (see related article in this edition of the *Bulletin*); and the Coyote Basin, which straddles Utah and Colorado (1999). Between 1991 and 1999, we released a total of 1,185 ferrets at these sites.

The black-footed ferret (*Mustela nigripes*) has come a long way since the late 1970s, when many people feared that it was extinct. This species once ranged over an enormous area spanning 11 Great Plains/Rocky Mountain states and 1 Canadian province. It was decimated by conversion of much of North America's native prairies to crop land and by decades of persecution against its principal prey, the prairie dog (*Cynomys* spp.). Hopes were raised when a small remnant population of ferrets was discovered near Meeteetse, Wyoming, in 1981. But canine distemper and sylvatic plague (*Yersinia pestis*) were detected in the Meeteetse population in 1985, and the black-footed ferret slipped perilously close to genuine extinction by 1987. The U.S. Fish and Wildlife Service finally captured the last 18 ferrets known in an effort to keep disease from claiming the species.

Although we kept looking for additional wild black-footed ferrets throughout the west following the loss of the wild Meeteetse population, our recovery priorities shifted to development of captive breeding techniques, establishing a secure captive population, and reintroduction programs. Other than reintroduced ferrets and their descendants, we have been unable to find any others since the last wild individual was removed from Meeteetse.

In 1988, the Service approved a revised Black-footed Ferret Recovery Plan. It called for reestablishing a prebreeding population of at least 1,500 free-ranging black-footed ferrets (in 10 or more populations, with no fewer than 30 breeding adults in any population) by the year 2010. When we attain this goal, we can downlist the black-footed ferret from "endangered" to the less critical status of "threatened."

Recovery of a species from captive stock alone presents many significant obstacles not faced by species still occupying natural habitats. Housing, husbandry, propagation techniques, maintenance of genetic diversity, retention of wild behaviors, and development of release and field protection strategies are factors potentially affecting ultimate success. Early captive breeding attempts were unsuccessful (Carpenter 1985, DonCarlos et al. 1989). Moreover, what little we know about the biology of the ferret in the wild, a rare and secretive species, is limited. It was obtained from two small remnant populations from fragmented habitats that soon died (Fortenbury 1972, Hillman 1974, Biggins et al. 1985).

Given the precarious status of the black-footed ferret following the Meeteetse population collapse and the challenges that still confront ferret recovery, progress has been nothing short of remarkable. Today, captive breeding population objectives have been reached, with a core breeding population (currently 269 prime breeding age ferrets) being retained in 5 zoos and 1 Service facility across the United States and Canada. To increase the number and quality of ferrets available for reintroduction, additional "field breeding" projects have been initiated in Arizona, Colorado, Montana, and New Mexico over the past 2 years, resulting in 133 total ferret kits born in 1998 and 1999.

The most promising reintroduction programs have been on National Forest lands in the Conata Basin, South Dakota, and at the Charles M. Russell National Wildlife Refuge. Ferret populations at both sites are approaching potential carrying capacity, and the population of wild born ferrets is more

than double that of captive born, reintroduced ferrets. As many as 350 black-footed ferrets were alive in the wild following the late 1999 ferret reintroduction efforts, well surpassing the number that existed in captivity and the peak level of the last known wild population near Meeteetse (128 ferrets).

As with other endangered species programs, overall progress in black-footed ferret recovery is the product of numerous trials, failures, successes, and hard work involving many partners. To facilitate recovery and gain more input from affected interests, the Service established a Black-footed Ferret Recovery Implementation Team in 1996. The team is represented by 26 state and federal agencies, conservation organizations, and Indian tribes. Although enormous progress has been made in the black-footed ferret recovery program, success is far from assured. Indeed, ferret recovery will largely depend on the redoubled efforts of the team to help restore and conserve large the prairie dog complexes upon which the black-footed ferrets depend.

To a large extent, we now have the technical capability to reestablish ferret populations. We can produce the ferrets and precondition them to survive in the wild (Vargas et al. 1996, Biggins et al. 1998). Yet, during the time when recovery efforts were most focused on practical ferret management applications, ferret habitat was disappearing at an alarming rate. Current reintroduction efforts suggest that a self-sustaining black-footed ferret population may require about 10,000 acres (4,050 hectares) of somewhat contiguous black-tailed prairie dog (*C. ludovicianus*) habitat, or a relatively greater acreage for the lower density colonies of white-tailed prairie dogs (*C. leucurus*) and Gunnison's prairie dogs (*C. gunnisoni*).

Diminished prairie dog populations now face the even greater catastrophe of sylvatic plague, an introduced contagious disease for which prairie dogs have little immunity. Many of the

large prairie dog complexes that existed in western states in the late 1980s are now gone or have been reduced to the point that they will no longer support ferret populations. Fewer than 10 quality ferret reintroduction sites remain in North America today. Two reintroduction areas, Ft. Belknap, Montana, and portions of the Colorado/Utah release area, experienced new episodes of sylvatic plague in 1999. Continued degradation of prairie dog habitats across North America will have serious implications for the black-footed ferret and many other sensitive and threatened species that depend on healthy, native prairie ecosystems. This is the challenge that must be met by the Black-footed Ferret Recovery Implementation Team and other wildlife managers across the West who are involved in the conservation of prairie wildlife communities.

Mike Lockhart, Paul Marinari, and Pete Gober are Wildlife Biologists with the Service's National Black-footed Ferret Conservation Center in Laramie, Wyoming.

Biologists use sensitive equipment to identify ferrets in the wild.



Literature Cited

Biggins, D.E., M.H. Schroeder, S.C. Forrest, and L. Richardson. 1985. Movements and Habitat Relationships of Radio-tagged Black-footed Ferrets. Pp. 11.1-11.17 in Proceedings of Black-footed Ferret Workshop, Sept. 18-19, 1984 (S.H. Anderson and D.B. Inkely, eds.). Wyoming Game and Fish Department, Cheyenne. 228pp.

Biggins, D.J., Godbey, L. Hanebury, P. Marinari, R. Matchett, and A. Vargas. 1998. Survival of Black-footed Ferrets. Journal of Wildlife Management 62:643-653.

Carpenter, J.W. 1985. Captive Breeding and Management of Black-footed Ferrets. Pp. 24.1-24.7 in Proceedings of Black-footed Ferret Workshop, Sept. 18-19, 1984 (S.H. Anderson and D.B. Inkely, eds.). Wyoming Game and Fish Department, Cheyenne. 228pp.

DonCarlos, M.W., B. Miller, and E.T. Thorne. 1989. The 1986 Black-footed Ferret Captive Breeding Program. Pp. in U.S. Seal, E.T. Thorne, M.A. Bogan, and S.H. Anderson (eds.). Conservation Biology of the Black-footed Ferret. Yale University Press, New Haven, CT.

Hillman, C.N. 1974. Status of the Black-footed Ferret. Pp. 75-81 in Proceedings of the Symposium on Endangered and Threatened Species of North America. Wild Canid Survival and Research Center, St. Louis, MO. 338pp.

Fortenbery, D.K. 1972. Characteristics of the black-footed ferret. U.S. Fish and Wildlife Service Resource Publication 109:1-8.

Vargas, A., M. Lockhart, P. Marinari, and P. Gober. 1996. The Reintroduction Process: Black-footed Ferrets as a Case Study. Pages 829-834 in Proceedings: American Zoo and Aquarium Association Western Regional Conference, May 15-19, 1996, Denver, Colorado.

Ferret Restoration on Fort Belknap Reservation

by Tim Vosburgh

The Fort Belknap Indian Community has been an active participant in black-footed ferret recovery efforts since 1997, when 23 ferrets were first reintroduced on the Fort Belknap Reservation. With more than 13,000 acres (5,260 hectares) of active black-tailed prairie dog colonies, the 650,000-acre (260,000-ha) Reservation, located in north-central Montana, has some of the most suitable black-footed ferret habitat in Montana. "When you look across the West, some of the very best of the remaining black-footed ferret habitat is in Indian country," said Poncho Bigby, Director of Natural Resource Planning at Fort Belknap. The large prairie dog com-

plexes on the reservation could provide habitat for a viable population of endangered black-footed ferrets. Indeed, ferrets have already found a home near Snake Butte, in the northwest corner of the reservation.

In 1996, the Fort Belknap Indian Community and the state of Montana signed an agreement to give the Gros Ventre and Assiniboine Tribes at the Reservation control over its black-footed reintroduction program. The Tribes, Bureau of Indian Affairs (BIA), and Montana traveled a 10-year odyssey to arrive at a request for black-footed ferrets. Since 1997, 110 black-footed ferret kits have been released on the

Snake Butte reintroduction site. With support from the Tribal Council, biologists plan to expand ferret reintroduction efforts to other prairie dog complexes on the Reservation this year.

One obstacle now stands in the way of ferret reintroductions on Fort Belknap. That obstacle is sylvatic plague, an exotic disease fatal to black-tailed prairie dogs. A plague outbreak was detected about 15 miles (24 kilometers) east of Snake Butte on the Peoples Creek prairie dog complex in September 1999. Visual surveys indicated that approximately 1,800 acres (730 ha) of prairie dogs have been wiped out. Apparently, no black-tailed prairie dog complex in the country is immune to the impacts of plague.

Cultural and Spiritual Aspects

Ferret reintroductions at Fort Belknap have returned an animal that has cultural and religious significance to area tribes. Tribal dancers have long adorned their costumes with ferret skins and tied them into their braids. Lyman Young, a member of the Assiniboine Tribe born and raised on Fort Belknap Reservation, remembers that his grandfather wore black-footed ferret pelts on his dance costume. The ferret skins were considered sacred possessions that were buried with his grandfather following his death.

The social aspects of the recovery process were evident during the afternoon of September 9, 1997, when, a ceremony was held in honor of the first ferret kits to be reintroduced on the Reservation. With the invocation of prayers and pipe smoke atop Snake Butte, the Assiniboine and Gros Ventre Indians welcomed back a missing link





to the prairie ecology. During the ceremony, Tribal members talked about how rich they are as a people because of the magnificent surroundings they are fortunate to live in and because they are part of a culture rich in traditions. They accepted the ferrets not with reluctance but with enthusiasm.

The return of the black-footed ferret raises hopes for preserving old ways. "Everything is finally coming back.... a lot of young people are finding out about themselves from the animals. In our prayers, we asked the Creator to let the ferrets multiply and help mend the circle of life," said George Shield, an Assiniboine elder, before he passed away recently. "All these things belong here. We humans can't live without animals, because we are part of the same circle." Gros Ventre spiritual leader Joe Iron Man, Sr., described the little ferret as big medicine for his people. "It is one of the animals we used in our doctoring," he said. "Bringing back the

buffalo to the reservation was the first step in restoring our old ways. The return of the ferret is the final step."

More than 100 ferrets have been released near Snake Butte, where over 400 bison roam freely on 12,000 acres (4,850 ha) of native short grass prairie. Another 20 kits are being proposed for release on the bison pasture in 2000. The U. S. Fish and Wildlife Service characterizes the reintroduction area as among the best remaining short grass prairie habitat in North America.

Reintroduction Update

Despite strong community support, the efforts to establish a viable population of black-footed ferrets have met with only moderate success. Ferret kits have been released on Fort Belknap during each of the past 3 years, but so far only one litter of kits has been produced in the wild. The first wild-born kits were found on the Snake Butte bison pasture in September 1999.

Mike Fox, Director of the Fort Belknap Fish and Wildlife Department: "The black-footed ferret belongs in this environment. The ferret is part of the buffalo culture. It brings back another part of the system, completing the circle between prairie dogs and bison and reestablishes a relationship with the land."

Fort Belknap Fish and Wildlife Dept. photos

During March 2000, biologists conducting routine spotlight surveys also identified a minimum of five black-footed ferret kits that were released in 1998 and 1999. More intensive surveys will be conducted this year. The entire Fort Belknap Indian Community is hopeful that a self-sustaining population will soon become established on the bison pasture.

Tim Vosburgh is a Tribal Biologist at the Fort Belknap Indian Reservation.

by Greg Balogh

Wild Goose Chase Helps Save Wild Goose



**An armful of Aleutian Canada geese
in the high grass of Buldir Island**

USFWS photo

**Opposite page: Relocating geese,
Buldir Island**

USFWS photo

Through 25-foot swells, the small boat crept along on its 200-mile journey. Below decks in the engine room, John Martin fought back waves of nausea brought on by diesel fumes and the heaving sea. His job: to keep four dozen endangered goose eggs close enough to the engine to stay warm, but not so close that they would cook.

Until his recent retirement, John was Manager of the Alaska Maritime National Wildlife Refuge, the most expansive refuge in the nation. Twenty years after his stint as a sometimes queasy caretaker of endangered eggs, he no longer needs Dramamine as a dietary supplement. Also retired is the office chair from which he helped direct one of the most dramatic endangered species success stories to date: the recovery of the Aleutian Canada goose (*Branta canadensis leucopareia*).

This goose is not the same resident critter that defiles soccer fields and cemeteries across the U.S. Instead, it nests in the Aleutian Islands, an archipelago that extends from southeastern Alaska hundreds of miles into the Pacific. In fact, the Aleutian Canada goose is the only subspecies of Canada goose that nests exclusively on islands, and the only one with a range that reaches into Asia. However, despite its remote breeding territory and wide range, this bird very nearly disappeared.

By the late 1800's, the fur trade came close to driving the Aleutian Canada goose into extinction. On almost every island where this goose bred, fox farmers released arctic and red foxes (*Alopex lagopus* and *Vulpes vulpes*, respectively), leaving these non-native predators to fend for themselves. The

trappers returned when the foxes were in thick winter pelage. During spring and summer, the foxes feasted upon the geese. Eggs, incubating adults, flightless molting birds, and young—the foxes ate them all. Other island nesting birds, such as puffins and petrels, also were hit hard, but none as badly as the Aleutian Canada goose.

By 1936, foxes had been introduced to an astounding 190 islands within the breeding range of the Aleutian Canada goose. For a time, biologists thought this unique bird had become extinct. But there was one place they hadn't looked.

At the far end of the Aleutian chain sits a steep-sided volcano, Buldir Island. Surrounded by crashing surf, there is no place on its perimeter to land a boat. This presented a serious challenge to biologists wanting to survey the island for remnant geese. But the island's inhospitable coast was actually the goose's greatest salvation; what kept biologists out apparently kept fox farmers out, too. This fox-free habitat turned out to be the goose's last refuge. A 1963 expedition to Buldir found 200-300 geese.

Early recovery efforts focused on raising captive flocks from wild eggs (hence John Martin's egg-sitting job). After several months, the young birds were released on small fox-free islands.

Unfortunately, the survival rate for pen-reared, parentless birds was not good. Field crews decided to try something else. They began trying to capture entire family groups of wild geese, which often required the biologists to sprint up and down 30 degree slopes in chest-high soaking wet grass, trying to herd the geese into groups. The molting adults, with their young, were then hauled down the steep volcanic slopes to small inflatable boats. After an often harrowing launch in crashing surf, the boat carrying the penned geese rendezvoused with a larger ship offshore. Several days later, biologists carefully released the birds onto a fox-free island. They hoped that the young geese, when they reached breeding age, would return to the place they learned to fly. Indeed, this is exactly what happened. For the next 20 years, field crews repeated this wild goose chase with astounding success, and the transplanted family groups thrived.

Come winter, the heartiest of the field crews were dropped off on the most remote islands imaginable, much the way the old time fox farmers had dropped off their foxes. But the job of this elite field corps was not to foster fox populations. Quite the opposite; they methodically removed all of the introduced mammalian predators that they encountered. Each island cleared of non-native foxes meant additional nesting habitat for the geese and other seabird species. So far, 35 islands have been cleared.

Meanwhile, banding operations on Buldir taught us where the birds spent winter. Armed with this knowledge, federal and state officials were able to enact hunting closures in strategic portions of California's Central Valley and southern Oregon. Soon, landowners were pitching in to do their part in helping the goose recover. The Gallo's, famous vintners, set aside 2,000 acres (810 hectares) of grassland where wintering geese could graze and roost in peace. Some especially important parcels of land were purchased outright

and added to the San Joaquin River NWR. Other goose habitat parcels are being managed by the Bureau of Land Management, the state of California, various local governments in California and Oregon, and even a local utility company. Also important to the geese are the private dairy farms near Colusa, California, where the geese and cattle must compete for grass.

A wide array of interests can be proud of their hard work to recover the Aleutian Canada goose, from federal

and state biologists to the fox trappers who cleared the way for geese and the dairy farmers, wine makers, and utility who share their land with the birds. The more than 35,000 Aleutian Canada geese alive today owe these people a debt of gratitude for reversing the mistakes of the past.

Greg Balogh is a Fish and Wildlife Biologist in the Anchorage Ecological Services Field Office.



Reintroducing Hawaii's Silverswords

by Robert Robichaux, Steven Bergfeld, Marie Bruegmann, Joan Canfield, Patrice Moriyasu, Tanya Rubenstein, Timothy Tunison, and Frederick Warshauer



A Mauna Loa silversword being planted at Kulani Correctional Facility. Inmates from the facility have participated in an innovative volunteer program to help with silversword reintroduction.

All photos by Joan Canfield

(Opposite page, bottom) Members of the sunflower family (Asteraceae), silverswords have a rosette form, with dagger-shaped leaves that are densely covered by silvery hairs. Most silverswords flower only once, after growing for 30-50 years, with the majestic flowering stalks of large rosettes often exceeding 1.5 meters in height.

Of the many endangered plant species in the Hawaiian Islands, silverswords have the highest profile due to their radiant beauty and the severity of the threats confronting them. The large-scale reintroduction of greenhouse-grown seedlings is raising hopes for the recovery of these spectacular endemic species, although serious challenges remain.

The Mauna Kea silversword (*Argyroxiphium sandwicense* ssp. *sandwicense*) had an historical range that encircled Mauna Kea volcano at 8,500-12,500 feet (2,600-3,800 meters) elevation on the Island of Hawai'i. Based on the records of early naturalists, this silversword grew in abundance and was a dominant plant of the subalpine and alpine ecosystems. In the late 1700s, European voyagers introduced sheep and other alien (non-native) ungulates to the island. The alien animals spread rapidly, with the sheep population on Mauna Kea eventually exceeding 40,000. As alien ungulate populations increased, silverswords declined severely in distribution and abundance, presumably due to heavy browsing. The small natural population of silverswords that persists on Mauna Kea now contains only 42 plants, all of them confined to cliffs and rock faces that are inaccessible to ungulates.

The Mauna Loa silversword (*Argyroxiphium kauense*) suffered a similar fate. Historically, this species was common in moist to wet ecosystems between 5,000 and 8,900 feet (1,500 and 2,700 m) on Mauna Loa and Hualalai volcanoes. Following the introduction and spread of pigs, mouflon sheep, and other alien ungu-

lates, however, the Mauna Loa silversword suffered a severe decline. The surviving individuals, numbering fewer than 1,000 plants, are confined to three small natural populations widely scattered across Mauna Loa.

In addition to direct threats from alien ungulates, Mauna Kea and Mauna Loa silverswords may face serious indirect threats from alien insects, especially ants and wasps. These alien predators have the potential to decimate populations of native bees and moths that serve as pollinators, thereby greatly limiting seed set in silverswords.

Partnership for Recovery

Though the threats are daunting, the outlook for recovery of Mauna Kea and Mauna Loa silverswords has brightened considerably in recent years. Key to this reversal of fortune has been a public/private partnership between the Volcano Rare Plant Facility, Hawaii Division of Forestry and Wildlife, Fish and Wildlife Service, National Park Service, Biological Resources Division of the U.S. Geological Survey, and Hawaiian Silversword Foundation. The Rare Plant Facility has grown the large number of silversword seedlings destined for reintroduction, closely tracking the pedigree (or parentage) of each one. Different agencies in the partnership have then overseen the outplanting effort in different parts of the historical ranges. The non-profit Silversword Foundation has worked closely with all of the partners to facilitate the collaborative initiative. By sharing expertise, resources, and enthusiasm, and by emphasizing on-the-ground actions, the partnership has made major strides recently with silversword reintroduction.

In 1999, we outplanted more than 2,500 silverswords on Mauna Kea, bringing the total reintroduced population to about 4,000. (About 1,500 Mauna Kea silverswords were successfully outplanted by the Division of Forestry and Wildlife between 1973 and 1998.) We planted the seedlings at multiple sites in the State Forest Reserve. Survivorship has varied among the sites and with the time of planting, but has been exceptionally high in some cases. Of the 1,200 seedlings planted in late fall on the east slopes of Mauna Kea, for example, more than 99 percent have survived their critical first 9 months on the volcano.

We also outplanted more than 1,000 silversword seedlings on Mauna Loa and Hualalai in 1999. They went to protected sites in Hawaii Volcanoes National Park, Kulani Correctional Facility, and State Forest Reserves. Again, survivorship has varied among the sites, but has exceeded 90 percent at some locations.

To ensure high genetic diversity in the reintroduced silversword populations, we have implemented a controlled crossing program in which we hand-pollinate flowering silverswords in both the field and greenhouse to produce seeds (see *Bulletin* Vol. XXIII, No. 2-3). Although hand-pollinating the plants can be challenging at times, especially on Mauna Kea, where we must perch precariously on steep cliffs and rock faces, the program has enabled us to significantly increase the number of founders (or parents) for the reintroduction effort, and to balance their genetic representation among the seedlings that are outplanted.

Over the next year, we plan to outplant another 2,000 silverswords on Mauna Kea and 8,000 silverswords on Mauna Loa and Hualalai. Thus, we will soon be about 40-60 percent of the way towards achieving our long-term goal of reintroducing more than 15,000 Mauna Kea and Mauna Loa silverswords throughout their historical ranges.

The major threat to the recovery of silverswords (and many other endangered plant species in Hawaii) continues to be alien ungulates. Even at low numbers, these animals can have severe impacts. On the upper slopes of Mauna Kea, for example, where alien ungulate populations have been greatly reduced by a court-ordered removal program, browsing still caused significant seedling mortality, and serious damage to adult silverswords, at some of the outplanting sites in 1999. Because alien ungulates are still abundant on Mauna Loa and Hualalai, all of our outplanting sites for Mauna Loa silverswords must be protected by fencing, which ultimately constrains the scope of the reintroduction effort. Alien insects may also continue to pose a significant threat to the health of native pollinator populations.

The large-scale reintroduction strategy for silverswords, implemented through our public/private partnership, highlights both the opportunities and challenges for recovery of other endangered plant species in Hawaii.

Robert Robichaux is President of the Board of Trustees of the Hawaiian Silversword Foundation. Steven Bergfeld is a Forester with the Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife. Marie Bruegmann is a Botanist with the Fish and Wildlife Service's Pacific Islands Ecoregion Office. Joan Canfield is Deputy Director of the Pacific Island Ecosystems Research Center (USGS/BRD/PIERC), U.S. Geological Survey, Biological Resources Division. Patrice Moriyasu is a Horticulturist with the University of Hawaii, Center for Conservation Research and Training, Volcano Rare Plant Facility. Tanya Rubenstein is Olaa-Kilauea Partnership Coordinator at Hawaii Volcanoes National Park (HAVO). Timothy Tunison is Chief of Resources Management at HAVO. Frederick Warshauer is a Botanist with USGS/BRD/PIERC.



The Volcano Rare Plant Facility is part of the Center for Conservation Research and Training of the University of Hawaii. In addition to growing thousands of silversword seedlings for reintroduction each year, the facility has successfully propagated more than 70 other endangered and threatened plant species from the Island of Hawai'i.



by Richard G. Biggins and
Robert S. Butler

Bringing Mussels Back in the Southeast



Mussel shells collected from a muskrat midden on the Conasauga River in Tennessee

Photo by Richard Biggins/USFWS



Tan riffleshell in Indian Creek, a Clinch River tributary in southwestern Virginia

Photo by Richard Biggins/USFWS

The world's greatest diversity of freshwater mussels occurs in the continental United States. Early American naturalists marveled at this fauna's beauty and diversity. T.A. Conrad wrote in a paper presented to the Academy of Natural Sciences of Philadelphia in 1834, "The great variety and beauty of the fresh water shells of this country are truly surprising. Whilst the streams of Europe contain very few species, not remarkable for elegance of color or variety, the rivers of Ohio, Kentucky, Tennessee, Alabama, etc., contain at least one hundred species of almost every imaginable shape."

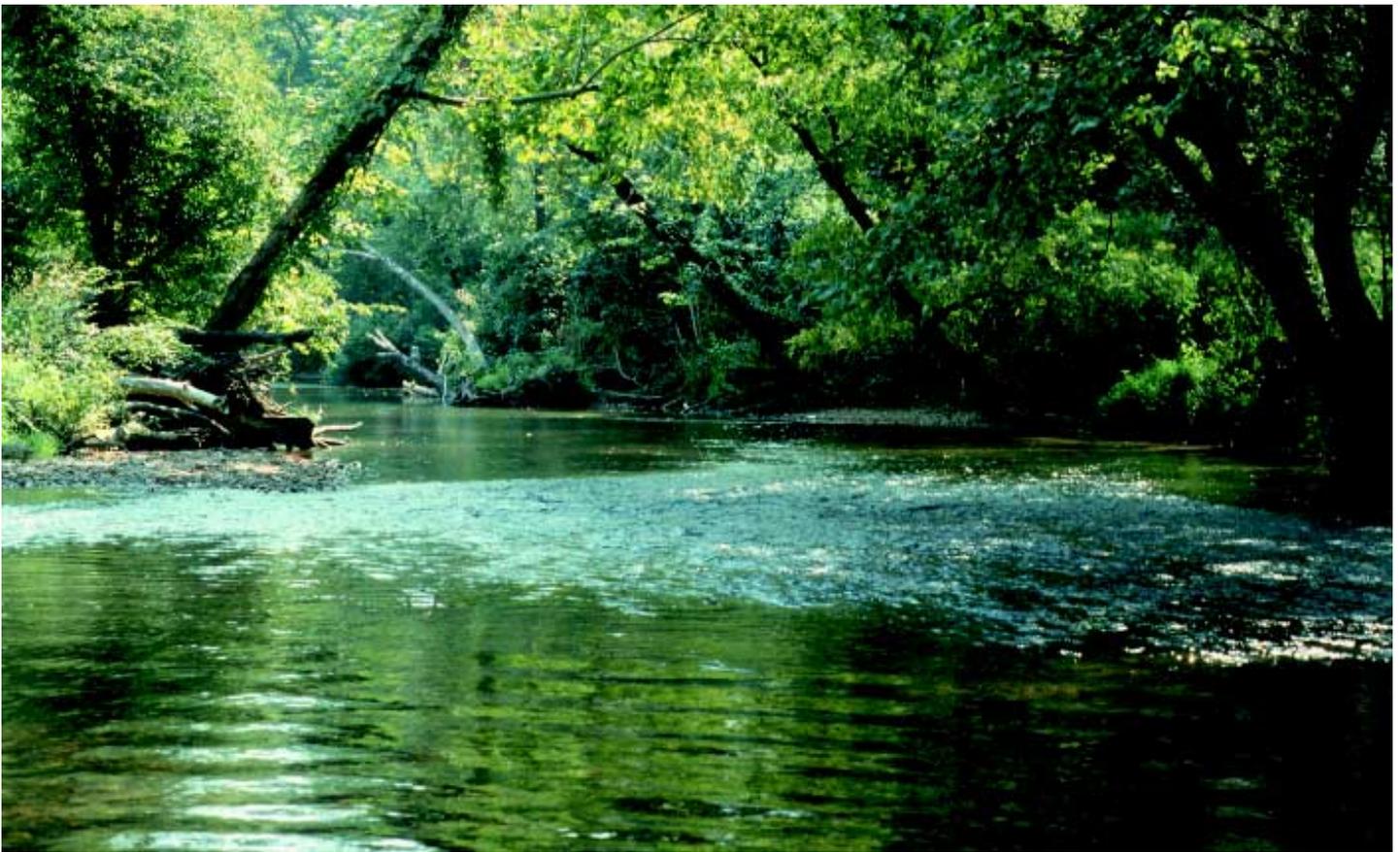
Native Americans made extensive use of this abundant natural resource. Mussels in unimaginable numbers once paved the shallow shoals of many rivers and provided an easily accessible food supply. Many of the shells were fashioned into spoons, plates, hoes, and an array of other tools, and some of the colorful and ornate shells were transformed into adornments. In spite of extensive use, this mussel fauna remained relatively unchanged for centuries prior to European settlement.

However, during the last 100 years, the habitat of this rich fauna (nearly 300 species) has been inundated by impoundments, smothered in silt, dredged for navigation, and polluted with toxins. The U.S. Fish and Wildlife Service currently recognizes about 12 percent of our mussel fauna as extinct and 23 percent as threatened or endangered. No other widespread North American animal group has experienced this level of collapse. For example, The Nature Conservancy (TNC) considers 68 percent of our nation's mussel

species at risk, compared to only 17 percent for mammals and 15 percent for birds. The American Fisheries Society estimates that 72 percent of our mussels need protection. The precipitous decline of freshwater mussels in the 20th century is unparalleled in our nation's history, and many more extinctions are likely without a coordinated conservation effort.

Freshwater mussels serve important ecological roles. They are a food source for many aquatic and terrestrial animals. They improve water quality by filtering contaminants, particulates, and excess nutrients from our rivers. Sensitive to toxic chemicals, they serve as an early warning of water quality problems before other biological resources are noticeably affected.

The economic value of some of the more common species is also significant. Native mussel shells are used in the cultured pearl and jewelry industries. In 1993, the mussel shell industry in the United States exported roughly 6,500 tons of shells. The annual value



A mussel shoal on the Conasauga River, Tennessee

Photo by Richard Biggins/USFWS

to the mussel shell industry has been estimated at \$40 to \$50 million, and the shell harvest provides employment to about 10,000 residents, primarily in the Mississippi River basin.

Although biologists have been documenting mussel declines since the early part of this century, only in the last 25 years have environmental laws been available to significantly reduce threats to these animals. Numerous federal, state, tribal, and local agencies; conservation groups; and concerned citizens now recognize the severity of the problem and the vulnerability of freshwater mussels. Many historical and current threats to this fauna are not economically or socially feasible to remedy. However, much can and is being done to help secure a future for this valuable national resource.

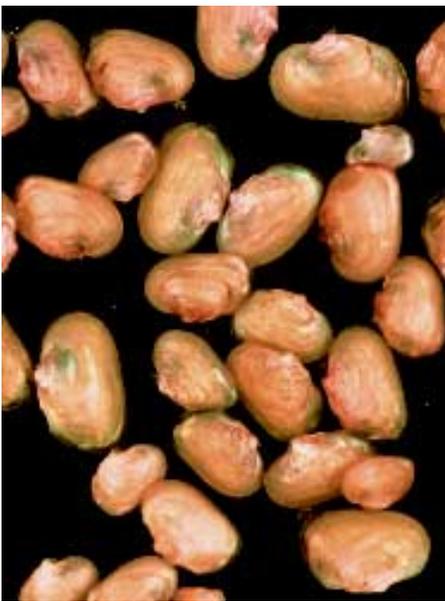
Since the early 1980s, the Service's Southeast Regional office, which encompasses an area containing more than 90 percent of the nation's mussel taxa and more than 95 percent of all federally listed mussels (70 species), has

actively supported mussel research and conservation initiatives. As a result, the Service's Asheville (North Carolina) Field Office, with its many partners (Alabama Division of Game and Fish, Kentucky Department of Fish and Wildlife Resources, North Carolina Wildlife Resources Commission, Tennessee Wildlife Resources Agency, Virginia Department of Game and Inland Fisheries, U.S. Geological Survey [USGS], U.S. Forest Service [USFS], National Park Service, Natural Resources Conservation Service, Resource Conservation and Development Councils, State Soil and Water Conservation Districts, Tennessee Valley Authority [TVA], Tennessee Aquarium/Southeast Aquatic Research Institute [SARI], and TNC) is poised to implement a major mussel recovery program in the Southern Appalachians and lower Tennessee-Cumberland River ecosystems.

Recent advances in mussel research make it possible to maintain and propagate some endangered mussel species in captivity, and research is

underway to develop propagation technology for other listed mussels. Captive propagated mussels can be used to augment existing populations and to reestablish populations into restored historical habitats.

Juveniles of the endangered tan riffleshell (*Epioblasma walkeri*) have been reared in captivity and for the past 3 years have been released into the Hiwassee River, a Tennessee River tributary in east Tennessee. This project, funded by the Service and the Tennessee Wildlife Resources Agency, is truly a cooperative venture. Gravid female riffleshells were provided by the Virginia Department of Game and Inland Fisheries. The young were produced at Virginia Polytechnic Institute and State University by the Biological Resources Division of USGS. The USFS, USGS, and TVA assisted with identification of the release sites in the Cherokee National Forest, and local school children assisted in the actual release of the juveniles. The Hiwassee River contains an extremely small and



Artificially propagated mussels ready for release into the wild

Photo by Richard Neves/U.S.G.S.

currently nonreproducing population of tan riffleshells.

Endangered mussel populations in two other upper Tennessee River tributaries have also been augmented. In 1999, the Tennessee portions of the Clinch and Powell Rivers above Norris Reservoir received over 100,000 juvenile of 6 endangered mussels, and more juveniles of these and other species are being released this year. In addition, SARI has released hundreds of juvenile fine lined pocketbook (*Lampsilis altilis*), a threatened mussel, this year into the Conasauga River. Through this and future augmentations, we hope that the population levels increase to the point where the species can again sustain itself. Research is underway to identify other endangered mussel populations and river reaches that could benefit from augmentations.

In addition to augmenting existing populations, the Service and its partners are evaluating the feasibility of reintroducing mussels into currently unoccupied historical habitats. Thanks to the water quality improvement efforts of TVA, the Environmental Protection Agency, State water resource and natural resource agencies, industries, and municipalities, some reaches of the

Tennessee River and its tributaries appear suitable for reintroducing their historic mussel fauna.

The Service and its partners have identified the lower French Broad River below Douglas Reservoir, Tennessee, as a potential mussel reintroduction site. This river reach historically supported approximately 60 mussel species. Thanks to TVA's reservoir release improvement program, the resident aquatic fauna has rebounded, and the habitat below the dam now appears suitable for mussel reintroduction. The area below Wilson Dam on the Tennessee River in north Alabama has also been identified for the reintroduction of 16 federally listed mussels. Historically, this river reach harbored the world's greatest mussel assemblage (more than 70 species).

The Asheville Field Office also has a cooperative riparian habitat restoration program that addresses the habitat needs of mussels and other imperiled aquatic organisms. This comprehensive effort, involving many of the same agencies and organizations mentioned above, restores and protects riverine habitat containing diverse aquatic communities. Many miles of important mussel streams have been degraded by poor land use practices, and efforts are underway to restore and protect the

habitat quality through partnerships with willing private landowners.

Because this recovery action is a Service program funded under the Endangered Species Act, the effort focuses on endangered mussel restoration. However, the program has much wider economic, aesthetic, and ecological benefits. Habitat improved for mussels benefits sport fisheries and other wildlife. Improved habitat and cleaner streams have increased aesthetic and recreational value, and reestablishing biodiversity helps to restore the complex ecological function of aquatic communities. There are few quick fixes to the problems that have plagued our rivers and their aquatic life for many years, but through public and private partnerships on an ecosystem scale, we can restore aquatic ecosystems for the public's use and enjoyment.

Richard G. Biggins is the Fish and Mussel Coordinator and Robert S. Butler is the River Restoration Biologist in the Asheville Field Office.

Biologists using snorkeling equipment release adult mussels into a marked-off area in the Holston River in eastern Tennessee so that the success of the release can be monitored.

Photo by Richard Biggins/USFWS



A Road Trip for Recovery

by Craig Springer

*I*t's slow going down a rocky back road to the Pecos River. Stiff springs on the four-wheel drive jostle me around the cab. The corrugated road bisects low hills rounded off by incessant winds. Only stiff, scrubby creosotes that stand unyielding to the wind break a monotonous view. You can see for miles across this part of New Mexico, and it looks the same in any direction. Were it not for landmarks like the river, one could easily get lost.

The shallow Pecos River makes a wide swath across the landscape. It is typical of plains streams: slow flowing over a low gradient, and lined with sandy banks. The bottom is sand, too, and it's transitory, always moving. The river elbows its way into the foot of a hill, eroding in one place, depositing in another. Only the non-native salt cedar (*Tamarix* sp.) that rims the river hold the banks in place, and even these plants are temporary.

Another alien species, the object of our foray, lives here as well. The Arkansas River shiner (*Notropis girardi*) was brought to the Pecos via an inadvertent 'bait bucket' introduction some 22 years ago. It has become established here, but in its native range—the Arkansas River from Kansas down to Arkansas—this small fish is headed for extinction. Dwindling water, poor water quality, and reservoirs have all contributed to the species' decline, which led to its listing as a threatened species in 1998.

The Pecos River itself is a reservoir—a reservoir of Arkansas River shiners. I've made the trip with other biologists from the U.S. Fish and Wildlife Service's Oklahoma and New Mexico Fishery Resources Offices, our Oklahoma Ecological Services Office, and the New Mexico Game and Fish Department for what could be a milestone in the



shiner's road to recovery. Our purpose: to collect shiners and carry them back alive to the Tishomingo National Fish Hatchery in Oklahoma for propagation.

"Hatcheries are increasingly important to endangered species conservation," said Brent Bristow, of our Oklahoma Fishery Resources Office. "Witness the successes with paddlefish in the Mississippi basin or trout in the Southwest. There's a hatchery component to all, but hatcheries cannot go at it alone. In front of any successful conservation project is habitat restoration."

Advancing ridges of sand across the stream bottom are where you find Arkansas River shiners. Summer freshets flush and erode the sand, keeping the ridges moving. "These transitory ridges provide two things, a place to eat and a place to rest," said Chris Hoagstrom, biologist for our New Mexico Fishery Resources Office. "Flows with the right amount of turbulence are paramount to maintain habitat for this animal. The turning sand turns up food for shiners that lie in wait. Stop the flows and you essentially stop feeding fish."

While the Service works to restore habitat for the shiner, biologists at Tishomingo learn to feed and spawn it in captivity. It's never been done before

Habitat losses caused downward trends in threatened Arkansas River shiner populations. Biologists hope to raise shiners in hatcheries for release into protected habitats.

Photo by Ken Collins/USFWS

with this species. The learning curve is steep and the stakes are high.

In the end, after 3 days of seining, 300 shiners made the 500-mile (200-kilometer) trip to the hatchery, where they are doing quite well. It's a long way from southeast New Mexico to the hatchery in Oklahoma. Long, too, is the road to recovery for the Arkansas River shiner, but conservation efforts like this one can get us there.

Craig Springer is a Fishery Biologist with the Division of Fisheries in the Service's Albuquerque Regional Office.

Sarah E. Rinkevich and
Stuart C. Leon

Stakeholders Assist Species Recovery in the Southwest

*R*estoring our nation's rare plant and animal resources to a secure status is a task much too large for any single agency. To assist us in this effort, the Fish and Wildlife Service has adopted a policy of involving stakeholders—local jurisdictions, private organizations, land owners, and other affected individuals—in as many recovery programs as possible. This approach not only makes recovery a more achievable goal but also gives stakeholders more of a voice in determining how recovery plans are developed and implemented. The Southwest Region's Recovery Program benefits greatly from cooperative stakeholder involvement, as these examples illustrate.

Southwestern willow flycatcher

Photo by S. & D. Maslowski



Southwestern Willow Flycatcher

The recovery program for the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) is one of the nation's largest and most comprehensive bird restoration efforts. One of four currently-recognized willow flycatcher subspecies, the southwestern willow flycatcher is a neotropical migratory bird that breeds in the southwestern United States and migrates to Mexico, Central America, and northern South America during the non-breeding season. The primary reason for the bird's decline is widespread loss of riparian habitat throughout the southwestern U.S.

Thirteen scientists appointed to the Southwestern Willow Flycatcher Recovery Team as a Technical Subgroup provide specialized biological information needed for the restoration program. Additionally, seven Implementation Subgroups have been appointed to guide the recovery effort as it is carried out in U.S. regions of the bird's geographic range. These regional groups consist of more than 300 community representatives of ranchers, environmental organizations, water and power interests, state and federal land managers, local governments, tribes, and private industry. Meetings between the Technical and Implementation subgroups have been useful in educating participants about the bird's status, identifying specific threats within different watersheds, and recognizing the various recovery activities.

To help the Technical Subgroup better understand Native American perspectives on the recovery of the flycatcher and to promote tribal participation in the recovery effort, a Tribal Working Group has been organized. Representatives from the Zuni Pueblo, Santa Ana Pueblo, Southern Ute, Northern Pueblo Association, White Mountain Apache, San Carlos Apache, Hopi, Hualapai, Cocopah, Salt River-Pima Maricopa, and the Colorado River Indian Tribes are actively helping the Technical Subgroup draft a portion of

the recovery plan that addresses Native American issues.

Rio Grande Silvery Minnow

The Rio Grande silvery minnow (*Hybognathus amarus*) was listed in 1994 as endangered because of extensive habitat loss due to water diversions. Historically, this fish was found in the Rio Grande from Española, New Mexico, to the Gulf of Mexico, as well as in the Pecos River in eastern New Mexico. The Rio Grande Silvery Minnow Recovery Team has involved stakeholders in the development of the recovery plan in order to minimize social and economic impacts. Members of the Recovery Team include individuals from the New Mexico Water Resource Research Institute, New Mexico Department of Game and Fish, Texas Parks and Wildlife Department, City of Albuquerque, University of Texas, University of New Mexico, Middle Rio Grande Conservancy District, and others. Having these participants on the Recovery Team is particularly important; in order for recovery to succeed, the interests of Rio Grande water users and the biological needs of the Rio Grande silvery minnow must be represented and clearly understood.

Cactus Ferruginous Pygmy-owl

The cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*) was listed as endangered in 1997. Like the flycatcher team, the Cactus Ferruginous Pygmy-owl Recovery Team consists of a Technical Group (scientists from agencies and academia) and an Implementation Group. The 26 members of the Implementation Group represent several counties within southern Arizona, environmental organizations, State and local governments, and various corporations and interest groups (e.g., Southern Arizona Cattle Association, private property rights advocates, Phelps Dodge). Further, several members of the Implementation Group also participate on the Steering Committee for the Sonoran

Desert Conservation Plan, a multi-species conservation plan under development that originated with an effort to save the pygmy-owl while accommodating other uses as much as possible. The plan is being expanded to address as many as 80 other vulnerable species native to southern Arizona.

Mexican Spotted Owl

The recovery plan for the threatened Mexican spotted owl (*Strix occidentalis lucida*) was published in 1995. It makes a series of management recommendations and calls for monitoring both the population and its habitat. Implementation Working Teams established for various recovery units have tackled such controversial issues as fire management, urbanization, and forestry practices. Because the teams are composed of a diverse membership, ideas from varying viewpoints are discussed and local interested parties are able to participate in recovery plan implementation.

The Fish and Wildlife Service views these teams as an innovative and positive approach towards involving stakeholders in recovery processes. We will continue to involve stakeholders in future recovery processes to promote creative solutions for the recovery of endangered plants and animals.

Sarah E. Rinkevich is an Endangered Species Biologist and Stuart C. Leon is the acting Regional Recovery Coordinator in the Service's Albuquerque Regional Office.

Multi-Species Recovery Plans



After stabilizing species that are headed for extinction, the ultimate goal of the Endangered Species Act is to recover endangered and threatened plants and animals to a secure status. Once a species is listed under the Act, a recovery plan is developed to serve as the blueprint for restoration. Until 1982, all recovery plans focused only on single species. That year, Region 1 of the Fish and Wildlife Service published a recovery plan covering two species of plants endemic to the sand dunes of Eureka Valley, California: the Eureka Dunes evening-primrose (*Oenothera avita* ssp. *eurekensis*) and Eureka Dune grass (*Swallenia alexandrae*). Thereafter, except for 1988, at least one multi-species recovery plan was completed every year, with a gradual increasing trend. In 1998, 18 multi-species plans were finalized, covering a total of 210 listed species. Why the change in our recovery approach?

According to Jeff Whitney, the Service's Southwest Strategy Regional Coordinator, recovery planners started asking more questions about the scope of recovery plans:

1) Is the species, as listed, distinct from other species in its floral/faunal community with respect to its habitat requirements and threats? Is it the only listed species in its general geographic area? If so, a single species recovery plan is appropriate.

2) Does the species, as listed, occur in two or more distinct geographic areas, and would the loss of any one of these areas diminish the species' capacity to survive or recover? If the answers are yes, designate "recovery units" for the species with separate goals.

3) Do two or more species of the same genus, or the same geographical areas, share a common threat? Such a situation calls for a multi-species recovery plan.

4) Do several listed members of a shared biotic community rely on protection and/or restoration of their ecosystem to reach recovery? Develop an ecosystem-based plan.

5) Does the species' range extend beyond the United States? If so, a cooperative international plan may be in order.

For all the complexity involved in developing such expanded plans, there are many advantages. A multi-species plan can streamline the public comment process and save time by reducing the need to describe habitats and threats separately for each species. Information can be presented in a format suitable for use in biological opinions and environmental impact statements with few modifications. A multi-species approach also promotes thinking on a broader scale.

Multi-species plans can reduce the conflicts between listed species that occur in the same area. For example, in the early 1990s, a proposed water management plan would have pitted endangered wood storks (*Mycteria americana*) against endangered snail kites (*Rostrhamus sociabilis plumbeus*) in the Everglades of South Florida. The plan would have improved habitat for wood storks in one area while decreasing habitat for snail kites in another. Opponents of the plan argued that destroying the kite habitat violated the Endangered Species Act. Proponents claimed that the improved stork habitat would benefit the kites as well, which

also frequented that area. The complex situation, with these and so many other listed species in one area, eventually led to the development of the South Florida Multi-Species Recovery Plan in 1999, which covers 68 species and 26,002 square miles (67,346 sq. km.).

In 1994, the Fish and Wildlife Service and National Marine Fisheries Service issued a cooperative interagency policy for applying the ecosystem approach to the Endangered Species Act. After all, the Act states that one of its primary purposes is "to provide a means whereby the ecosystems upon which endangered or threatened species depend may be conserved..." Various sections of the law authorize programs to cooperate with other federal agencies and non-federal partners in using the ecosystem approach.

Among the mechanisms the 1994 policy suggested for ecosystem management were the development and implementation of recovery plans for communities or ecosystems where multiple listed and candidate species occur. The policy also authorizes developing and implementing plans for listed species in a manner that restores, reconstructs, or rehabilitates the struc-

ture, distribution, connectivity, and function upon which those species depend. Obviously, an ecosystem plan is a form of multi-species recovery plan.

There are, however, still occasions when single-species recovery plans are preferable or when they should be written in addition to multi-species plans. For example, extremely imperiled species may require more detailed plans. The Florida panther (*Puma concolor coryi*) has captive breeding programs that are detailed in its own recovery plan, but it is also part of the South Florida Multi-Species Recovery Plan. The latter focuses on land management activities to benefit the entire group of imperiled species.

Multi-species recovery plans show a potential for solving many dilemmas characteristic of single species plans. We look forward to seeing more plans that take an ecosystem approach, such as the Lower Colorado River Multi-Species Conservation Plan (see sidebar).

Susan D. Jewell is a Biologist with the Division of Endangered Species in the Service's Arlington, Virginia, headquarters office.

Lower Colorado River MSCP by Sam Spiller

The Lower Colorado River Multi-Species Conservation Plan (MSCP) was initiated in 1995 as a partnership providing Endangered Species Act compliance for water and power resource management in southern California, Nevada, and Arizona. The Bureau of Reclamation releases flows for various water users, including Los Angeles, San Diego, Las Vegas, and Phoenix. The goal is to meet public needs, avoid species jeopardy, and assist in recovery of such species as the bonytail chub (*Gila elegans*), razorback sucker (*Xyrauchen texanus*), southwestern willow flycatcher (*Empidonax traillii extimus*), and Yuma clapper rail (*Rallus longirostris yumanensis*). But the MSCP does more, by targeting at least 90 species in an approach that addresses all the habitats that comprise the riverine corridor of the lower Colorado River from Hoover Dam to the Mexican border: aquatic, marsh, cottonwood-willow riparian, and mesquite bosque. Non-listed species that will benefit from the plan include fish like the flannelmouth sucker (*Catostomus latipinnis*), the yellow-billed cuckoo (*Coccyzus americanus*), and other neotropical migratory birds and bats that use riparian habitats. In implementing the plan, we are working closely with tribes, private landowners, irrigation districts, local communities, and other parties. Sam Spiller, the Lower Colorado River Coordinator for the Service, is located in Phoenix, Arizona.



The wood stork is just one of a number of listed species that should benefit from the South Florida Multi-Species Recovery Plan.

Corel Corp. photo

by Linda Andreasen and
Craig Springer

Hatcheries Promote Fish Recovery



**Dexter National Fish Hatchery and
Technology Center**

USFWS photo

The FWS Fisheries Program comprises a nationwide network of National Fish Hatcheries, Fish Technology Centers, Fish Health Centers, and Fishery Resources Offices. Together, these facilities provide a wealth of expertise in fish restoration and recovery. The National Fish Hatchery System currently assists in the recovery of 33 listed species. Fishery Resource Offices work closely with hatcheries, recovery teams, and other partners to develop and implement captive propagation programs, monitor reintroduced and wild populations, and assess and restore habitat. Fish Technology Centers and Fish Health Centers provide technical support to produce healthy and genetically appropriate fish, evaluate stocking programs, and assess wild fish population health.

Over the past decade, the number of fishes listed as threatened or endangered has nearly doubled to 112, comprising nearly 25 percent of the all listed animal species in the United States. In the past 100 years, 3 genera, 27 species, and 13 subspecies of North American fishes have become extinct. A recent paper in the journal *Conservation Biology* projects the future extinction rate to be 4 percent per decade for North American freshwater fauna, suggesting that North America's temperate freshwater ecosystems are being depleted as rapidly as tropical forests. As the number of imperiled fish species has increased, so has the development of innovative partnerships and programs to reverse these disturbing trends.

A Conservation Tool

Captive propagation is perhaps most familiar through the reintroductions of such species as the whooping crane (*Grus americana*), red wolf (*Canis rufus*), and California condor (*Gymnogyps californianus*). This same tool has great utility in aquatic resource conservation and is gaining increasing recognition by groups such as the World Conservation Union, which recently added both a Captive Breeding and a Reintroduction Specialist Group to its Species Survival Commission.

The success of captive propagation for recovery depends upon a number of things, including careful genetics planning and management, concurrent habitat restoration, thorough evaluation studies—and funding. Propagation of imperiled fish species is often more than twice as costly as rearing non-native game fish due to genetic analyses, and special diet requirements and rearing

conditions that enhance survival in the wild. Such programs often represent long-term investments, with a number of years between stocking and the return of adult fish to spawning grounds. Further complicating matters are factors such as range-wide variability in habitat conditions that can affect survival. Despite the challenges, success stories that go beyond the realm of “fish tales” are growing and showcase the National Fish Hatchery System's dedication to good science and management.

National Fish Hatchery Role

The Fish and Wildlife Service's (FWS) National Fish Hatchery System has made impressive contributions to the restoration and recovery of imperiled fish populations through the development of captive propagation and holding techniques. Many of the species now in FWS hatcheries have never been cultured and require the development of special diets and state-of-the-art holding and propagation techniques. The Dexter National Fish Hatchery and Technology Center in New Mexico and other facilities have developed captive rearing techniques for some of our nation's rarest and most unique fish species, including the Colorado pikeminnow (*Ptychocheilus lucius*), an endangered minnow that grows to nearly 6 feet (2 meters) in length, the Gila topminnow (*Poeciliopsis occidentalis*), arguably among the rarest fish in the world, threatened native game fish such as the Apache and Gila trout (*Oncorhynchus apache* and *O. gilae*, respectively), and the pallid and shortnose sturgeons (*Scaphirhynchus albus* and *Acipenser brevirostrum*, respectively). Forty-two Fish Technology

Centers, Fish Hatcheries, and Fish Health Centers are working together with Fisheries Resource Offices, endangered species biologists, other Federal agencies, the States, academia, and the private sector to restore 58 imperiled aquatic species. Here are some of the fish recovery highlights:

Apache Trout

Of the many species of sport fish in North America, the threatened Apache trout is among the rarest. With the Service's help, however, the Apache trout truly has rebounded. Since 1983, the Alchesay-Williams Creek National Fish Hatchery complex, located on the Fort Apache Indian Reservation, has produced several million Apache trout for sportfishing, while the Arizona Fishery Resources Office restores habitat for wild populations. The Arizona Game and Fish Department depends on the expertise of FWS hatchery personnel to produce this difficult to rear native species for the State's stream restoration projects on National Forest lands. (See "Apache Trout: On the Brink of Recovery" in *Bulletin* Vol XXIV, No. 4).

Meanwhile, the White Mountain Apaches and Arizona Fishery Resource Office have built barriers to protect Apache trout from invasions of non-native fish and have restored habitat through riparian revegetation, livestock enclosures, and non-native fish removal. To keep fish disease in check, fish health biologists at the FWS Pinetop Fish Health Center monitor wild Apache trout populations and frequently inspect Alchesay-Williams Creek NFH for disease pathogens. The most recently renovated and stocked population marks number 29 of 30 populations needed to declare recovery. "After three decades, we're happy to see this fish return to its native habitat," says Daniel Parker, a White Mountain Apache tribal member and biologist with the FWS Arizona Fishery Resources Office. "When we establish just one more stream population, we could make history."

Greenback Cutthroat Trout

The greenback cutthroat trout (*Oncorhynchus clarki stomias*), native to high-elevation streams in Colorado, is another example of coordinated recovery efforts and successful reintroduction by the FWS and our partners. When the greenback was listed as endangered in 1973, only 2 or 3 remnant populations totaling 1,000 fish remained. To begin recovery, State, Tribal, and Federal biologists developed a recovery plan that included captive propagation. A broodstock was established at the Bozeman Fish Technology Center in Montana. Streams were cleared of non-native fishes and barriers were built to prevent their reinvasion. Already, 23 self-sustaining populations of greenback cutthroat trout have been recovered and the species has been reclassified to the less critical category of threatened. The greenback is expected to be proposed for delisting within the near future.

Gila Topminnow



Photo by Jim Johnson

A network of desert springs known as Bylas Springs, lying adjacent to the Gila River on the San Carlos Indian Reservation in Arizona, was once home to a thriving population of Gila topminnows. In the early 20th century, the springs became overrun with non-native mosquitofish, which were introduced for mosquito control, and choked with salt cedar trees (*Tamarix* spp.), introduced to stabilize embankments. The native Gila topminnow, once one of the most common fish in southern Arizona, had become one of the most endan-

gered vertebrates in the U.S. But, with the help of Dexter National Fish Hatchery, fish from 2 of the 11 remaining natural populations of the Gila topminnow have been reintroduced successfully into restored habitat in Bylas Springs. This project is part of ongoing efforts by the Service and its partners to restore the Gila River watershed, primarily through riparian restoration, and it will benefit the entire ecosystem, from fish and snails to reptiles, birds, and mammals.

The Gila topminnow has now been reintroduced into more than 20 historic sites, with others under consideration. The success of this project has depended upon partnerships. The San Carlos Apache Tribe granted access privileges, support, and equipment; the Dexter National Fish Hatchery held and propagated genetically appropriate Gila topminnows for reintroduction; and the Arizona State University and Arizona Department of Game & Fish provided expertise and assistance with surveys. The FWS Arizona Fishery Resources Office, using expertise from our Hatcheries and Ecological Services programs, designed this habitat restoration and reintroduction project. Continued restoration this year will be funded, in part, by EPA.

Our hatchery system provides a valuable management tool for the conservation of imperiled fishes. But that tool can only be successful with concurrent habitat restoration and sound scientific management—true keys to the success of any restoration or recovery program.

Linda Andreasen is a Fishery Biologist with the Division of Fish Hatcheries in the FWS Arlington, Virginia, headquarters office. Craig Springer is a Fishery Biologist with the Division of Fisheries in the FWS Albuquerque, New Mexico, Regional Office.

Texas Wild-rice Finds Refuge at Hatchery

by Craig Springer



Federal and State biologists scramble to rescue Texas wild-rice after a dam breach threatened the aquatic endangered plant.

USFWS photos

While some folks fretted over a Y2K meltdown last New Year's Eve, biologists at the San Marcos National Fish Hatchery and Technology Center contended with a real crisis: the accidental drawdown of the San Marcos River in central Texas.

The new year ushered in heavy rains, causing a low-head dam to breach near the town of San Marcos. With the dam compromised, the river dropped and its width narrowed, leaving 25 percent of the entire population of the endangered Texas wild-rice (*Zizania texana*) either high and dry or in water flowing too fast. This species is found only in the San Marcos River.

"With so few plants out there in the wild, we had to act decisively or risk losing up to 400 plants," said Paula Power, Fish and Wildlife Service botanist at the San Marcos hatchery. "We potted and transferred 184 wild-rice plants to the hatchery. Another 60 plants were moved to safer sites within the river." In 1978, the Service listed the Texas wild-rice as endangered, and since 1996, hatcheries have played a critical role in the plant's conservation. About 40 plants are normally kept at the San Marcos facility, and an additional 40 plants are maintained at Uvalde National Fish Hatchery in Uvalde, Texas. The second refugia population at Uvalde lends an added layer of security. Workers at both hatcheries keep the plants healthy and repot the tillers, the product of asexual reproduction, which grow into mature plants. These new plants are ultimately transplanted to face the rigors of life in the river.

"Our experience with Texas wild-rice in the hatcheries proved invaluable when the dam broke," said Power. "Moreover, without a place to move the plants to, recovery of wild-rice would have been set back significantly. The hatcheries mean a lot for the future of Texas wild-rice."

Service hatchery personnel didn't toil alone. The Texas Parks and Wildlife



Department and the Service's Ecological Services Field Office in Austin chipped in, slinging shovels for the salvage. The wild-rice transplants are being cared for and monitored regularly until they can be returned to the San Marcos River.

Craig Springer is a Fishery Biologist with the Division of Fisheries in the Service's Southwest Regional Office, Albuquerque, New Mexico.

During February and March 2000, the Fish and Wildlife Service and National Marine Fisheries Service (NMFS) published the following Endangered Species Act (ESA) listing actions in the *Federal Register*. The full text of each proposed and final rule can be accessed through our website: <http://endangered.fws.gov>.

Proposed Rules

Ohlone Tiger Beetle (*Cicindela ohlone*)

A colorful insect found only in Santa Cruz County, California, the Ohlone tiger beetle has large, prominent eyes, metallic green forewings with small light spots, and coppery-green legs. Adults measure up to about one-half inch (12.5 millimeters) in length. Researchers estimate that only five populations of this species, each occupying fewer than five acres (two hectares), remain. All are found on remnants of open native grassland on coastal terraces associated with two specific soil types. Fragmentation and destruction of these specific habitats caused by urban development and other habitat changes caused by invasive non-native plants are the main threats to the Ohlone tiger beetle. On February 11, the Service proposed to list this species as endangered.

Showy Stickseed (*Hackelia venusta*)

Fewer than 150 individuals of this showy wildflower, the rarest plant in Washington, are known to exist at a single location in Chelan County. A perennial herb in the borage family (Boraginaceae) family, the showy stickseed has large, white, five-lobed flowers, making it an eye-catching attraction for those people fortunate enough to see it in bloom. Habitat modification and loss have reduced the species' range to an area less than 2.5 acres (1 hectare) in size on a steep, highly unstable slope near a state highway.

The showy stickseed is a plant that does not tolerate shade and does not compete well with other plants. Historically, wildfires created natural openings for this species, but fire suppression has allowed encroaching trees and shrubs to shade and out-compete the stickseed. Several non-native noxious weeds also have invaded the site, exacerbating the problem. Ironically, since the species



Showy stickseed

Photo by Ted Thomas/USFWS

now has such a restricted range, a wildfire could cause its extinction. Habitat management work for the plant's recovery therefore will need to be planned and carried out very carefully. To help protect the showy stickseed, the Service proposed on February 14 to list it as endangered.

Steelhead Trout (*Oncorhynchus mykiss*)

The NMFS proposed on February 11 to list the northern California "evolutionary significant unit" (ESU) of the west coast steelhead as threatened. Five other ESUs of this fish are already listed as threatened or endangered. Widespread degradation of aquatic habitats resulting from logging, mining, agriculture, and urbanization is one of the main reasons for the decline of steelhead populations. Water diversions for irrigation, flood control, domestic, and hydropower purposes also contributed to the decline.

Critical Habitat for the Coastal California Gnatcatcher (*Poliioptila californica californica*)

The Service proposed on February 7 to designate lands within a nearly 800,000-acre (325,000-hectare) area of southern California as critical habitat for a threatened bird, the coastal California gnatcatcher. The gnatcatcher was listed in 1993 due primarily to widespread loss of its coastal sage scrub habitat and nest parasitism by the brown-headed cowbird (*Molothrus ater*). Lands encompassed by the proposal include portions of Los Angeles, Orange, San Diego, San Bernardino, and Riverside counties.

Critical habitat designations do not establish wildlife refuge, wilderness area, or any other type of conservation reserve, nor do they affect actions of a purely private nature. They are intended to

delineate areas in which federal agencies must consult with the Service to ensure that actions they authorize, fund, or carry out do not adversely modify the critical habitat. Within these broad boundaries, the Service will require interagency consultation only in those areas that contain the physical and biological features necessary for the species' survival and recovery; many of the towns, cities, and other developments no longer contain suitable habitat. Maps and more specific information on the areas covered under the proposal are contained in the February 7 *Federal Register*.

Critical Habitat for the Alameda Whipsnake (*Masticophis lateralis euryxanthus*)

A proposal to designate critical habitat for this threatened, non-venomous snake was published March 8. The seven proposed areas encompass a total of about 406,700 acres (164,700 hectares) in Alameda, Contra Costa, San Joaquin, and Santa Clara counties, although interagency consultation will be required only on lands within these boundaries that retain suitable habitat. Critical habitat elements for the Alameda whipsnake include areas that support plant communities such as scrub, grasslands, and oak woodlands. Within these plant communities, specific habitat features needed by whipsnakes include small animal burrows, rock outcrops, talus, and other forms of cover to provide for temperature regulation, shelter from predators, egg laying, and hibernation. The snake's historical habitat was reduced by residential, commercial, and recreational development, and has been altered by certain fire suppression activities.

Critical Habitat for the San Diego Fairy Shrimp (*Branchinecta sandiegonensis*)

The Service proposed on March 8 to designate critical habitat for the San Diego fairy shrimp, an endangered aquatic crustacean endemic to vernal or seasonal pools in southern California. Remaining vernal pools within an area of approximately 36,500 acres (14,770 ha) in San Diego and Orange counties are included in the proposal. Vernal pools were once abundant throughout most of California's Central Valley and coastal areas, but most have been altered or destroyed by such factors as urbanization, agricultural development, draining, off-road vehicle use, and livestock overgraz-

ing. A number of plant and animal species that depend on vernal pool habitats are listed as endangered or threatened.

Critical Habitat for the Spectacled Eider (*Somateria fischeri*) On February 8, the Service proposed to designate a total of approximately 74,540 square miles (193,050 sq. kilometers) of coastal areas in Alaska as critical habitat for the spectacled eider, a threatened seabird. The proposal covers nesting habitat on the North Slope, the Yukon-Kuskokwim Delta, and adjacent marine waters; molting areas in eastern Norton Sound and Ledyard Bay; and wintering habitat in the central Bering Sea between St. Lawrence and St. Matthew islands. The Service does not expect the lives and livelihoods of rural and Native Alaskans to be affected by the critical habitat designation, if it is approved.



Steller's eider
USFWS photo

Critical Habitat for the Steller's Eider (*Polysticta stelleri*) A March 13 proposal would designate critical habitat for the Alaska breeding population of another threatened bird, the Steller's eider. The proposal encompasses parts of the North Slope, Yukon-Kuskokwim Delta, and seven marine areas in southwest and southern coastal Alaska. Within the boundaries are approximately 17,000 square miles (44,030 sq. km) of land and about 8,440 square miles (21,860 sq. km) of marine

waters. Biologists believe that the habitats proposed for designation contain the primary breeding, molting, wintering, and migration staging areas for the Alaska breeding population of the Steller's eider. More than 60 percent of the areas proposed as critical habitat for the Steller's eider were included in the critical habitat proposal published earlier for the spectacled eider.

Final Rules

Blackburn's Sphinx Moth (*Manduca blackburni*) Hawaii's largest native insect, the Blackburn's sphinx moth, was listed on February 1 as an endangered species. Once found on six Hawaiian islands, it now exists on only Maui, Kaho'olawe, and Hawai'i. Threats to the moth's survival include non-native ants and parasitic wasps that prey on its eggs and caterpillars, overcollection, and the loss of the moth's native host plant, a dryland forest tree.

Yreka Phlox (*Phlox birsuta*) A perennial shrub in the family Polemoniaceae, the Yreka phlox is endemic to Siskiyou County in northern California, where it grows at only two locations on serpentine slopes near the city of Yreka. Due to threats from habitat loss, the Service listed this plant on February 3 as endangered.

Kneeland Prairie Penny-cress (*Thlaspi californicum*) This plant, a perennial herb in the mustard family (Brassicaceae), grows only on serpentine soils at a small site in Humboldt County, California. Most of the species' habitat was lost to construction of an airport, and the remaining plants survive on less than one acre of land. A proposed airport expansion and potential road alignment threaten the remaining plants, leading the Service to list the Kneeland Prairie penny-cress as endangered on February 9.

Keck's Checker-mallow (*Sidalcea keckii*) An annual herb in the mallow family (Malvaceae), this species grows only on serpentine-derived clay soils in the grasslands of California's central western Sierra Nevada foothills. The Keck's checker-mallow is an attractive plant, producing showy deep pink flowers. Fewer than 300 individuals are known to remain, all in Fresno and Tulare coun-

ties. On February 16, because of threats to the species from urban development and the conversion of grasslands to agriculture, the Service listed the Keck's checker-mallow as endangered.

Two San Joaquin Valley Mammals Two mammals endemic to California's San Joaquin Valley, the riparian brush rabbit (*Sylvilagus bachmani riparius*) and the riparian or San Joaquin Valley woodrat (*Neotoma fuscipes riparia*), were listed on February 23 as endangered. Both historically inhabited dense cover in riparian forests along major streams, but habitat loss has reduced their range by approximately 90 percent. Biologists know of only a single population of each animal at Caswell Memorial State Park. Flooding periodically forces the animals into upland habitats that have been cleared or otherwise modified, increasing the threat from predation.

Two Alabama Snails Two species of snails endemic to Alabama, the armored snail (*Pyrgulopsis pachyta*) and slender campeloma (*Campeloma decampi*), were listed on February 25 as endangered. Both species are very rare, and exist only in a few isolated sites along two or three creek reaches in Limestone County. Siltation and other forms of pollution from poor land use practices and waste discharges are contributing to a general deterioration in water quality, which poses a continuing threat to the snail species.

Purple Amole (*Chloroganum purpureum*) A perennial in the lily family (Liliaceae), the purple amole grows from a bulb and produces bluish-purple flowers. A March 20 rule listed the species' two known varieties, both restricted to California, as threatened; *C. p.* var. *purpureum* occurs in the south coast ranges in Monterey County, and *C. p.* var. *reductum* is known only from two sites in the coast ranges in San Luis Obispo County. The degradation or loss of habitat and encroachment by non-native grasses are the main threats to the purple amole.

Four Central California Plants A separate March 20 rule listed four plant species native to the south-central coast region of California as endangered: the Lompoc yerba santa (*Eriodictyon capitatum*), a shrub in the waterleaf family

(Hydrophyllaceae); La Graciosa thistle (*Cirsium loncholepis*), a short-lived plant in the sunflower family (Asteraceae); Gaviota tarplant (*Hemizonia increscens* var. *villosa*), an annual in the sunflower family; and Nipomo Mesa lupine (*Lupinus nipomensis*), an annual in the pea family (Fabaceae). All four plants have small populations with limited distribution, and are restricted to coastal areas in northern and western Santa Barbara County and southern San Luis Obispo County. Their habitats have been reduced or degraded by urbanization, conversion to agriculture, oil/gas development, alteration of natural fire cycles, and invasive non-native plant species.

Santa Cruz Tarplant (*Holocarpha macradenia*) The Santa Cruz tarplant, an aromatic annual herb in the aster family, is native to coastal prairies and grasslands in Contra Costa, Santa Cruz, and Monterey counties, California. Much of its habitat has been lost to urban and commercial development or altered by grazing. Because of continuing pressure from development and non-native plants, the Service listed the Santa Cruz tarplant on March 20 as a threatened species.

Canada Lynx (*Lynx canadensis*) The “distinct population segment” of the Canada lynx in the contiguous U.S. was listed March 24 as threatened. A forest-dwelling cat of northern latitudes, this species is found in North America from Alaska south through much of Canada to the northeastern U.S., the Great Lakes states, the Rocky Mountains, and the Cascade Mountains. Within the contiguous 48 states, the Canada lynx was native to forested portions of Colorado, Idaho, Maine, Michigan, Minnesota, Montana, New Hampshire, New York, Oregon, Utah, Vermont, Washington, and Wisconsin. The Northern Rockies/Cascades region supports the largest amount of lynx habitat and has the strongest evidence of long-term lynx populations, both historically and currently. In reaching the listing decision, the Service concluded that the threat to the lynx in the contiguous 48 states is the lack of guidance to conserve the species in current federal land management plans. Work has begun in an effort to improve habitat conservation on public lands.

Critical Habitat for Salmon In the February 16 *Federal Register*, NMFS published a designation of critical habitat for 19 listed ESUs of chinook (*Oncorhynchus tshawytscha*), chum (*O. keta*), coho (*O. kisutch*), and sockeye (*O. nerka*) salmon and steelhead trout in California and Pacific Northwest waters.

Dismal Swamp Southeastern Shrew (*Sorex longirostris fisheri*) This small mammal was listed in 1986 as threatened based on the information available at that time, which indicated vulnerability due to habitat loss, hybridization with another subspecies, and a restricted range in southeastern Virginia and an adjacent area of North Carolina. On the basis of further research conducted since 1986, biologists have found that it has a wider range than once thought, is genetically secure, and occurs at healthy levels. For these reasons, the Service removed the Dismal Swamp southeastern shrew from the list of threatened species on February 28, 2000.

Withdrawal

Pecos Pupfish (*Cyprinodon pecosensis*) In 1998, the Service proposed to list the Pecos pupfish, a small fish native to the Pecos River, its tributaries, and nearby waters in New Mexico and Texas, as an endangered species. The threats cited in the proposal were 1) habitat alteration resulting from dams, water diversions, and excessive groundwater pumping, and 2) hybridization with a non-native fish species, the sheepshead minnow (*Cyprinodon variegatus*), which anglers introduced into the pupfish's habitat in the 1980s as a baitfish. Since publication of the listing proposal, the Service and other federal and state resource management agencies have executed a Conservation Agreement that addresses the threats to the pupfish and establishes a plan to restore the species to a viable status. For that reason, the Service published a notice in the March 17, 2000, *Federal Register* withdrawing the listing proposal.

The Fish and Wildlife Service's recovery program home page has more information on many of the issues discussed in this edition of the *Bulletin*. To enter the website, go to <http://endangered.fws.gov> and click on “Recovery.” Through this site, you can download copies of species recovery plans that were approved between 1989 and 1999. The site also contains a list of threatened and endangered species that have approved recovery plans and a list of species that have been delisted or reclassified.

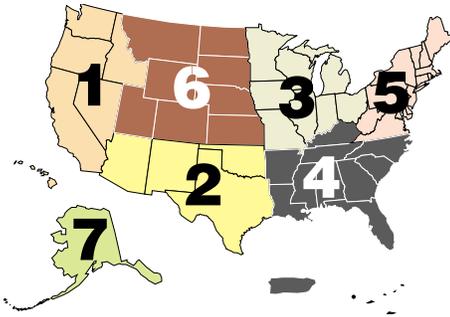
Also on the Service's national endangered species home page, the current “Creature Feature” focuses on “America's Mussels: Silent Sentinels.”

The Service's Region 3 website contains a “Gray Wolf Recovery” webpage with information on the July 13, 2000, proposal to reclassify most wolf populations in the lower 48 states as threatened: <http://midwest.fws.gov/wolf>

For information on the Mexican gray wolf or *lobo*, which is not affected by the reclassification proposal, visit Region 2's “Mexican Gray Wolf Recovery” webpage. It provides a variety of information on the current reintroduction effort, and can be found at <http://mexicanwolf.fws.gov>

One of our nation's rarest mammals is featured on Region 6's “Black-footed Ferret” webpage. For information on progress towards ferret recovery: <http://www.r6.fws.gov/ferret>

For information on the recovery and proposed delisting of the Aleutian Canada goose, visit Region 7's webpage for this bird at <http://www.r7.fws.gov/es/acg/acg.html>



Fish and Wildlife Service regional endangered species staffers have reported the following news:

Region 1

Non-native Plant Control The 22nd annual “Lupine Bash” took place recently at the Lanphere Dunes Unit of the Humboldt Bay National Wildlife Refuge (NWR). This event, co-sponsored by the Fish and Wildlife Service, California Native Plant Society, and Friends of the Dunes, focuses on one of the area’s troublesome non-native plant species. The yellow bush lupine (*Lupinus arboreus*) is native to the dunes of central and southern California, but not northern California where the refuge is found. This legume was introduced to Humboldt Bay in 1908. Since then, it has spread invasively and now covers over 44 percent of the habitat for two endangered plants on the Humboldt Bay dunes. (Another invasive, European beachgrass, *Ammophila arenaria*, covers an additional 38 percent). Yellow bush lupine has been removed from the Lanphere Dunes Unit each year since 1985, but new plants continue to emerge from the seedbank. Volunteers from the community chopped and pulled plants, once again leaving the refuge dunes lupine-free.

Refuge volunteer Kyle Wear collected soil samples from our continuing study on the effects of applying sawdust to restored areas that have been previously nitrified by yellow bush lupine. (Like other legumes, the lupine fixes atmospheric nitrogen in its roots.) Soil overly-rich in nitrogen is detrimental to the refuge’s native plants. The presence of the carbon in sawdust stimulates the growth of microbes that consume nitrogen, thus acting as an “anti-fertilizer.” We are carrying out this experi-

ment in collaboration with Dr. Peter Alpert of the University of Massachusetts. This study, now in its third year, may require up to 5 years before a reduction in nitrogen levels is evident.

Staff from the Lanphere Dunes Unit joined staff from the Service’s Arcata, California, Fish and Wildlife Office for a day of digging European beachgrass (*Ammophila arenaria*) at the south end of Clam Beach. This site was cleared of beachgrass when the Mad River abruptly changed its course last winter, and last summer it was used for nesting by the threatened western snowy plover (*Charadrius alexandrinus nivosus*). The cooperative effort is aimed at eliminating newly-sprouting beachgrass in order to keep it from regaining a foothold. The Service will ask Humboldt County, the landowner, to continue to maintain this effort after nesting season is over.



Western snowy plover

Photo by T. A. Blake/USFWS

San Francisco Bay NWR Biologist Ivette Loredo and Intern Ross Wilming, accompanied by refuge volunteers Frank and Janice Delfino, held the second Antioch Dunes evening-primrose (*Oenothera deltooides* ssp. *howellii*) “Planting Party” of the season on January 29 at Antioch Dunes NWR. Refuge staff have conducted prescription burns on this unit for the past 3 years to control exotic vegetation and promote recovery of the endangered primrose. Last December, during the first “Planting Party” of the season, 425 primroses were planted on this unit. Unfortunately, the weeks that followed were very dry, causing great stress on the new seedlings. Eighty of these plants were replaced on January 29, and an additional 175 new primroses were also planted that day. The 600 total plants are

individually numbered and tagged, and will be monitored for survival and regeneration. Continual weeding around each plant will be done frequently, especially as new seedlings emerge at the time of seed germination next year.

Columbia Spotted Frog (*Rana luteiventris*) Staff from the Service’s Snake River Basin Office in Boise, Idaho, presented awards to three ranching families at the Owyhee County Cattlemen’s Association annual meeting. The awards were given in recognition of the ranchers’ cooperation and willingness to allow access to private property to survey and monitor sites that support the Great Basin population of Columbia spotted frog. We hope that this recognition will lead to continued cooperation for long-term monitoring efforts.

Reported by LaRee Brosseau of the Service’s Portland, Oregon, Regional Office.

Region 4

Wood Stork (*Mycteria americana*) The Service, in cooperation with several other state, federal, and private interests, hopes to conduct surveys during the upcoming nesting season, beginning in October, to determine the current status of this endangered bird. Currently, wood stork nesting colonies are found in South Carolina, Georgia and Florida. Post-breeding storks disperse as far north as North Carolina and as far west as Mississippi and Alabama. In the early 1930s, wood stork populations totaled 75,000 birds. By the early 1980s, however, the stork’s population had drastically declined to 5,000 nesting pairs in 52 active colonies. The generally accepted explanation for the decline was a reduction in the stork’s food base caused by a decline in wetland habitat, accompanied by a change in hydroperiods resulting from the intensive water management in south Florida.

During the 1990s, the stork’s total population increased to 6,000 nesting pairs in 59 active colonies in Florida, Georgia, and South Carolina. Historically, the wood stork’s largest populations have been concentrated in Florida’s Big Cypress National Preserve and the Everglades. Recently, the population appears to be growing in northern



Wood stork

Photo by Dick Dickenson

Florida, South Carolina, and Georgia. However, biologists are not yet certain whether the stork's population is actually increasing in the northern areas or is just moving north because of changes in the Everglades. This will be an important determination to make before a proposal to reclassify the wood stork from endangered to threatened can be made; the species' recovery plan calls for at least 2,500 nesting pairs in the south Florida area.

Reported by Bill Brooks of the Service's Jacksonville, Florida, Field Office.

Region 5

Bog Turtle (*Clemmys mublenbergii*)

The Service's New Jersey Field Office participated in a series of meetings with the New Jersey Department of Environmental Protection (NJDEP) and the Township of Hardyston in Sussex County regarding a proposed expansion of the township's sewer service area. The expansion area originally included several known bog turtle populations, which could be adversely affected via secondary and indirect impacts. As a result of the discussions, Hardyston Township agreed to minimize the expansion area, avoiding all but two known bog turtle locations. Hardyston Township agreed to provide a written letter to the two landowners

involved, alerting them to Service concerns regarding any planned development activities on their property. The New Jersey Field Office also agreed to provide additional assistance, including guidance on developing a Habitat Conservation Plan if needed.

Landowners who propose to develop the last of three golf course/residential communities that had been planned within the Township met with the Service and NJDEP to identify project designs that would have adversely affected bog turtles. The project proponents noted that they were interested in protecting the bog turtle population and agreed to redesign the project to avoid adverse effects. The New Jersey Field Office will continue to coordinate with the NJDEP and the project proponents to ensure the long-term survival and viability of the Hardyston bog turtle population.

Blackside Dace (*Phoxinus cumberlandensis*) Biologists recently found the blackside dace in Cox Creek, a small tributary of the North Fork Powell River in Lee County, Virginia. The report is the first record of this threatened fish outside of the upper Cumberland River system. Cox Creek is located just across the divide between the Tennessee and Cumberland Rivers systems, and the species may have entered Cox Creek through stream "pirating;" the stream once may have flowed into the Cumberland but some geologic event of the past rerouted the stream to the other side of the divide. This would not be the first example of fauna moving into a new drainage as a result of stream pirating.

Mr. Chris Skelton, an aquatic zoologist with the Georgia Natural Heritage Program and an expert on the genus *Phoxinus*, notified us that he had identified some 1995 collections from Cox Creek and had found *P. cumberlandensis*. He also had collected from the stream himself recently and found the species present. Dr. Dave Etnier at University of Tennessee said he had seen the specimens from Cox Creek and felt that Chris Skelton's identification as *P. cumberlandensis* was a good one. As Dr. Etnier pointed out, these fish could turn out to be an undescribed species closely related to *P. cumberlandensis*, but for now we have to call them *P. cumberlandensis*.



Blackside dace

Photo by Richard Biggins/USFWS

Northeastern Bulrush (*Scirpus ancistrochaetus*) Last April, the Service's Conte NWR added a 278-acre (112-hectare) site in Putney, Vermont, to protect a population of the endangered northeastern bulrush. The site supports the state's second largest population of this wetland plant.

Reported by Tom Chapman of the Service's Abingdon, Virginia, Field Office.

Washington, D.C., Office

Earth Day 2000 The 30th anniversary of Earth Day was celebrated with great enthusiasm on the Mall in Washington, D.C. On April 22, several hundred thousand conservation-minded people joined Vice President Gore to learn about the current issues affecting the world's environment. The Service's National Outreach Team organized a booth in the Earth Tent representing all Service Programs. The Endangered Species program was well-represented with materials to distribute and with staff on hand to converse with the public. Besides Endangered Species, staff from Public Affairs, Habitat Conservation, National Conservation Training Center, and Region 4 spoke with hundreds of adults and children at the booth. Other speakers besides the Vice President were Earth Day Chair Leonardo DiCaprio, Ted Danson, and Melanie Griffith. Performers included Carole King; James Taylor; Indigenous; and Peter, Paul and Mary. Dozens of other well-known speakers and performers took the stage in front of the Capitol.

Reported by Susan D. Jewell of the Division of Endangered Species in the Service's Arlington, Virginia, headquarters office.

BOX SCORE

Listings and Recovery Plans as of June 30, 2000

GROUP	ENDANGERED		THREATENED		TOTAL LISTINGS	U.S. SPECIES W/ PLANS**
	U.S.	FOREIGN	U.S.	FOREIGN		
 MAMMALS	63	251	9	16	339	47
 BIRDS	77	176	15	6	274	76
 REPTILES	14	65	22	14	115	30
 AMPHIBIANS	10	8	8	1	27	12
 FISHES	69	11	44	0	124	90
 SNAILS	20	1	11	0	32	20
 CLAMS	61	2	8	0	71	45
 CRUSTACEANS	18	0	3	0	21	12
 INSECTS	30	4	9	0	43	28
 ARACHNIDS	6	0	0	0	6	5
ANIMAL SUBTOTAL	368	518	129	37	1,052	365
 FLOWERING PLANTS	565	1	139	0	705	528
 CONIFERS	2	0	1	2	5	2
 FERNS AND OTHERS	26	0	2	0	28	28
PLANT SUBTOTAL	593	1	142	2	738	558
GRAND TOTAL	961	519	271	39	1,790*	923

TOTAL U.S. ENDANGERED: 961 (368 animals, 593 plants)

TOTAL U.S. THREATENED: 271 (129 animals, 142 plants)

TOTAL U.S. LISTED: 1,232 (497 animals***, 735 plants)

*Separate populations of a species listed both as Endangered and Threatened are tallied once, for the endangered population only. Those species are the argali, chimpanzee, leopard, Stellar sea lion, gray wolf, piping plover, roseate tern, green sea turtle, saltwater crocodile, 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 530 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.

***Nine animal species have dual status in the U.S.

ENDANGERED
Species
BULLETIN

*U.S. Department of the Interior
 Fish and Wildlife Service
 Washington, D.C. 20240*

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