

E N D A N G E R E D

Species
B U L L E T I NU.S. DEPARTMENT OF THE INTERIOR
MARCH/APRIL 1997FISH AND WILDLIFE SERVICE
VOL. XXII NO. 2

*N*ative plants make possible the diverse ecological communities that support our economic prosperity and quality of life. Unfortunately, native plants are disappearing at an unprecedented rate, not only from remote tropical rain forests but also from our own backyards. According to The Nature Conservancy, the United States has lost nearly 200 species of plants since the 1800's. The Fish and Wildlife Service lists over 600 others as threatened or endangered.

Conserving the health and biodiversity of ecosystems, including native plant species, is essential to sustaining the natural resource base upon which humans depend. This edition of the **Endangered Species Bulletin** takes a look at some ways in which private organizations and public agencies are working together to conserve our nation's native plant treasures.



Bernice DeSantos

U.S. Fish & Wildlife Service

WASHINGTON D.C. OFFICE *Washington, D.C. 20240*

John Rogers, <i>Acting Director</i>	E. LaVerne Smith, <i>Chief, Division of Endangered Species</i>	(703)358-2171
Jamie Rappaport Clark, <i>Assistant Director for Ecological Services</i>	Ren Lohofener, <i>Deputy Chief, Division of Endangered Species</i>	(703)358-2171
	Ren Lohofener, <i>Acting Chief, Branch of Information Management</i>	(703)358-2171
	Jay Slack, <i>Chief, Branch of Conservation and Classification</i>	(703)358-2105
	Richard Hannan, <i>Chief, Branch of Recovery & Consultation</i>	(703)358-2106

REGION ONE *Eastside Federal Complex, 911 N.E. 11th Ave, Portland OR 97232*

<i>California, Hawaii, Idaho, Nevada, Oregon, Washington, American Samoa, Commonwealth of the Northern Mariana Islands, Guam and the Pacific Trust Territories</i>	Michael J. Spear, <i>Regional Director</i>	(503)231-6118 http://www.r1.fws.gov
--	--	--

REGION TWO *P.O. Box 1306, Albuquerque, NM 87103*

<i>Arizona, New Mexico, Oklahoma, and Texas</i>	Nancy Kaufman, <i>Regional Director</i>	(505)248-6282 http://sturgeon.irm1.r2.fws.gov
---	---	--

REGION THREE *Federal Bldg., Ft. Snelling, Twin Cities MN 55111*

<i>Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin</i>	William Hartwig, <i>Regional Director</i>	(612)725-3500 http://www.fws.gov/~r3pao/r3home.html
--	---	--

REGION FOUR *1875 Century Blvd., Suite 200, Atlanta, GA 30345*

<i>Alabama, Arkansas, Louisiana, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Florida, Tennessee, Puerto Rico, and the U.S. Virgin Islands</i>	Noreen Clough, <i>Regional Director</i>	(404)679-4000 http://www.fws.gov/~r4eao
---	---	--

REGION FIVE *300 Westgate Center Drive, Hadley, MA 01035*

<i>Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia</i>	Ronald E. Lambertson, <i>Regional Director</i>	(413)253-8659 http://www.fws.gov/~r5fws
---	--	--

REGION SIX *P.O. Box 25486, Denver Federal Center, Denver CO 80225*

<i>Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, Utah, and Wyoming</i>	Ralph O. Morgenweck, <i>Regional Director</i>	(303)236-7920 http://www.r6.fws.gov/www/ty
---	---	--

REGION SEVEN *1011 E. Tudor Rd., Anchorage, AK 99503*

<i>Alaska</i>	Dave Allen, <i>Regional Director</i>	(907)786-3542 http://www.fws.gov/~r7hpirn
---------------	--------------------------------------	--

ENDANGERED

Species BULLETIN

Telephone: (703)358-2390

Fax: (703)358-1735

Internet:

R9FWE_DES.ESB@fws.gov

<http://www.fws.gov/~r9endspp/endspp.html>

Editor

Michael Bender

Associate Editor

Jennifer Greiner

Art Director

David Yeargin

Editorial Assistance

Martha Balis-Larsen

Design Consultant

Steve Friesen

Contributors

Margaret Sotham

Nancy Morin

Kathryn Staley

Kelly Amsberry

Robert J. Meinke

Mike Jennings

Brien Meilleur

Richard A. Fischer

Chester O. Martin

Ann-Marie Trame

Mary G. Harper

Clifford G. Rice

Kirsten Winter

Tess Higgins

Jim Lewis

Lt. Colonel Charles Gross

LaRee Brosseau

On the Cover

With its brilliant pink flowers, the scrub blazing star (*Liatris oblongerae*) is one of the more distinctive plants of Florida's Lake Wales Ridge.

Photo by Reed Bowman



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.

The Fish and Wildlife Service distributes the Bulletin primarily to Federal and State agencies, and official contacts of the Endangered Species Program. It also is reprinted by the University of Michigan as part of its own publication, the Endangered Species UPDATE. To subscribe, write the Endangered Species UPDATE, School of Natural Resources, University of Michigan, Ann Arbor, MI 48109-1115; or call 313/763-3243.

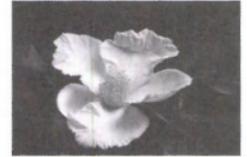


Printed with vegetable-based ink on recycled and recyclable paper. If you do not keep back issues, please recycle the paper, pass them along to an interested person, or donate them to a local school or library.

IN THIS ISSUE

4 Nurturing Native Plants

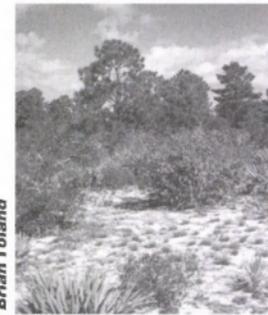
8 Safe Places for Plants



William L. McLean III

10 Life on the Windiest Peak*

12 Restoring the Popcorn-flower



Brian Toland

14

The Treasures of Lake Wales Ridge

17 Center for Plant Conservation

18 Managing Plant Communities

20 DoD's Wildlife R&D

21 The Shrine Pool

22 Alerting the Birds

24 Teaming Up for PV Blues

26 A Second Chance



Jeremiah George

Departments

27 Call for Contributions

28 Regional News and Recovery Updates

30 Listing Actions

Nurturing Native Plants

Wildflowers are hip. Just ask any one of thousands of visitors what brings them out in droves this spring to national parks, national forests, arboreta and botanic gardens, and you'll often hear it is the radiant blossoms of every shape, size, color and configuration that adorn native plants. Wildflower viewing has become an official leisure time activity for many Americans, but it's serious business for the Native Plant Conservation Initiative (NPCI). For the past three years, the initiative has sponsored Celebrating Wildflowers, a year-long public awareness campaign featuring a calendar of wildflower activities from around the country. Celebrating Wildflowers kicks off this year during National Wildflower Week, which takes place May 18-24.

NPS,

On a hot mid-May morning, Susan Spackman stood in a remote corner of Mesa County, Colorado, binoculars in hand, scanning the pinyon-juniper stands and rolling sagebrush fields around her. She could have passed for a nature enthusiast out for the day, but her gear included items most hikers do not carry—pencils, notebooks, and an odd assortment of tools designed for the serious business of botany.

Spackman, a botanist with the Colorado Natural Heritage Program, had received a grant from the National Fish and Wildlife Foundation through the Native Plant Conservation Initiative to spend three weeks surveying Bureau of Land Management (BLM) lands for six rare plants endemic to the region: canyonlands lomatium (*Lomatium latilobum*), fisher towers milkvetch (*Astragalus piscator*), Dolores skeletonplant (*Lygodesmia doloresensis*), DeBeque milkvetch (*Astragalus debequaeus*), Grand Junction milkvetch

(*Astragalus linifolius*), and naturita milkvetch (*Astragalus naturitensis*).

Finding them wasn't easy since these flowering plants were known to exist in only a few locations in Colorado and Utah. Four of the 6 species in the study area were considered by the Colorado National Heritage Program to be imperiled globally, with fewer than 20 known populations, and the other taxa were considered *critically* imperiled globally, with fewer than 5 known populations. Perseverance paid off, though, and by the survey's end, Spackman, along with botanists Peggy Lyon and Kim Fayette, and a team of volunteers, discovered additional colonies of all six plants. She also demonstrated the success that cooperative ventures can achieve.

One of the fastest growing counties in the nation, Mesa is a booming area in western Colorado surrounded by the Rocky Mountains. Nearly 70 percent of the dusty desert steppe that comprises the county is public land, managed either

This rugged area of western Colorado is habitat for the DeBeque milkvetch.

Photo by Susan Spackman



by the BLM or the Forest Service. The county's population explosion, says Spackman, results from the combination of a great climate and a strong economy. Recognizing the potential effects this growth could produce, Mesa County commissioners awarded a \$40,000 grant to the Colorado Heritage Program for a biological inventory of Mesa County's public *and* private lands. The survey ultimately covered roughly 1.6 million acres (647,500 hectares) of Federal land and 576,000 non-Federal acres (233,100 ha). This wider inventory, conducted by Peggy Lyon (who is also with the Colorado Heritage Program), expanded on Spackman's more focused efforts by looking beyond BLM lands.

Spackman now will make recommendations to BLM for management of the surveyed species as well as associated plant communities that are at risk. Her recommendations also will be incorporated into the larger Mesa County survey report Lyon is producing. This report will serve as a guide for the commissioners to use when approving land acquisition and development, and thus will help to protect the area's rare, threatened, and endangered species.

To conduct the surveys, Lyon and Spackman relied on help from a variety of Federal, State, and local organizations. Among the partners are the Grand

Junction and Glenwood Springs Resource Areas of BLM; the Colorado Native Plant Society, which provided in-the-field volunteers; Mesa State College, which contributed information on areas of potential habitat; and The Nature Conservancy, which provided technical and administrative support, such as the identification of ecologically significant survey areas.

The grant Spackman received was just one of 27 awarded by the Native Plant Conservation Initiative and administered by the National Fish and Wildlife Foundation in 1996. A partnership of 9 Federal agencies and nearly 60 non-Federal cooperators, the initiative brings together individuals, agencies, and organizations to accomplish on-the-ground conservation of native plants as well as to foster public awareness of the need for such efforts. Since its inception in 1994, the Native Plant Conservation Initiative has awarded nearly \$800,000 in challenge grants for 37 projects in over half of the 50 States.

Collaborations such as that in Spackman's survey form the cornerstone of the Native Plant Conservation Initiative's grant program, which funds efforts that pair public entities with private groups and organizations to conduct on-the-ground conservation projects. In the case of the Mesa County

Begun in the Pacific Northwest by the USDA Forest Service, Celebrating Wildflowers was quickly adopted by NPCI as a national outreach program designed to increase public awareness of native plants and the need to conserve this precious natural resource. National parks, national forests and BLM lands all offer wildflower-related activities that range from guided walks to volunteer fieldwork opportunities to festivals. These activities are featured on a wildflower hotline (1-800-354-4595) and in a national calendar of events distributed to public lands and through the initiative's cooperating organizations. More information about Celebrating Wildflowers is available on NPCI's homepage on the World Wide Web at <http://www.aqd.nps.gov/natnet/npci>.



The DeBeque milkvetch has reddish, inflated seed pods.

Photo by Susan Spackman

survey, the commissioners receive an exhaustive biological survey of their county upon which they can craft a master plan and chart an ecologically sound course for the area's population boom. The survey could help determine whether the rare native plants survive or become extinct. The BLM gains a thorough inventory of its Mesa County lands without having to commit scarce labor resources, and it can now design and implement management practices appropriate for these lands. At the same time, the Colorado Heritage Program has megabytes of additional information on these rare plants for its computerized biological conservation data base, a major focus of the program. Finally, the residents of Mesa County also benefit. Says Spackman, "We hope to increase the understanding among local people about the value of these plant resources, to build a sense of pride among the community's citizens about their natural resources." To do this, she and Lyon will prepare a slide presentation about the survey as well as a brochure about the county's biological diversity.

This emphasis on education at the local level reflects the initiative's national strategy, which values public education about native plant conservation equally with on-the-ground conservation and restoration work. While the Native Plant

Conservation Initiative reaches out to the field through its grant program, it simultaneously seeks to convey to the public the importance of native plants in everyday life. Websurfers can log onto the group's homepage on the World Wide Web (<http://www.aqd.nps.gov/natnet/npci>) to get the latest information on the group's activities, read about the medicinal uses of native plants, or find links to other sources of native plant information. The initiative also prints educational brochures on native plants, offers a traveling display, and creates awareness campaigns designed to carry its message to a larger audience (see sidebar on pages 4 and 5).

Although much of the group's current work is restoration, preventing endangerment and extinction of plant species is the long-term goal for one simple reason: what we don't know could hurt us. As Spackman puts it, "If we don't know what function a plant has in its natural environment, we don't know what will happen to that environment once the species is gone or what we could have learned from it."

Margaret Sotham is the outreach coordinator for the Native Plant Conservation Initiative.

Grand Junction milkvetch (in foreground) was found at this site in the Echo Canyon area.

Photo by Peggy Lyon



Opposite page:
The Dolores skeletonplant, endemic to a few locations in Colorado and Utah, produces showy, light-purple flowers.

Photo by Peggy Lyon



Safe Places for Plants

Flora of North America

Botanists in the United States and Canada have mobilized their botanical forces to produce an up-to-date, authoritative flora of North America north of Mexico, including the Florida Keys, Greenland, St. Pierre et Miquelon, and the Aleutian Islands. More than 30 institutions are major participants and more than 700 specialists are writing and reviewing the species treatments. Treatments include accepted names; major synonyms; descriptions; state and province distributions; and discussions of taxonomic problems, economic uses, biologically interesting features, and (where applicable) conservation status. Every species will have a range map, and one-third of the species will be illustrated.

Treatments are being reviewed carefully by regional botanists, including many in federal and state agencies, and by The Nature Conservancy staff. As a consequence, the distribution information is more complete and reliable than it has been in other works. Special attention will be devoted to ensuring that the conservation status (that is, whether a taxon is of concern) is correctly represented. Every attempt is made to

One of the earliest roles of botanical gardens and arboreta was to collect and grow rare plant species from throughout the world. This was prompted by keen interest in the unusual, especially novelties from other lands, but various gardens served pharmaceutical, horticultural, and scientific purposes as well. In line with their work to document and display the world's plant diversity, gardens and arboreta traditionally have been major centers for research. Rare species receive particularly careful attention. The *Flora of North America* (centered at Missouri Botanical Garden), the *Intermountain Flora* (by staff at The New York Botanical Garden), and *Flora of Pennsylvania* (at the Morris Arboretum) are examples of large-scale floristic projects sponsored by botanical gardens.

Through the American Association of Botanical Gardens and Arboreta, gardens share ideas and collaborate to ensure that their conservation activities are effective. Gardens and arboreta throughout the country are playing a key role both in growing plants to increase stock for reintroduction and to conduct the necessary research on how these plants should be managed. Gardens by themselves, or in partnership with other academic institutions, are analyzing the genetic diversity of living collections in cultivation, and of individual plants in the wild, to determine the best strategy for maintaining viable populations. Similar studies are being conducted on pollination biology, pathology, competition, and microhabitat requirements. Many gardens also are members of Botanical Gardens Conservation International, an organization dedicated to plant conservation activities at gardens throughout the world. It has very active educational programs and is developing standards for establishing and maintaining collections of rare species.

A number of botanical gardens specialize in native plants. Examples of these are the Desert Botanical Garden (Phoenix, Arizona), Boyce Thompson Southwestern Arboretum (Superior, Arizona), Rancho Santa Ana Botanic Garden (Claremont, California), Bernheim Forest Arboretum (Clermont, Kentucky), Garden in the Woods (Framingham, Massachusetts), Matthaei Botanical Gardens (Ann Arbor, Michigan), North Carolina Botanical Garden (Chapel Hill, North Carolina), Berry Botanic Garden (Portland, Oregon), and Mt. Cuba Center (Greenville, Delaware).

Gardens and arboreta in the United States and Canada attract about 45 million visitors each year. These facilities perform an important service by educating the public about environmental processes, the importance of biodiversity, and the need for conserving species and their habitats.

Botanical gardens and arboreta today recognize how precious their existing living collections are and the potential they have for providing a safe haven for species that are endangered in the wild.

Some even grow plants that no longer can be seen in the wild (*Franklinia alatamaha*, for example) or that the public is unlikely to encounter. In these ways, gardens not only illustrate the importance of good environmental stewardship, but also show how much is lost when a species becomes extinct.

Nancy Morin is Executive Director of the American Association of Botanical Gardens and Arboreta and Convening Editor of the Flora of North America.

Franklinia alatamaha, sometimes known as the Franklin tree, now exists only in cultivation.

Photo by William L. McLean III



facilitate dialogue between the specialist preparing the treatment and those responsible for conservation of a species in the wild. Whenever questions remain or differences of opinion exist, these will be explained in the treatment's discussion.

Two volumes have already been printed and the third is expected soon. When complete, the flora will comprise 30 printed volumes. All information in the published books will also be available on CD-ROM and on the Internet at <http://www.fna.org>. The flora will cover all vascular plants and bryophytes (non-flowering plants comprising the mosses and liverworts) native or naturalized in North America.

Life on the Windiest Peak

It takes a tough plant to survive on Mt. Washington, North America's windiest peak. Wind speeds there have been clocked in excess of 230 miles per hour. In this extreme setting, a partnership of public and private organizations is working to conserve one of our rarest alpine plants.

Near the summit of Mt. Washington, a windswept peak in the White Mountains of New Hampshire, the Robbins' cinquefoil (*Potentilla robbinsiana*) is battling extinction. This plant survives in a rocky area called Monroe Flats, adjacent to the Appalachian Mountain Club's (AMC) Lake of the Clouds hut in the Presidential Range. Botanists believe that the Robbins' cinquefoil established itself on Mt. Washington as the glaciers receded at the end of the Ice Age about 10,000 years ago. One of the Nation's rarest alpine plants, this species currently numbers only about 1,700 adults. In 1980, the Fish and Wildlife Service (FWS) listed the Robbins' cinquefoil as endangered. Biologists with the New England Wildflower Society, AMC, White Mountain National Forest, and FWS have been working together for over 10 years in a successful partnership to recover this vulnerable alpine species.

A member of the rose family (Rosaceae), the Robbins' cinquefoil is endemic to the White Mountains and occurs there at two sites. Only one population, found on a 2-acre (0.8-hectare) patch at Monroe Flats, is considered viable. Because of the plant's rarity and unusual reproductive strategy (see sidebar), the Robbins' Cinquefoil Recovery Plan called for an extensive species viability analysis, population dynamics studies, and refinement of propagation and transplant techniques. Now that these studies are complete, transplanting expeditions are an annual event for the recovery partners.

Although the plants are hardy enough to tolerate Mt. Washington's extreme weather, they are fragile and particularly vulnerable to physical disturbances. One threat to the survival of Robbins' cinquefoil came from the 5,000 to 7,000 hikers who trek through the area each year. Another threat to the species came from excessive removal of plants by overzealous collectors. With only one viable population in existence, a single catastrophic event could push the species over the edge into extinction. Because so many threats face this plant, AMC's Kenneth Kimball, New England Wildflower Society's Bill Brumback, and Federal biologists have been working together toward the long-term goal of establishing additional colonies of the plant at other former sites in the White Mountains and enhancing the surviving colony.

To establish additional colonies, seeds have been removed for the past 5 years from the Monroe Flats population and propagated at the Garden in the Woods botanical

garden of the New England Wildflower Society in Framingham, Massachusetts. Cultivation at the garden speeds their growth, allowing them to mature to reproductive age within 2 years. The progeny from these greenhouse-raised plants are then transplanted at historical locations in the White Mountains.

Based on demographic studies and extinction probability models developed by AMC's Research Department and funded by the Forest Service, transplanted seedlings are expected to form successful colonies at two additional sites. Costs for collecting seeds, germinating them, and transplanting the seedlings are shared among the partners and the National Forest Foundation.

Until recently, the Robbins' cinquefoil was concentrated in the area of the Crawford Path, a popular hiking route in use since the early 1800's. This section of the trail has been re-routed and a scree wall constructed to keep the heavy feet of hikers from damaging the colony. Today, the plants grow relatively undisturbed.

The alpine zone of the White Mountains provides habitat for several other alpine species, all vulnerable to the influx of wildflower enthusiasts who trek to the famed Alpine Garden on Mt. Washington. In addition to Robbins' cinquefoil, hikers can see Lapland rosebay, alpine azalea, and an abundance of diaspensia. With financial assistance from the National Forest Foundation, efforts are underway to provide interpretive signs, brochures, and information to remind hikers to tread lightly as they trek through alpine areas.

We hope that the enduring partnership among Federal agencies, the New Hampshire Natural Heritage Inventory, AMC, and the New England Wildflower Society, coupled with an increased awareness by recreationists of the fragility of the alpine ecosystem, will keep this and other unique alpine species safe for generations to come.

Kathryn Staley is Program Leader for the Wildlife, Fish, TES (Threatened and Endangered Species) and Botany Program at White Mountain National Forest in Franconia, New Hampshire.

Photo by Rose Paul



To survive on Mt. Washington, Robbins' cinquefoil has adapted to the extreme demands of an arctic environment. This plant has a long tap root which keeps it well-anchored in the shifting soil. It grows close to the ground, where the force of snow blown by violent winds is less damaging. Robbins' cinquefoil prefers south-facing slopes, which provide a maximum of sunshine and a longer growing season. Its flowers contain both male and female parts, and while the male fertilizes the female stigma with pollen, the pollen does not contribute to the genetic make-up of the offspring. It simply stimulates the female ovules to develop into seeds. As a result, the plant's offspring are genetic clones of the parent plant and there is little or no genetic variation in the total population.

This reproductive strategy, known as apomixis, is common in some arctic plant genera, possibly an adaptation to variable seasonality and lack of pollinators. Because of *P. robbinsiana's* lack of genetic diversity, it may be poorly equipped to evolve and adapt to changing conditions. It can take as long as 15 years to reach reproductive maturity, which increases its vulnerability to the threat of extinction.

by Kelly Amsberry and Robert I. Meinke

Restoring the Popcorn-flower



Botanists transplant greenhouse-propagated popcorn-flower plants at a site along Interstate 5 in southwest Oregon.

ODA photos

One Oregon native in desperate need of conservation action is a plant with the unusual name of the hairy popcorn-flower (*Plagiobothrys hirtus*). This bristly-stemmed marsh species, a member of the family Boraginaceae, is endemic to a few low fields near the city of Roseburg. The large, forget-me-not-like flowers, curiously aromatic with a wintergreen scent, resemble popped kernels of buttered popcorn with their bright yellow centers and stark white petals. Wetland drainage, sheep grazing, and invasive exotics have taken their toll on its habitat, and today the species is one of the rarest and most vulnerable in the Pacific Northwest. A mere four populations remain, with only a single site on public land. Collectively, the four populations comprise less than 10 acres (4 hectares) of habitat and fewer than 3,000 plants. Designated as endangered under Oregon law, the species is also a candidate for listing under the federal Endangered Species Act.

In a collaborative effort, the U.S. Fish and Wildlife Service (FWS) and the Oregon Department of Agriculture's Conservation Biology Program have joined forces to study the popcorn-flower's biology and restore its populations. With the additional cooperation of Oregon State University, the Oregon Department of Transportation, and The Nature Conservancy (TNC), experiments to augment populations were initiated at two small sites: a section along Interstate 5 in southwest Oregon and a local preserve operated by TNC. We hoped that this research would not only increase population sizes but would also establish useful protocols for seed collection, greenhouse propagation, and transplantation techniques.

Life history studies soon revealed that the species is not strictly an annual, as reported in the literature, but often a creeping perennial with rooting stems (a unique trait for the genus). It behaves as an annual only under drought conditions. This is significant, as subsequent greenhouse research showed popcorn-flower plants to be surprisingly vigorous and easy to grow from cuttings, enabling mass production of transplant materials.

In late spring of 1996, 480 popcorn-flower starts were established at the wetland study sites from plants grown from field-collected seeds. Transplants were arrayed in individual plots within zones having different moisture and vegetation characteristics. The goal was to assemble information useful in evaluating the suitability of future reintroduction sites. Plots were also subject to various pre-treatments, including fertilization and mowing of competitive weeds.



The data collected so far indicate that site selection, even within a wetland, is critical to survival. Eighty percent of the popcorn-flower transplants in the wetter zones persisted and flowered, while those in areas subject to even brief summer dessication did not survive. Plants in areas with higher soil moisture also grew faster and more robustly than survivors in drier plots. Mowing of competing weeds or using sites with naturally lower vegetative cover also improved prospects for the popcorn-flower transplants, but fertilization had no measurable effect.

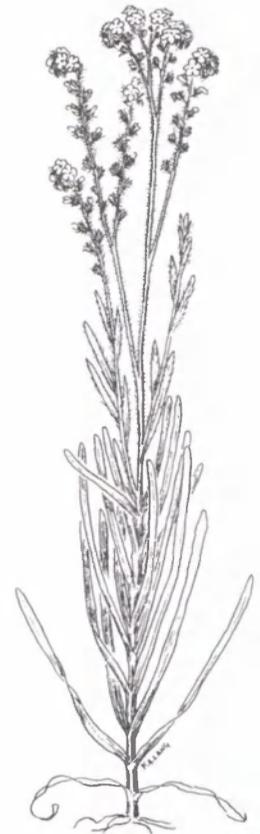
While continued monitoring will be necessary, this initial reintroduction of the hairy popcorn-flower appears successful. The relatively easy propagation and rapid growth after transplanting (when soil moisture and vegetative competition are taken into account) signify that the species is an excellent candidate for continued restoration work. The size of populations at the study locations has increased, and ensuing reintroduction efforts to repopulate the species should benefit from the information gathered on propagation methods and site selection.

Although much needs to be accomplished before the hairy popcorn-flower is out of jeopardy, recovery seems to be an achievable goal. Future work will focus on continuing additions to existing populations and creating new ones. The major factor limiting recovery will be the protection of suitable habitat, either by acquisition or by negotiation of conservation agreements with sympathetic landowners. In this region of intensive agriculture, restoration opportunities will likely occur mainly on highway margins and the occasional uncultivated field. Tie-ins with wetland improvements or mitigation actions, including FWS-sponsored "Partners for Wildlife" projects, may provide additional avenues for securing the future of this unique wetland wildflower.

Kelly Amsberry is a graduate student at Oregon State University in Corvallis. Bob Meinke is Assistant Professor of Botany at OSU and Plant Conservation Biology Program Leader for the Oregon Department of Agriculture.

Hairy popcorn-flowers (right) can grow up to a meter tall and are striking components of their habitat.

Illustration by Frank Lang



Flowers of the hairy popcorn-flower are the largest and showiest in the genus, ranging up to 20 mm (almost 0.8 inch) across.

Photo by Thomas Kaye/ODA



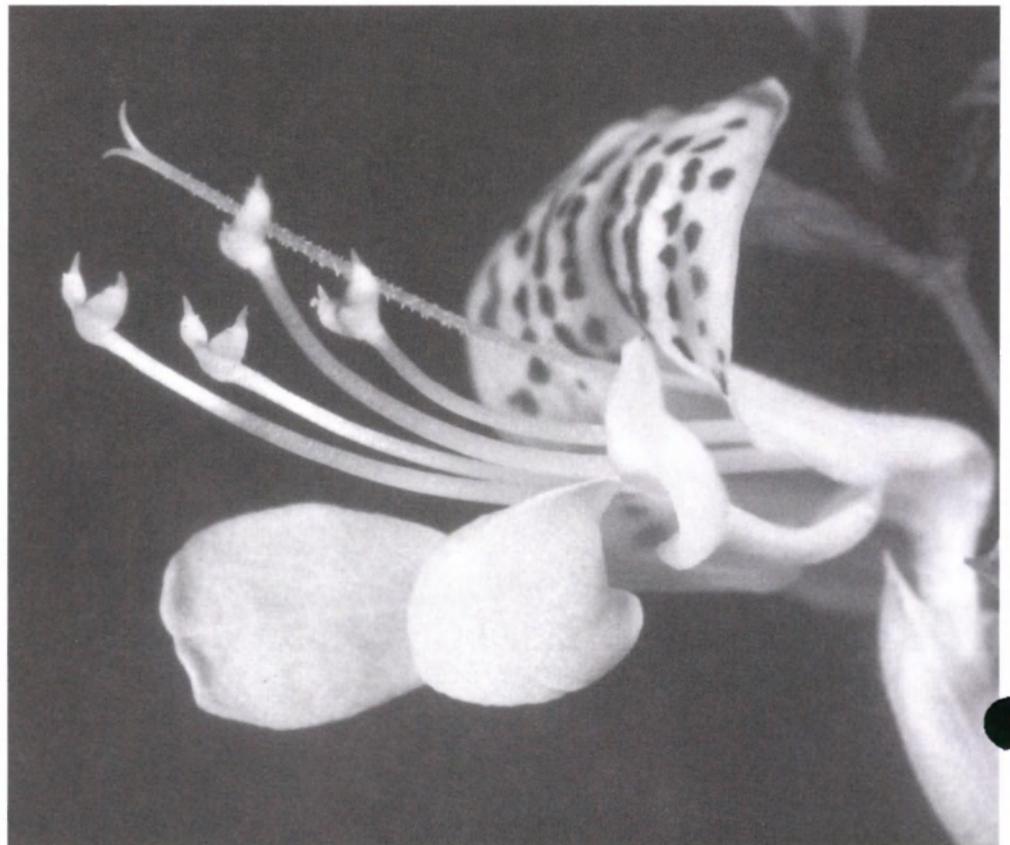
by Mike Jennings

The Treasures of Lake Wales Ridge

About 40 species of plants that occur on the ridges of central and coastal Florida are found nowhere else in the world. Most of these rare and endemic plants grow on the Lake Henry, Winter Haven, and Lake Wales Ridges, collectively known as the Central Florida Ridge. It was once part of an archipelago that formed 25 million years ago when the Everglades were a shallow sea. Atop these ancient islands, unique species evolved in their own isolated habitats. These dry, hot, sandy habitats, the remains of ancient beaches and dune systems, are usually referred to as scrub. They are typically categorized as oak scrub, sandpine scrub, or rosemary scrub, depending on the dominant vegetation.

The scrub mint (*Dicerandra christmanii*) produces aromatic, cream-colored flowers marked with purplish-red spots. This species is endemic to scrub habitat on Florida's Lake Wales Ridge.

Photo by Tom Eisner^o





The scrub jay is a crestless bird with blue wings and tail, a blue-gray back, and gray breast. Loss of scrub habitat is the greatest threat to this bird.
Photo by Brian Toland

Within central and coastal scrub habitats, 23 plants are vulnerable enough that they have been listed by the Fish and Wildlife Service (FWS) as threatened or endangered. These endemic plants are essentially restricted to the highest and driest habitats in Florida and are competing with residential, commercial and agricultural development for the limited amount of remaining scrub. Periodic burning is needed for the maintenance of healthy scrub, and fire suppression has resulted in habitat degradation and the disappearance of listed plants from some areas.

Efforts are underway to conserve these unusual scrub ecosystems. In 1993, Congress authorized the FWS to establish the Lake Wales Ridge National Wildlife Refuge, the first refuge devoted primarily to the conservation of endemic plants. The primary objectives of the refuge will be to (1) protect and preserve remaining undeveloped areas of scrub and their unique plants and animals; (2) foster scientific research in scrub ecology, especially in conjunction with the State of Florida, local universities, and private conservation organizations; and (3) provide opportunities for compatible public use, such as wildlife observation, nature photography, and environmental education.

When land acquisition is complete, the projected 13,880-hectare (19,630-acre) refuge will protect about 26 rare or listed plants, 4 listed vertebrates, more than 40 endemic invertebrate species, and one of the rarest and most severely threatened ecosystems in North America. Another site already supporting listed plants is the Archbold Biological Station, a non-profit research facility on the Lake Wales Ridge. Scrub habitat also has been recently purchased for protection by The Nature Conservancy, the State's Water Management Districts, county governments, and local municipalities.

Extensive land acquisition efforts continue under the State of Florida's Preservation 2000 Conservation and Recreational Lands (CARL) program, which will commit about \$300 million annually until the year 2000 for the conservation of sensitive natural and cultural resources. As part of the CARL program, and others mentioned above, about 20 parcels of scrub habitat have been acquired throughout the central and coastal



Surprisingly species-rich scrub habitat like this is now protected by the Lake Wales Ridge NWR.

Photo by Brian Toland

ridges of Florida. If all lands targeted for scrub conservation are eventually acquired, about 25 to 30 sites will contain from 31,800 to 35,360 hectares (45,000 to 50,000 acres).

Protection of scrub habitat does not end with the acquisition of habitat. Like other lands in public ownership, these relatively small, isolated habitats will require management to support and enhance their continued biodiversity. Proper fire management, for example, will be a necessity. Although we are only now beginning to understand the role of fire in maintaining scrub vegetation, we do know, with some degree of certainty, the frequency of natural fires in scrub habitat (see table). Little is known about the effects of fire on individual species of rare scrub endemics. In some cases, certain rare plants have become so restricted in their range that use of fire must be extremely controlled to ensure the species' survival. Overall, however, land managers are using fire as a way to maintain and recover many of the degraded scrub communities that have been acquired. Land managers will continue to be challenged with developing methods to restore these unique plant communities for future generations to enjoy.

Mike Jennings is a biologist with the FWS South Florida Ecosystem Office in Vero Beach.

Estimates of natural fire regimes and management requirements of Florida scrub communities.

Scrub Community	Fire Frequency (years)	Fire Intensity
Turkey oak barrens	5-20	Low-Moderate
Scrubby flatwoods	5-20	Moderate
Oak dominated	10-20	Moderate-Intense
Rosemary	20-60	Moderate-Intense
Sandpine	60-100	Intense

Center for Plant ● Conservation

by Brien Meilleur

The future of many native plant species is increasingly at risk, and the Center for Plant Conservation (CPC) is dedicated exclusively to their well-being. Since its founding in 1984, the CPC has created a unique program of conservation, research, and education within a nationwide network of 28 botanical gardens and arboreta. These participating institutions collect, store, grow, and maintain the National Collection of Endangered Plants, a living collection of over 500 of the nation's rarest species, approximately half of which are federally listed as threatened or endangered. These plants are maintained as security against extinction, as source material for reintroduction and ecological restoration, and as resources for research and education. The CPC's national office, based at the Missouri Botanical Garden in St. Louis, coordinates maintenance of the National Collection and helps to develop associated conservation, research, and education programs.

The CPC also initiates and coordinates research projects and symposia associated with native plant rarity, *ex situ* (off-site) storage technologies (particularly for seeds and slow-growth tissue culture), and other conservation-related issues. The organization has published research results and conference proceedings in rare plant genetics, reintroduction strategies, and the economic potential of rare plants, and has produced guidelines for rare plant seed storage. Following a study on rare plant "hot spots" that it undertook in the late 1980's, the CPC designated five priority plant conservation regions in the U.S.—California, Florida, Hawaii, Puerto Rico and the U.S. Virgin Islands, and Texas — for special conservation attention. Since then, the

CPC has organized rare plant task force meetings in all of these regions. Recently, the CPC also organized a 16-state Midwestern plant task force meeting.

One outcome of these gatherings, where rare plant specialists, researchers, land managers, and educators share information and plan regional plant conservation projects, can be seen in the strategic plans that have been produced for Florida and Hawaii. Another will be written this year for the Midwest region. Such plans are particularly useful as integrated plant conservation "white papers" for achieving consensus on priority actions, determining divisions of labor, and promoting cooperation among the many plant conservation partners that exist in any State or region.

The CPC also supports efforts to conserve rare U.S. plants in their natural habitats (*in situ* or on-site conservation) through collaboration with land-managing agencies and organizations on recovery plans, reintroductions, and the development of conservation policies and standards. In its draft policy on controlled propagation, published in the February 7, 1996, *Federal Register*, the Fish and Wildlife Service designated the CPC as the preferred collaborator for Federal, State, and private agencies seeking to develop programs in controlled propagation of listed U.S. plants.

For more information, please visit our homepage at <http://www.mobot.org/cpc>, contact us by e-mail at cpc@mobot.org, or phone (314) 577-9450.

Brien Meilleur is Executive Director of the Center for Plant Conservation.

In an effort to promote awareness about plant conservation as well as the organizations and persons practicing it in the United States, CPC engages in a variety of educational activities. For example, it distributes a 24-page educator's guide to biodiversity and rare plant conservation entitled *Plants in Peril*, and produces a variety of brochures and exhibits on rare plants. Each year, the CPC produces the *Plant Conservation Directory*, a resource guide that compiles the names, addresses, and phone numbers of the major plant conservation interests throughout the United States. The Friends of the CPC receive a biannual newsletter describing activities within the network and current conservation and research advances on rare native plants. In addition to these activities and publications, the CPC's national office and many of the participating gardens offer internships for students interested in the field of plant conservation.

Managing Plant Communities

by Richard A. Fischer, Chester O. Martin, Ann-Marie Trame, and Mary G. Harper

Plant communities on Department of Defense (DoD) military installations serve various purposes; they provide realistic environments for military training, buffer zones between military and civilian activities, forest products (e.g., timber, pine straw), and recreational opportunities. Because DoD has converted a relatively small percentage of its bases for urbanization or agricultural use, large areas are maintained in a relatively natural condition. These lands contribute significantly to regional biodiversity, and provide refugia for a large number of threatened, endangered, and candidate plant and animal species. Historically, the military managed protected species as individual components of their environment, but DoD policy now stresses ecosystem-based, multiple-species management to sustain healthy ecosystems on military installations.

Careful management of natural plant communities is essential for DoD to meet military mission requirements while

conserving high-quality habitats. This objective is supported by an ongoing DoD Threatened and Endangered Species Research and Development Program (see the following article, *DoD Endangered Species Research and Development*). As part of this research program, a joint investigation by the U.S. Army Waterways Experiment Station and the Army Construction Engineering Research Laboratories was formed to assist the managers of southeastern DoD installations in developing appropriate plant community management strategies to conserve the habitat of listed species. This project has 1) identified the presence and distribution of major plant communities on most DoD installations within the southeastern U.S.; 2) determined listed animal and plant species potentially occurring, or known to occur, on these installations; 3) summarized available information on habitat requirements for these species; and 4) synthesized current information about management techniques for the conservation of high-quality natural plant communities. It will lead to the development of a comprehensive community-based management plan for installation managers in the southeast.

Although our approach is community-based, it does not ignore the legal and ecological requirements of individual species. Information on species occurrences on DoD installations was provided by state Natural Heritage Programs, The Nature Conservancy, and installations that have completed their own rare species surveys. Information on the ecology and management of these species was compiled from Fish and Wildlife Service recovery plans, installa-

Chapman's rhododendron, an attractive species with light pink flowers, is endemic to Florida. This endangered plant depends on habitat maintained by periodic fires.

Photo by E. LaVerne Smith



tion reports, peer-reviewed literature, and species experts.

Plant Communities

Comprehensive documents are being written for several of the major plant communities, including longleaf pine (*Pinus palustris*) flatwoods and sandhills, bottomland hardwoods, pocosins, herbaceous seeps/bogs, and maritime communities. These reports synthesize available information on classification, geographic range, biological composition, environmental factors (e.g., topography, hydrology, soils, fire regime), associated plant communities, successional relationships, impacts to the community (military and non-military), and indicators of community quality. Most importantly, the reports include plant community management prescriptions (e.g., controlled burning, hydrology management, timber management, erosion control, control of exotic species) that mimic natural processes, based on historic patterns.

The most detailed synthesis is being written for the longleaf pine ecosystem. Some of the largest remnants of this once-extensive ecosystem, which includes sandhills and flatwoods, occur on southeastern military installations. Communities within the longleaf pine ecosystem are extremely diverse, contain many rare and endemic plant and animal taxa, and are linked by landscape-level hydrologic and fire processes. Endangered plant species found within this ecosystem include the Chapman's rhododendron (*Rhododendron chapmani*), Michaux's sumac (*Rhus michauxii*), American chaffseed (*Schwalbea americana*), and rough-leaved loosestrife (*Lysimachia asperulaefolia*). The gopher tortoise (*Gopherus polyphemus*), the endangered red-cockaded woodpecker (*Picoides borealis*), and the threatened eastern indigo snake (*Drymarchon corais couperi*) are high-profile animal species within the longleaf pine community that also receive considerable attention on military installations. Other lesser known

rare species that inhabit such forests include the gopher frog (*Rana capito* ssp.), flatwoods salamander (*Ambystoma cingulatum*), pine snake (*Pituophis melanoleucus*), and Bachman's sparrow (*Aimophila aestivalis*).

Although military training can cause ground disturbances in plant communities, military land ownership generally has been compatible with the conservation of endangered plants. For example, some of the highest quality longleaf pine communities occur in and around artillery impact areas, because these areas have a history of frequent fire resulting from exploding ordnance and ammunition. Such burns can mimic the effects of natural fires, which are necessary for the long-term survival of some plant and animal communities.

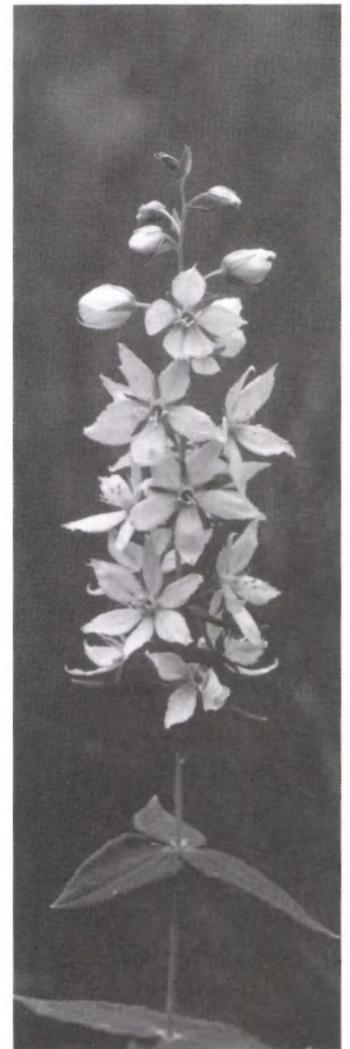
Regional Management Plan

In the future, the conservation and management of plant communities on DoD installations in the southeast will be assisted by a regional threatened and endangered species management guidebook. This publication can be used by installations as a foundation for their management planning. It will not only recommend specific management techniques for each plant community but will also provide landscape-level information, such as how to best connect fragmented habitats (e.g., through cooperative agreements with adjacent landholders) or create a landscape mosaic of different communities. We hope that our approach will be useful for developing community-based management plans in other regions.

Richard Fischer and Chester Martin are research wildlife biologists with the U.S. Army Corps of Engineers Waterways Experiment Station in Vicksburg, Mississippi. Ann-Marie Trame is an ecologist with the Army Construction Engineering Research Laboratories in Champaign, Illinois. Mary G. Harper is an ecologist with the Illinois Natural History Survey.

The rough-leaved loosestrife, found only in North Carolina, produces showy yellow flowers. This plant also depends on fire to maintain its habitat.

Photo by Kerry T. Givens



DoD's Wildlife R & D

by Clifford G. Rice

With over 25 million acres of land under its management authority, the Department of Defense (DoD) manages habitat for many species listed as threatened or endangered. Land set aside for realistic training and as safety buffers for weapons testing allows natural resources on DoD property to flourish. Military land managers work to achieve their conservation obligations, such as protecting rare species, while ensuring that defense objectives are met. The U.S. Army is the lead DoD agency for research and development on matters of land management. Primary responsibility for this research is assigned to the Army Construction Engineering Research Laboratories (CERL), working in conjunction with other Army research labs around the country and additional partners such as major universities and other Federal agencies.

A group of representatives from various military agencies has identified the following priorities for research and development on listed species: inventories, assessments of species' status in areas inaccessible for safety reasons, evaluations of the impacts of military operations on threatened and endangered species, mitigation of military-unique impacts, monitoring, habitat suitability, spatial aspects of habitat, and population modeling.

Inventory

The military requires information about listed species on all of its lands in order to evaluate management needs, assess potential impacts on mission readiness, and properly allocate the resources available for species and habitat management. For this reason, the research and development group established the TES (Threatened and Endangered Species) Tracking System, which records data on species distribution and abundance, critical habitats,

mission constraints, management projects, expenditures, and population trends on military installations.

One area in which the military has unique requirements for inventory is at sites where human activity is restricted, such as in weapons impact and dud areas. Here, CERL's effort is focused on developing methods for automatically and remotely recording and recognizing bird and other animal vocalizations.

Impacts of Military Operations

Three major military-unique disturbance types have been identified for research focus: maneuver disturbance, smokes and obscurants, and noise. Maneuver disturbance refers to physical impacts, primarily of tracked vehicles, that may affect habitat, and behavioral disturbance caused by humans and equipment moving through an area during training exercises. To address the potential impacts on listed species from the use of smokes and obscurants (which are used to conceal military movements as part of imitating a realistic battle environment), research has focused on three areas: (1) detecting, quantifying, and predicting the environmental behavior of the chemicals; (2) diagnosing toxic effects and estimating their magnitude; and (3) estimating exposure and dosage. The third type of military-related disturbance, noise, is caused primarily by guns, explosions, helicopters, fixed-wing aircraft, and ground vehicles. To evaluate potential impacts from these sources, CERL plans to (1) assess field exposure levels; (2) conduct laboratory studies to determine the thresholds at which species are affected; and (3) study the effects on animals in the field.

Management and Mitigation

One joint project between CERL and another Army lab, the National Water-

ways Experiment Station in Vicksburg, Mississippi, is the development of an approach for managing TES on a community basis, which will result in plant community management documents, species profiles for selected animal species, and a review of potential military impacts to selected plant communities in the southeastern U.S., leading to a prototype Regional Community-based Management Plan for TES (see companion article: *Community-Based Management For Threatened And Endangered Species On DoD Lands*).

Modeling

Two types of modeling are important components of research on listed species: (1) statistical modeling, which explores and describes relationships between ecological factors relating to listed species; and (2) simulation modeling, which builds conceptual models of functioning ecological systems.

Simulation modeling provides a process for formalizing concepts of how ecosystems function and an explicit mechanism for improving conceptual models. It can also show the consequences of the conceptual models and alternative land management scenarios and provide priorities for data collection in monitoring.

Together, these research and development projects will improve DoD's responsiveness to new information on species needs as well as continue to meet its defense objectives.

Clifford G. Rice is an Ecologist with the U.S. Army Construction Engineering Research Laboratories in Champaign, Illinois.

The Shrine Pool

by Kirsten Winter and
Tess Higgins

From southern Oregon down through central California and extending into northern Baja California, small geographic depressions called "vernal pools" are found. These seasonal ponds, replenished only by winter rainstorms, occur on coastal mesas, areas of old volcanic activity, and marine or alluvial terraces with a Mediterranean climate.

As the winter rain falls, water begins to pool in depressions secured by a natural layer of clay. The clay layer prevents loss of the precious water through seepage. The impervious clay pool-lining is often reinforced by an underlayer of cobbles that have been cemented together by iron and silica, providing additional protection from water loss through this hardpan.

Usually heaviest during January, the rains fall sporadically for two or three months followed by many months of long summer drought. Over time, depending upon the size of the pool and the amount of water it contains, evaporation eventually dries the pool. By early autumn, the pools are completely dry. In this alternating wet and dry habitat, rare plants capable of surviving these seasonal variations have evolved.

One of these pools, known as the Shrine Pool, is located in the Cleveland National Forest near San Diego, California. The Shrine Pool contains habitat for the Parish's meadowfoam (*Limnanthes gracilis* var. *parishii*), a small annual plant that was, until recently, considered to be threatened. Because Shrine Pool is adjacent to the Shrine Camp special-use permit area, Forest Service botanists feared for its welfare. Off-road vehicular activities and unpermitted dumping were impinging on the health of the pool.

In 1990, the Forest Service learned of an opportunity to obtain funding from the State of California to mitigate effects of off-road vehicle use. These funds,

popularly known as "green-sticker funds," are generated by the sale of state permits required to operate an off-road vehicle. With the cooperation of the Shrine Camp Manager, Len Cartwright, and the California Native Plant Society, the Forest Service submitted a proposal for green-sticker funding. The proposal was to build 600 feet (183 meters) of split-rail fencing to exclude vehicles from the vernal pool area, and to develop an interpretive sign highlighting the rare plant resources and need for pool protection. The amount requested was \$1,500, with matching contributions of volunteer labor anticipated.

The proposal was funded and, in November 1991, work began. Volunteers from Shrine Camp, the Laguna Mountain Volunteer Association, and the California Native Plant Society cooperated with Cleveland National Forest employees in two days of hard work to install the fencing. Cartwright further assisted with the protection effort by eliminating several nearby car-camping sites, the presence of which affected the pool area, and by generously agreeing to undertake upkeep and maintenance of the fence.

The Shrine Camp vernal pool, secure behind the protective fence, has been able to heal itself and provide habitat for its unusual plant species. Now, not only the rare meadowfoam but the host of small fauna also dependent on the pool are recolonizing this treasure.

Kirsten Winter, Botanist, and Tess Higgins, Resource Assistant, are with the Cleveland National Forest, California.



After the Shrine Pool was fenced for protection, its unusual habitat healed, making it possible for native plants like the Parish's meadowfoam to recolonize the pool.

Photo courtesy of U.S. Forest Service

Alerting the Birds

As dawn approaches, a tall white bird signals his companions with a pre-flight posture. Then, with a few quick steps and powerful downstrokes of his long wings, he leaps into the air, trailed by four others of his kind. Slowly gaining elevation in the still morning air, he passes over the length of the marsh in which he roosted overnight and approaches a county road. Suddenly, his flight is halted in midair as if he had reached the end of a restraining rope. Spinning uncontrollably, his body falls to the ground and forever is stilled.

Events like this (19 since 1956) make collision with power lines the number-one known cause of death or injury to fledged whooping cranes (*Grus americana*), including 39 percent of the deaths in the Rocky Mountains flock. Two of nine radio-tagged whooping cranes in the population that migrates between Canada and Texas struck power lines in the first 18 months after they were tagged.

A large percentage of bird collisions are known to involve the "static wire," which typically hangs above the conducting lines and is designed to protect the system by grounding lightning strikes. Static wires are smaller in diameter and consequently less visible to birds. Within the Rocky Mountains, the problem was most evident in the agricultural San Luis Valley of Colorado, where abundant power lines support the pumping of ground water for irrigation. In 1983, an Ad Hoc Crane Study Group including representatives from the U.S. Fish and Wildlife Service (FWS), Public Service Company of Colorado, Edison Electric Institute, National Audubon Society, and local electric utility companies was formed to address the problem.

The group initially evaluated the benefits of installing oversized static lines

in some problem locations and of removing static lines in other areas. They also studied crane behavior with radar and photography, and evaluated habitat modifications that could reduce crane activity around lines. These studies concentrated on sandhill cranes (*Grus canadensis*), which provided an abundant research substitute for the endangered whooping crane. The research also included ducks (primarily mallards, *Anas platyrhynchos*) and Canada geese (*Branta canadensis*). Removal of the static wire would reduce bird collisions but could lead to lightning-caused power outages, and enlarging the static wire did not appear to reduce collisions. The researchers then recommended investigating techniques of marking the lines to increase their visibility.

That recommendation led to line marking studies in Nebraska and Colorado. The yellow balls used in some areas to alert low-flying aircraft were tested as line markers for birds during 1988-1990 along the Platte River, Nebraska, in research conducted by the Wyoming Cooperative Wildlife Research Unit. This research was sponsored by the FWS, Nebraska Public Power District, and Dawson Public Power District. The number of cranes flying over marked and

unmarked lines did not differ, but significantly more dead cranes were found under the unmarked lines. Cranes reacted to marked lines by flying higher and changing their flight path.

Yellow fiberglass hanging plates and yellow spiral vibration dampers were tested as markers in Colorado. The dampers consisted of polyvinyl chloride plastic twisted around the wires to reduce wind vibration. The subjects of this research were expanded in 1989 to include raptors, shorebirds, and other birds. Nine major electric utility companies and representative of all U.S. geographic areas joined the group, which was renamed the Avian Power Line Interaction Committee (APLIC). The APLIC membership included Central and South West Services of Texas, Florida Power and Light Company, Idaho Power Company, Nebraska Public Power District, Pacific Gas and Electric Company of California, PacifiCorp of Oregon, Public Service Power Company of Colorado, Salt River Project of Arizona, Southern California Edison, Virginia Power, Bonneville Power Authority of Oregon, and Edison Electric Institute, along with the Fish and Wildlife Service.

The hanging plates and spiral dampers reduced collisions by 40 to 60 percent in comparison to unmarked lines, but the plates cause line abrasion. A new marker developed in Europe appears to incorporate the benefits of both plates and dampers. These marking techniques can benefit a wide variety of birds, including such endangered species as whooping cranes, California condors (*Gymnogyps californianus*), brown pelicans (*Pelecanus occidentalis*), wood storks (*Mycteria americana*), and others.

In 1992, APLIC sponsored the International Workshop on Avian Interactions With Utility Structures to discuss methods of further reducing the impact of electric utility structures on avian populations. More than 100 engineers, scientists, and representatives of conservation and other interest groups from 10 countries attended. The workshop proceedings, published in 1993, included

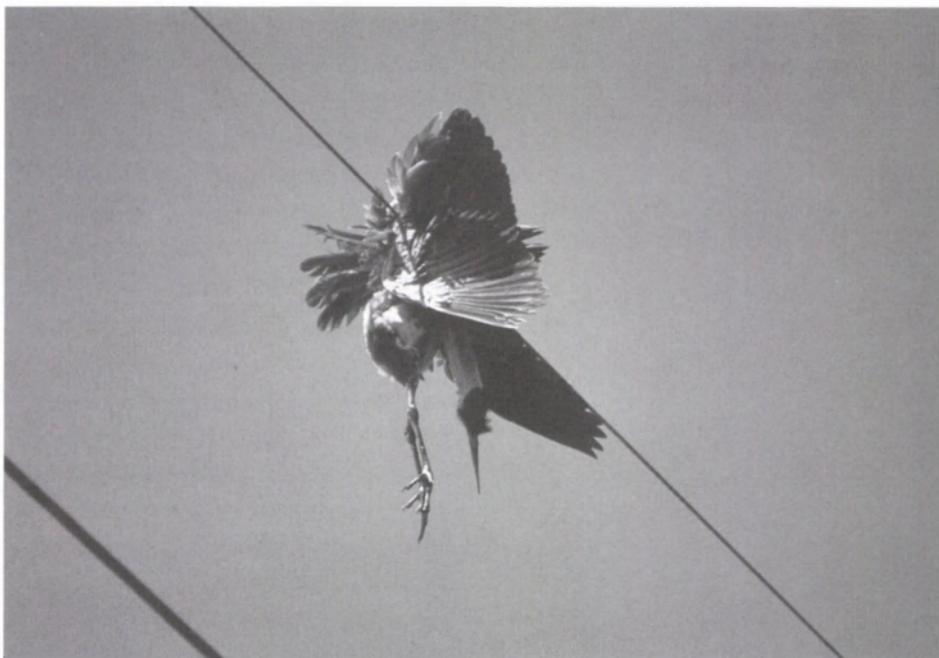
28 papers discussing conservation, economic, engineering, and other research issues.

In 1994, APLIC published "Mitigating Bird Collisions With Power Lines: The State of the Art in 1994" which has been distributed widely to utility companies and government agencies. This 100-page bulletin describes approaches to assessing and solving the problem of bird collisions. A subsequent publication, "Suggested Practices For Raptor Protection On Power Lines: The State Of The Art In 1996," reported the latest techniques for reducing bird electrocutions at electric utility structures. APLIC continues to provide an excellent example of how government and private industry can work cooperatively to address important conservation issues. An APLIC-sponsored short course, "Reducing Bird Collisions and Electrocutions," will take place May 20-21, 1997, at the Patuxent National Wildlife Center in Laurel, Maryland. For further information, contact Joel Mazelis, Manager of Environmental Programs for the Edison Electric Institute, at 202-508-5461, or by FAX at 202-508-5150.

Jim Lewis was the FWS Whooping Crane Recovery Coordinator until his recent retirement.

The tragic result of a collision with a power line. Electric utilities are working with the FWS to reduce the danger of power lines to birds like this sandhill crane.

Photo by Jim Lewis



Teaming Up for PV Blues



Butterflies depend on plants in many ways, requiring different food plants at various stages of their development. The larval food plant may be one particular species of plant, or a number of different species of the same or different families. This photo shows locoweed, a host plant for the Palos Verde blue butterfly.

Photo by Jeremiah George

It was a sunny southern California day in April 1994. Dr. Rudi Mattoni, Professor of Geography and Biology at UCLA, was busy collecting insect specimens at the Defense Fuel Support Point (DFSP) San Pedro. The DFSP, a major link in supplying jet and marine diesel fuels to the military in southern California, Arizona, and Nevada, proved to be an attractive location for this task. Comprising 320 acres (130 hectares) on the Palos Verdes Peninsula, several spots on the terminal consist of largely undisturbed natural habitat, an increasingly scarce commodity in Los Angeles County.

As Mattoni surveyed the site, he mentioned to his colleague that the terrain and vegetation looked like a prime location for the endangered Palos Verdes or "PV" blue butterfly (*Glaucopsyche lygdamus palosverdesensis*). Call it fate or a stroke of luck, but as soon as the words left his mouth, one of the small butterflies flew by. No larger than a quarter, the quick and low-flying PV blue only emerges and lives as a butterfly for about a week in late March to early April. The odds that Mattoni would be in the right place at the right time to view a little butterfly, thought to have gone extinct in 1982, are long. Even more incredible, had anyone but Rudi Mattoni been on site, this story would have turned out very differently.

While Mattoni reveled in his discovery, a few hundred yards away the operator of a bulldozer headed his machine toward the exact spot where Mattoni stood. His job: to clear a path through the scrub brush and weeds for a pipeline repair project starting that day. Little did he know those weeds were home to one of the rarest butterflies in the world. Fortunately, with the help of Terminal Superintendent Clarence Wilson, the bulldozer was stopped and the butterflies saved from extinction a second time.

Since all I knew about butterflies was that they made a beautiful wallpaper pattern in my daughter's room, I needed some help in sorting out this situation. Luckily, I didn't have to look far. Dr. Mattoni, Marjorie Nelson and Chris Nagano of the Fish and Wildlife Service, and Dawn Lawson, a biologist with the Southwest Naval Facilities Division, formed the nucleus of the team that made this conservation project so successful. In an initial strategy meeting, we laid the groundwork for our goals: to protect, and promote the propagation of, natural vegetation and wildlife (including the PV blue) while ensuring the uninterrupted operation of the military fuel mission.

What started as an ad hoc working group has expanded, and it now meets regularly to assess project success and formulate future goals and objectives. The group drew up a plan for surveying the wildlife population, large-scale habitat restoration,

and captive-rearing the butterfly. To date, approximately 100 acres (40 ha) of the terminal, clear of operational areas, is designated for restoration to its natural state. Since the initial survey indicated the PV blue population to be little more than 100 butterflies, habitat enhancement and expansion is seen as critical to ensuring the species' survival. The problem, as with most Federal agencies, is that the Department of Defense budget is shrinking rapidly. The proposal for hundreds of thousands of dollars for habitat restoration wound up, like many other worthwhile projects, unfunded.

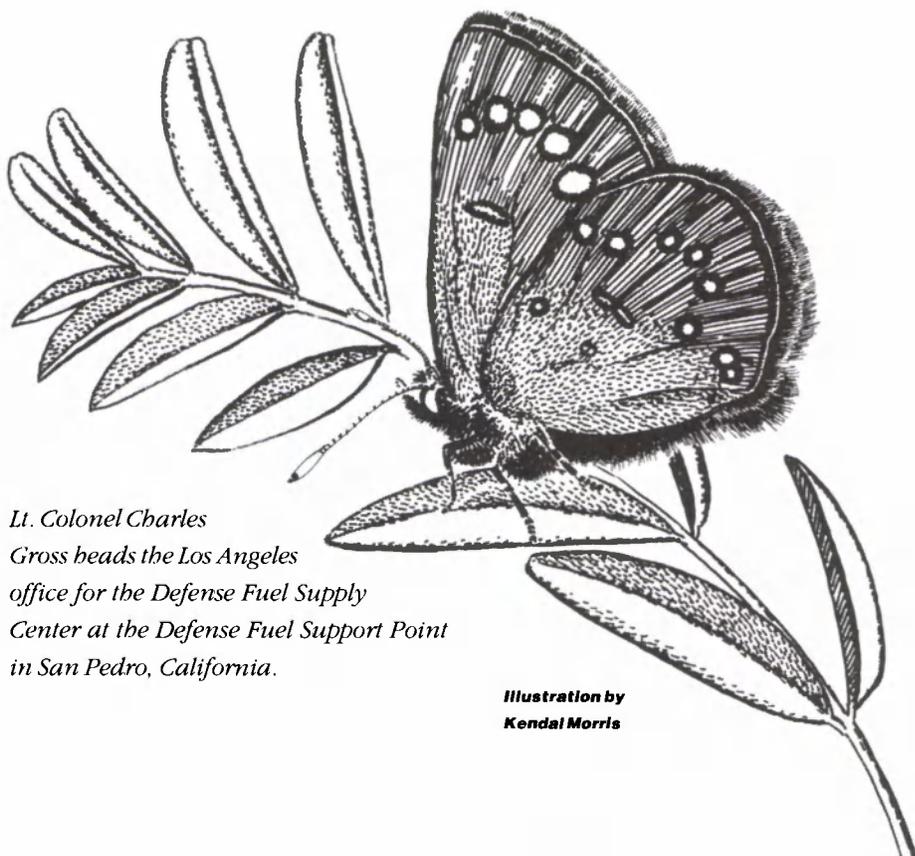
Necessity being the mother of invention, a suggestion was made that we use volunteer labor. A local conservation group, Rhapsody in Green, eagerly agreed to support our project. On the first Sunday of every month, an average of about 50 volunteers descend on the terminal. They perform a number of backbreaking tasks such as manual removal of exotic plant species, native seed collection, and planting. The effort proved so successful that two other volunteer groups, Audubon YES! (Youth Environmental Service) and LA Clean and Green, joined the project. To date, approximately 5,000 volunteer hours have resulted in more than tripling the available habitat for the butterfly.

Additionally, through an agreement with UCLA, and in cooperation with the FWS, Dr. Mattoni oversees a captive rearing program for the PV blue. A lab converted from an old warehouse on the fuel terminal houses a limited number of female butterflies within individual compartments in a temperature-controlled environment where they are fed, cared for, and closely monitored.

Once the butterfly lays its eggs, which are barely visible to the human eye, they are collected and transferred into separate containers. Each butterfly can produce up to 100 eggs, all of which are painstakingly handled and cared for by a young man named Arthur Bonner. Seemingly even more unlikely than finding an endangered butterfly on an active fuel terminal is the background of

the person charged with their day-to-day care. A veteran volunteer who worked with Dr. Mattoni on a similar project involving the PV blue's close cousin, the El Segundo blue butterfly (*Euphilotes battoides allyni*), Arthur freely admits that this project has changed his life. After growing up influenced by the streets of Los Angeles, Arthur distanced himself from gang activity and now focuses all his attention on the preservation of endangered butterflies.

The results speak for themselves. In the two years since the rediscovery of the PV blue, numbers of this butterfly have increased steadily to this year's estimate of 400 to 1,000. While the butterfly's numbers have climbed, so too has the spirit of cooperation among the Defense Department, FWS, academia, and volunteer groups. Everyone involved in this project is a shareholder, and all are equally responsible for its success. No one person or group could have accomplished these results alone, clearly demonstrating the power of partnership. The key...TEAMWORK.



Lt. Colonel Charles Gross heads the Los Angeles office for the Defense Fuel Supply Center at the Defense Fuel Support Point in San Pedro, California.

**Illustration by
Kendal Morris**

A Second Chance

On April 5, 1997, Arthur Bonner and Dr. Rudi Mattoni were among a group of prominent conservation leaders awarded the National Wildlife Federation's National Conservation Achievement Award.

Arthur Bonner examines PV blue eggs in incubation chambers at the captive propagation lab at the Defense Fuel Support Point in San Pedro, California.

Photo by Jennifer Greiner



Arthur Bonner's enthusiasm is obvious in everything he does. A former gang member now gung-ho on the game of life, his energy is endless. Dr. Mattoni first met him at a Los Angeles Conservation Corps restoration site for the El Segundo blue butterfly (*Euphilotes battoides allyni*) at the Los Angeles International Airport. "Bonner stood out from the others, he had real drive and ambition, so I hired him for a new project at the Navy property in San Pedro." Mattoni gave Bonner a stack of textbooks, some specimen slides and other laboratory paraphernalia and told him he was there to help save other threatened species. As Bonner puts it, "I'm saving them from extinction and they're saving me from the street."

Bonner's interest in the recovery of the Palos Verdes blue butterfly and its coastal sage scrub habitat at the Defense Fuel Support Point at San Pedro, California, has been crucial to increasing the number of individuals raised this season. The laboratory is located in a building that sat vacant until a group of volunteers got together and cleaned and painted it, and constructed shelving. They also assembled equipment (an environmental chamber) in which Bonner could raise the collected butterfly eggs. In addition to his supervision of the captive propagation effort, Bonner also maintains a plant nursery adjacent to his laboratory. The nursery contains cuttings taken from native vegetation on the fuel terminal.

Some of the plants that are being grown by Bonner include the coastal sage (*Artemisia californica*), a shrub belonging to the sunflower family that blooms from August to February; locoweed (*Astragalus trichopodus lonchus*), a perennial in the pea family, blooming from February to April; and deerweed (*Lotus scoparius*), a sprawling shrub that blooms year round.

Bonner sets his standards high, expecting to reestablish 10,000 native plants on-site each year. He's getting lots of help from local volunteer groups such as Audubon YES!, the Youth Environmental Service program; Rhapsody in Green, a local group dedicated to restoring habitat; and Clean and Green, a project through which young teens can be brought into the habitat restoration initiative from a local youth conservation corps program in Los Angeles. The project usually draws between 50 and 100 volunteers on any given weekend, from elementary schools, high schools, colleges, hospitals, and business groups.

Bonner is not surprised by the diversity of the participants. "Kids like bugs," he says, so it seems natural to him that children given the opportunity to broaden their horizons will do so. Bonner is also broadening his own horizons, entering college for the first time to attend spring classes this year. "I'm not actually a scientist, but one day I hope I can say I am."

LaRee Brosseau is a Writer/Editor for the FWS Ecological Services division in the Portland, Oregon, Regional Office.

Have A Story to Share?

Let us publish it in the *Endangered Species Bulletin!*

The *Endangered Species Bulletin* (ESB) was created in 1976 to meet the growing demand for news of developments in the endangered species program of the U.S. Fish and Wildlife Service. Current distribution of this publication numbers over 6,000, including local, State and Federal agencies, non-profit organizations, members of Congress, and official program contacts (both nationwide and international).

Because of its increasingly diverse audience, the ESB is seeking to diversify and expand its coverage of endangered species issues. To be successful, we need your help. Material on a wide range of topics relating to endangered species is welcome and may be technical or popular in nature. We are particularly interested in success stories and news about recovery (both the development of recovery plans and their implementation). Material also is needed on interagency consultations; Habitat Conservation Plans; other cooperative ventures with Federal and State agencies, conservation organizations, business, and private landowners; changes in a species' status; and new threats to important habitat.

Contributors are encouraged to contact the *Bulletin* editor (703/358-2390) before preparing a manuscript to determine the length, focus, and timing of proposed articles. We welcome all submissions but cannot guarantee their publication. Manuscripts may be edited for length, style, and clarity. The *Bulletin*

staff will consult with authors on all changes that may affect the content of a manuscript and authors will have an opportunity to review edited material before publication. Credit will be given for all published articles and illustrations.

Helpful Hints:

- feature articles are generally about 800 words in length (shorter ones are OK, too)
- provide both common and scientific names when referencing listed or non-listed species
- provide metric equivalents for all measurements; C and F equivalents for all temperatures
- include author's name, position, duty station, address, and telephone and fax numbers
- include photographs or line drawings whenever possible (materials will be returned)
- submit article electronically via Internet gateway to R9FWE_DES.ESB@fws.gov
- articles can also be sent on diskette to USFWS, 452 ARLSQ, Washington, D.C. 20240

The ESB is on a bimonthly printing schedule and each issue is developed around a distinct theme. Upcoming themes are listed below. While contributions are welcome at any time, material not received by the "Article Due" date will be held for a future issue.

ISSUE DATE

July/August 1997

September/October 1997

November/December 1997

January/February 1998

ARTICLE DUE DATE

May 15, 1997

July 15, 1997

September 15, 1997

November 15, 1997

ISSUE THEME

Prairie ecosystems

Foreign species

Benefits of biodiversity

Marine ecosystems



Region 1

Thelypodium howellii* var. *spectabilis The Oregon State Office of the Fish and Wildlife Service's (FWS) Partners For Wildlife program has been involved with a 600-acre (240-hectare) conservation easement set up by the Farm Services Administration to protect a large wetland complex and related resources in Baker County, Oregon. This habitat contains one of five known populations of *Thelypodium howellii* var. *spectabilis*, a biennial plant in the mustard family (Brassicaceae) that is a candidate for Endangered Species Act protection. At least 200 acres (80 ha) of the easement is considered to be suitable habitat for this plant. Partners For Wildlife funds have been used to construct more than 4 miles (6.4 kilometers) of fencing to protect the habitat from livestock grazing, and the FWS continues to provide technical assistance and funds to ensure the plant's health.

Wetlands On February 14, 1997, public and private parties signed a purchase agreement and supporting documents for the public acquisition of 880 acres (355 ha) of the Bolsa Chica lowlands in Orange County, California. Future actions for this important wetland, which supports several endangered birds, include an ecological risk assessment to identify contaminated areas, a clean-up of the site under the lead of the CalResources Oil Company, and other restoration actions.

Region 2

Mexican Wolf (*Canis lupus baileyi*) Two milestones were passed recently in the Mexican wolf recovery program. On March 4, 1997, Secretary Babbitt signed a Record of Decision that approved the preferred alterna-

tive described in the environmental impact statement: to reintroduce a "nonessential, experimental" population into the Blue Range wolf recovery area in southeastern Arizona and southwestern New Mexico. The recovery area consists of over 7,000 square miles of National Forests, including the Gila and Aldo Leopold Wilderness Areas in New Mexico.

In the second milestone, nine Mexican wolves in rearing facilities throughout the country were transferred to the new FWS Captive Wolf Management Facility at Sevilleta National Wildlife Refuge near Socorro, New Mexico. The facility consists of 6 large, interconnected pens in a remote canyon. The refuge is administered as a long-term ecological research area and closed to most public use. The wolves have been paired with prospective mates and some are expected to produce pups this year for release in 1998. The recovery objective for the Mexican wolf is to reestablish a viable, self-sustaining population of at least 100 wild wolves over the next 7 to 10 years.

Red-cockaded Woodpecker (*Picoides borealis*) "Operation Recovery" is the name for a four-state effort to capture and relocate the endangered red-cockaded woodpecker, or RCW, to areas that are most at risk of population decline. This effort is expected to improve RCW population density in sparse populations where group isolation is reducing reproductive success and survival. Participants cooperating in this effort include the FWS, U.S. Forest Service (National Forests in Texas, Louisiana, Oklahoma, Arkansas), Texas Parks and Wildlife Department, Oklahoma Department of Conservation, Champion International, and Temple Inland. RCW populations in the Vernon District of the Kisatchie National Forest, Louisiana, and in Sam Houston National Forest, Texas, have been identified as donor populations based upon population size and an increasing trend in the number of active RCW groups. Recipient populations include McCurtain County Wilderness in Oklahoma, Ouachita National Forest in Arkansas, and the Angelina, Davy Crockett, and Sabine National Forests in Texas.

Operation recovery involves intensive monitoring of RCW groups in both donor and recipient populations, the banding of nestling RCWs in donor populations, the translocation of juvenile RCWs to recipient populations, and the monitoring of translocated individuals to determine success. A translocation is considered successful

when a translocated pair breeds successfully. To date, capture and translocation has been completed for the Arkansas (five pairs moved from the Sam Houston National Forest) and Oklahoma (five pairs and a single female from Sam Houston and Kisatchie) recipient sites. This effort was accomplished through close coordination among seven capture crews from Arkansas, Louisiana, Oklahoma, and Texas totaling 28 biologists and technicians. Additional RCWs have been moved within forests in Texas and Louisiana to improve population status and ensure better chances for breeding success this coming spring. It is anticipated that an additional six pair of RCWs will be translocated to the Angelina and Sabine National Forests to complete this year's goals.

Whooping Cranes (*Grus americana*) Thirteen captive-reared juvenile whoopers were released in the Kissimmee Prairie of Florida on December 10, 1996. These birds, produced at International Crane Foundation, Baraboo, Wisconsin, and Calgary Zoo, Calgary, Alberta, Canada, were allowed to fly from a holding pen after a quarantine period. These whooping cranes join 49 others released during 1993-1996. Another 17 juvenile cranes, produced at the Patuxent Wildlife Research Center in Laurel, Maryland, will be released in Florida in January and February. The goal of the recovery effort is to reestablish a nonmigratory population in Florida. Older birds (4 and 5 years old) are beginning to show territorial behavior characteristic of sexual maturity. Last spring, a pair constructed a nest and was observed copulating and defending a several-hundred-acre marsh, but biologists were unable to find evidence of egg production. Project personnel are hopeful that the first chick production will occur this year.

Black-footed Ferret (*Mustela nigripes*) Forty-four captive-bred ferrets sent to Aubrey Valley, Arizona, in March 1996 for acclimation were released to the wild there between September 5 and November 19. Each animal had a surgically implanted passive integrated transponder tag, and nine adults and seven kits also had radio collars affixed to track their movements. Cooperators in the continuing ferret restoration project include Arizona Game and Fish, Bureau of Land Management, U.S. Forest Service, Northern Arizona University, the Navajo and Hualapai Nations, and the FWS.

Northern Aplomado Falcon (*Falco femoralis septentrionalis*) Four pairs of this endangered raptor fledged three young in 1996 in the vicinity of Laguna Atascosa National Wildlife Refuge in southeastern Texas. These pairs originated from captive-produced young released in the area since 1993. The young falcons are produced at a breeding facility operated by The Peregrine Fund in Boise, Idaho, and released in Texas with FWS cooperation. Twenty-nine young were released in 1996. A proposed "Safe Harbor" program for coastal Texas landowners should provide incentive to open up other suitable aplomado habitat for release sites.

Region 3

Hine's Emerald Dragonfly (*Somatoclora bineana*) During an informal consultation on upgrading a railroad for coal transport through the two largest breeding populations of the endangered Hine's emerald dragonfly in Illinois, Commonwealth Edison (ComEd), U.S. Army Corps of Engineers, the FWS Chicago Field Office, and other biologists and landowners worked together to find a way to avoid impacts to the dragonfly. As a result, ComEd volunteered to install steel ties as an alternative to creosote-treated ties to avoid potential contamination of wetland habitat in Lockport Nature Preserve and on adjacent private property. Use of steel ties will not only benefit the dragonfly, but will also

reduce future railroad tie maintenance needs and costs for ComEd. The utility also will conduct or contribute to studies on creosote migration, water quality and hydrological monitoring, and foraging and breeding behavior to help gain more information about this species and potential impacts to it. To continue the cooperative relationship established during the consultation, a Right-of-Way (ROW) Management Team has been formed, consisting of ComEd, local and state resource agencies, a railroad company, a quarrying corporation, and the FWS, to cooperate in simultaneously meeting the needs of dragonfly habitat management as well as those of ROW maintenance, coal transport, and adjacent landowners.

Region 5

Tan Riffleshell Mussel (*Epioblasma walkeri*) A new population of this extremely rare mussel was discovered recently in the upper Clinch River and a tributary, Indian Creek, in southwestern Virginia. Both are part of the greater Tennessee River system.

The tan riffleshell's distribution is restricted to the Cumberland and Tennessee River systems. The most recent collection records were from the Middle Fork Holston River in Virginia, but is not known for certain if the tan riffleshell still exists there. The newest population, located in the upper Clinch River drainage, included evidence of reproduction, which indicates that the species' fish hosts are present. The FWS is providing funds to determine which fish species host this mussel during its parasitic larval stage. If successful, this research could lead to additional efforts to culture the tan riffleshell and return young individuals to suitable habitat.

The FWS has also initiated actions to inform residents along the upper Clinch River of the importance and uniqueness of this species, and to enlist their support for its recovery. Early efforts to work with local citizens, county officials, and other individuals and agencies have been well received.



The Peregrine Fund's success in propagating aplomado falcons at its breeding facility in Boise, Idaho, has been instrumental in the effort to restore this impressive bird to Texas.

Photo by Cal Sandfort

In January -February of 1997, the Fish and Wildlife Service (FWS) published the following Endangered Species Act (ESA) listing actions in the *Federal Register*.

Final Listing Rules

Final rules added 13 plants and 12 animals to the list of endangered and threatened species:

Three Southwestern Wetland Species Two plants and one salamander endemic to rare wetland habitats in southern Arizona and northern Sonora, Mexico, were listed on January 6 as endangered:

Canelo Hills Ladies-tresses (*Spiranthes deliiescens*) -- a slender, terrestrial orchid that produces an inflorescence of up to 40 small white flowers in a spiral.



Canelo Hills Ladies-tresses

Photo by Ronald Coleman

Huachuca Water Umbel (*Lilaeopsis schaffneriana* var. *recurva*) -- a small, herbaceous, semi-aquatic perennial in the family Apiaceae with cylindrical, hollow leaves.

Sonora Tiger Salamander (*Ambystoma tigrinum stebbinsi*) -- a large salamander with light-orange splotches on a dark background.

All three taxa depend on cienegas, perennial streams, and other wetlands, which are extremely rare in the

desert southwest. (Cienega is a Spanish word for a distinctive type of marshy, mid-elevation wetland community that is often surrounded by an arid environment. Cienegas support diverse assemblages of plants and animals, including many species with limited distributions.) Sonoran tiger salamanders now are found only in stock tanks or impounded cienegas, which are used for watering livestock. Stock tanks do not provide the habitat security that naturally occurring wetlands supply.

Potential threats to these native wetland species include illegal collection, predation or competition from introduced species, disease, and habitat degradation resulting from overgrazing, water diversions, dredging, and groundwater pumping. Private landowners are not expected to be affected by the listing action. Stock tank use will not be affected and the FWS may provide assistance through the Partners for Wildlife program to landowners who wish to restore cienegas on their property.

Cordia bellonis A species of plant that lacks a common name, *C. bellonis* is a shrub in the borage family (Boraginaceae). It is endemic to the island of Puerto Rico, where it is found in the Maricao, Susua, and Rio Abajo Commonwealth Forests. As of 1996, only 81 individuals were known to survive in the wild. The species has declined due to habitat loss and certain forestry practices. With its reduced numbers, *C. bellonis* is threatened further by the fact that it is dioecious (having male and female flowers on different plants) and requires outcrossing to reproduce. Most of the remaining plants are widely scattered and unlikely to reproduce. On January 10, the FWS listed *C. bellonis* as endangered.

Nogal or West Indian Walnut (*Juglans jamaicensis*) Another species native to Puerto Rico, the nogal occurs on the islands of Hispaniola and Cuba as well. Only 14 individuals are known to survive on Puerto Rico, and the Center for Plant Conservation reports that the species is becoming increasingly rare on the other two islands. The West Indian walnut may reach up to 25 meters (82 feet) in height, and has wood that is highly prized. Much of the forested land in the central mountain region of Puerto Rico, where this species occurs, has been cut for the planting of coffee. The site containing the last 14 nogal trees known on the island is privately owned and may be used to expand an adjacent coffee plantation. Because of its precarious status, *J. jamaicensis* was listed January 13 as endangered. In cooperation with the Commonwealth of Puerto Rico, the FWS will attempt to work with the landowner to protect the remaining trees.

Six Southern California Plants On January 29, the FWS extended ESA protection to six plant taxa native to grassland, chaparral, or coastal sage scrub habitats in the mountains surrounding the Los Angeles basin in southern California. The two plants in greatest danger were listed as endangered:

Braunton's milk-vetch (*Astragalus brauntonii*) -- a perennial in the pea family (Fabaceae) that produces clusters of light purple flowers.

Lyon's pentachaeta (*Pentachaeta lyonii*) -- an annual in the aster family (Asteraceae) with yellow flowers that blooms in late spring.

Because the other four plants are vulnerable but in somewhat less immediate danger, they were listed as threatened. All four are in the genus *Dudleya*, which belongs to the stoncrop family (Crassulaceae). In southern California, members of this genus are succulent, rosette-forming perennials that frequently inhabit rocky soils or rock outcrops in interior and coastal mountains. Many species tend to be highly localized in their distribution. The four taxa recently listed as threatened are:

Conejo dudleya (*Dudleya abramsii* ssp. *parva*), **marcescent dudleya** (*Dudleya cymosasp. marcescens*), **Santa Monica Mountains dudleya** (*Dudleya cymosa* ssp. *ovatifolia*), and **Verity's dudleya** (*Dudleya verityi*).

The six Los Angeles basin plants are threatened by one or more of the following: urban development, certain recreational activities, alteration of natural fire cycles, overcollecting, competition from non-native weeds, and habitat loss and fragmentation.

Two California Grassland Plants Two plants native to the grasslands of California's San Joaquin Valley received ESA protection on February 6:

Hartweg's golden sunburst (*Pseudobahia bahiifolia*), listed as endangered, and

San Joaquin adobe sunburst (*Pseudobahia peirsonii*), listed as threatened.

Both species are short, annual herbs covered with white, wooly hairs and produce bright yellow flowers typical of the aster family. They are threatened primarily by the conversion of native habitat to residential development and, to a lesser extent, by agricultural development,

competition from non-native plants, incompatible grazing practices, mining, and other factors.

Two California Butterflies Two butterfly taxa found in southern California were listed January 16 as endangered:

Laguna Mountains skipper (*Pyrus ruralis lagunae*) - a small, whitish butterfly restricted to montane meadows in the Laguna Mountains and Mount Palomar, San Diego County.

Quino checkerspot (*Euphydryas editha quino*) -- a small butterfly checkered with dark brown, reddish, and yellow spots. It occurs only in open grasslands and sunny openings within chaparral and coastal sage shrublands in the foothills of southwestern California and northwestern Baja California, Mexico.

Both butterflies are threatened by overcollecting and by habitat degradation, fragmentation, or destruction due to urban development, grazing, and certain fire management practices.

Two California Insects On January 24, the FWS listed two species of insects native to the Santa Cruz Mountains of California as endangered:

Mount Hermon June beetle (*Polyphylla barbata*) -- a small, dark scarab beetle.

Zayante band-winged grasshopper (*Trimerotropis infantilis*) -- one of the smallest representatives of its genus, marked with crossbands on the forewings.

Both of these insects are restricted to the Zayante sand hills ecosystem, which is found only on inland marine deposits. Much of their specialized habitat has been lost to sand mining, urban development, recreational impacts, and agriculture. The remaining sites are vulnerable to the same factors.

San Diego Fairy Shrimp (*Branchinecta sandiegonensis*) A small freshwater crustacean, the San Diego fairy shrimp is endemic to shallow vernal pools in southwestern coastal California and extreme northwestern Baja California, Mexico. This species has specific temperature and water chemistry requirements.

The widespread loss of vernal pools in this region has reduced its distribution to less than 81 hectares (200 acres) of likely habitat. On February 3, the San Diego fairy shrimp was listed as endangered.

Five Freshwater Mussels The FWS listed five species of freshwater mussels native to the southeastern U.S. as endangered on January 10. All five have undergone significant reductions in range and numbers, and exist now in relatively small, isolated populations:

Cumberland elktoe (*Alasmidonta atropurpurea*) -- exists in very localized portions of the Cumberland River system in Kentucky and Tennessee.

oyster mussel (*Epioblasma capsaeformis*) -- persists in extremely low numbers in parts of the Cumberland and Tennessee River basins in Kentucky, Tennessee, and Virginia.

Cumberlandian combshell (*Epioblasma brevidens*) -- same current distribution as the oyster mussel.

purple bean (*Villosa perpurpurea*) -- now survives in a few reaches of the upper Tennessee River system in Tennessee and Virginia.

rough rabbitsfoot (*Quadrula cylindrica strigillata*) - same current distribution as the purple bean.

These species were eliminated from much of their historical range by the conversion of freshwater stream and river habitats to impoundments. At present, the main threat to their survival is water quality degradation, primarily resulting from poor land-use practices that lead to siltation and run-off of contaminants.

Northern Copperbelly Water Snake (*Nerodia erythrogaster neglecta*) In 1953, when this subspecies was described, its range was given as extending from south-central Michigan and northwestern Ohio, southward through Indiana, to extreme southeastern Illinois and adjacent parts of Kentucky. However, there was a large gap in location records between the southern and northern population segments. A harmless snake, it occurs in bottomland forests and shrub swamps.

Conversion of these lands to agricultural use eliminated or fragmented much of the copperbelly's historical habitat. In recent years, other land uses, such as dredging, coal mining, stream channelization, road construction, and development have played a more significant role in the loss of wetlands and associated habitats. On August 18, 1993, the FWS proposed listing the copperbelly throughout its range as threatened. Subsequently, the adoption of conservation agreements intended to protect the snake's habitat in the southern portion of its range led the FWS to determine that the southern population does not need Endangered Species Act protection. The January 29, 1997, final rule listed only the northern population of the copperbelly, which is defined as those

snakes in Michigan, Ohio, and Indiana north of 40 degrees north latitude.

Proposed Listing Rule

Bog Turtle (*Clemmys mublenbergii*)

Bog turtles are known for their small size, dark shell, and the distinctive bright orange blotch on either side of the neck. They inhabit shallow, spring-fed fens, sphagnum bogs, swamps, marshy meadows, and pastures that have soft, muddy bottoms, slow-moving water, and open canopies. Bog turtles are distributed sparsely over a discontinuous geographic range extending from New England south to northern Georgia. A 250-mile (400-kilometer) gap separates the northern and southern populations.



Photo by G. Rocco

The northern population, consisting of those turtles found from New York and Massachusetts south to Maryland, has declined significantly in the past 20 years. Much of its wetland habitat has been lost due to draining, ditching, filling, and flooding by impoundments. Bog turtle numbers in the northeast continue to decline as habitat is invaded by non-native plants, eggs are eaten by raccoons, and adults are illegally collected for the national and international pet trade. In light of the ongoing decline, the FWS proposed on January 29 to list the northern population of the bog turtle as threatened.

At the same time, the southern population was proposed to be treated as threatened because of its similarity in appearance to the less secure northern population. The FWS does not consider the southern population to be in danger of extinction, but regulating it under the ESA's similarity of appearance provision should help law enforcement officials eliminate the chances of northern bog turtles being represented in the pet trade as southern bog turtles.

BOX SCORE

Listings and Recovery Plans as of March 31, 1997

GROUP	ENDANGERED		THREATENED		TOTAL LISTINGS	SPECIES W/ PLANS
	U.S.	FOREIGN	U.S.	FOREIGN		
 MAMMALS	55	252	8	16	331	38
 BIRDS	75	178	14	6	273	72
 REPTILES	15	64	18	14	111	29
 AMPHIBIANS	8	8	6	1	23	11
 FISHES	67	11	40	0	118	74
 SNAILS	15	1	7	0	23	18
 CLAMS	56	2	6	0	64	44
 CRUSTACEANS	15	0	3	0	18	6
 INSECTS	24	4	9	0	37	21
 ARACHNIDS	5	0	0	0	5	4
ANIMAL SUBTOTAL	335	520	111	37	1,003	317
 FLOWERING PLANTS	495	1	109	0	605	313
 CONIFERS	2	0	0	2	4	1
 FERNS AND OTHERS	26	0	2	0	28	19
PLANT SUBTOTAL	523	1	111	2	637	333
GRAND TOTAL	858	521	222	39	1,640*	650**

TOTAL U.S. ENDANGERED: 858 (335 animals, 523 plants)
TOTAL U.S. THREATENED: 222 (111 animals, 111 plants)
TOTAL U.S. LISTED: 1080 (446 animals***, 634 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, leopard, gray wolf, piping plover, roseate tern, chimpanzee, 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 454 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.

***Four animals have dual status in the U.S..

ENDANGERED Species BULLETIN

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

**FIRST CLASS
POSTAGE AND FEES PAID
U.S. DEPARTMENT OF THE INTERIOR
PERMIT NO. G-77**

RESO 500

GREG ZAHM
P.O. BOX 1500
VALLEY FORGE PENNSYLVANIA 19482