U.S. Fish & Wildlife Service

ENDANGERED Species BULLETIN

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Safeguarding our Nation's security is the ultimate mission of the Department of Defense. Due to its many training and testing needs, DoD manages millions of acres throughout the country. The necessary restrictions on access to those lands have resulted in havens for wildlife. In many areas, development has eliminated natural habitats surrounding military installations, leaving only the Defense lands to harbor a unique plant or animal species. Congress has given DoD the responsibility to manage its lands to accommodate wildlife conservation, to the extent it is compatible with the primary military mission. This edition of the Endangered Species Bulletin takes a look at how DoD's natural resource managers work to conserve these important wildlife resources while maintaining our country's security.

U.S. Fish & Wildlife Service

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ENDANGERED Species BULLETIN

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On the Cover
Marines at the Kaneohe Bay Marine Corps Air Station in Hawaii help to safeguard sensitive coastal, wetland, and upland habitats for endangered species while continuing to train for their military mission.

Photo by Lewis Gorman

The Endangered Species Bulletin is now an on-line publication. Three electronic editions are posted each year at www.fws.gov/endangered/bulletin.html, and one print edition of highlights will be published each year. To be notified when a new on-line edition has been posted, you can sign up for our list-serv by clicking on "E-Mail List" on the Bulletin web page.

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

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Please send us your comments and ideas! E-mail them to us at esb@fws.gov.

IN THIS ISSUE

Defense and Conservation: Compatible Missions

by L. Peter Boice

The Department of Defense (DoD) manages approximately 29 million acres (12 million hectares) of land throughout the nation. Access limits due to security considerations and the need for safety buffer zones have shielded these lands from development pressures and large-scale habitat losses. About 380 installations have "significant natural resources," as defined by the Sikes Act, and more than 250 have at least one federally-listed threatened or endangered species. In total, 320 listed species may be found on DoD-managed lands.

Opposite page: The rare Sandhills lily* (Lilium pyrophilum) *grows in fire-maintained habitats on Fort Bragg, North Carolina.
Photo by Elizabeth J. Evans

Below: Marines at the California least tern nesting area, Camp Pendleton.

USMC

Management decisions affecting DoD lands are guided by the principle that these lands were set aside to serve military training and testing purposes. The Sikes Act, DoD's enabling legislation for natural resources management, requires that these lands be managed for "no net loss in the capability . . . to support the military mission." Within these guidelines, the DoD has embraced its stewardship responsibilities for the rich variety of natural resources on the lands it manages.

The DoD's challenge is to balance the need to use its air, land, and water resources for military training with its stewardship responsibility to conserve these resources for future generations. It uses principles of multiple use, sustained yield, and biodiversity conservation to manage its biological resources, and the conservation of endangered and threatened species is a priority.

A Sound Legislative Foundation

In 1997, Congress amended the Sikes Act, providing DoD an opportunity to enhance its management of natural resources. It directed all military installations with significant natural resources to develop and implement Integrated Natural Resources Management Plans (INRMPs) in cooperation with the U.S. Fish and Wildlife Service and the appropriate state wildlife agency. With this requirement came increased funding for many projects relevant to endangered species management, including man-

Lance Cpl. Matthew K. Hacker

James Bradley, a student at Allegheny College in Pennsylvania, inserts a small light into a red-cockaded woodpecker nest on Camp Lejeune.

Cadet Wendy Cook

Hawaii Army National Guard field ecologist Trae Menard cares for a new population of* Scheidea adamantis*, an endangered plant known to grow only at Diamond Head Crater at Fort Ruger.

agement plans, inventories, resource monitoring, and habitat restoration and enhancement.

An INRMP is a comprehensive document that provides for the sustainable use of natural resources and the conservation of listed or sensitive species and ecosystems. Its purpose is to balance the management of ecosystem resources with the specific mission requirements of the installation. INRMPs are also comprehensive sources of biological and geographic information and primary sources of information for preparing environmental assessments and impact statements.

An amendment to the Endangered Species Act contained in the FY 2004 Defense Authorization Act further increased the importance of INRMPs to endangered species management. This amendment precludes a critical habitat designation on military lands under DoD management where an approved and implemented INRMP provides a benefit to the species.

INRMP Strategic Action Plans

In 2005, to provide a road map for future INRMP implementation, DoD endorsed a "Cooperative Plan for Using INRMPs at Active Military Installations and Ranges to Sustain Readiness." The plan identified a set of activities, including:

- a Sikes Act Tripartite Memorandum of Understanding that establishes a cooperative relationship involving the DoD, Service, and the relevant state fish and wildlife agency;
- a template that will provide consistency to all new and revised INRMPs;
- a course, tested in November 2005, to assist all tripartite stakeholders in the cooperative development and implementation of INRMPs; and
- a workshop, held in May 2006, to determine how to integrate INRMPs and State Wildlife Action Plans.

Managing for Species at Risk

A partnership initiated in 2001 among DoD, NatureServe, and the network of State Natural Heritage Programs identified more than 500 species at risk. This information has been invaluable in identifying and prioritizing potential conservation actions on or near DoD installations; since the conservation of such species can make it unnecessary to list them as endangered or threatened. A follow-up project developed management guidelines for four key species. A second project used a habitat approach to evaluate and map species at risk on six military installations in Georgia and to prepare management guidelines.

Regional Ecosystem Management Initiatives

Cooperative regional partnerships enhance communication, program efficiency, and understanding among the partners. In 1994, the DoD adopted an ecosystem approach to natural resources management. It has established important initiatives for such regions as the Sonoran Desert, Great Basin, Mojave Desert, Gulf Coastal Plain, Colorado Front Range, Fort Huachuca (Arizona) watershed, and Camp Pendleton (California).

Conservation Easements

The habitats on DoD installations are often the last, best hope for imperiled species. Many surrounding lands are experiencing rapid development and other encroachments. It is important that the DoD cooperates on resource management beyond installation borders to reduce potential restrictions on training and to enhance species recovery. For example, the Army has aided landowners in establishing conservation easements near Fort Bragg, North Carolina, to protect habitat for the endangered red-cockaded woodpecker *(Picoides borealis)*. These efforts were the origin of the Army Compatible Use Buffer program and similar efforts to secure compatible long-term land uses near military installations.

Researching Military Effects

Some military activities have the potential to affect listed and at risk species in unique ways. The DoD Strategic Environmental Research and

Maslowski Productions

California least tern

Development Program (SERDP) has sponsored research on the effects of such activities as military noise, smoke and obscurants, and unexploded ordnance. Almost seven years ago, SERDP also established a long-term ecosystem monitoring program at Fort Benning, Georgia, and it recently initiated a similar effort focusing on estuarine issues at Camp Lejeune, North Carolina.

New Tools for DoD Managers

In addition to the training courses and workshops implemented under the INRMP Strategic Action Plan, DoD is providing its resource managers with a wide range of management tools. The INRMP Handbook, "Resources for INRMP Implementation," was revised in the summer of 2005. An August 2005 study, "Best Practices for INRMP Implementation," identifies management practices and lessons that will improve the effectiveness of INRMPs. A revised handbook, "Conserving Biodiversity on Military Lands," will provide new scientific and policy information and detailed DoD case studies. An outreach toolkit will describe the importance of biodiversity on DoD lands for military commanders, base residents, and other audiences. We also have developed new training oriented towards the needs of military land managers, and have reviewed and endorsed additional courses developed by other federal resource management agencies. These and other actions make today an exciting time for resource conservation on DoD lands.

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Wildlife Conservation and the U.S. Army

by Rosemary Queen

US Army

Camp Shelby burrowing crayfish

Conservation of natural resources on the Army's 15 million acres (6 million hectares) has long been part of its heritage. In the 1870s, the Army sent cavalry troops to what are now Yosemite National Park and other future parks to protect wildlife from poaching and vandalism. In 1886, the cavalry arrived to protect the future Yellowstone National Park, and it remained there until 1916, when the National Park Service was created.

In the 1950s and earlier, the Army managed its property for hunting, timber harvesting, and agricultural use. During this period, the U.S. Fish and Wildlife Service worked with the Army on management programs to develop recreational opportunities. The Service, states, and Department of Defense recognized the importance of conserving fish and wildlife resources on military lands. Congress formalized the DoD's role in 1960 with passage of the Sikes Act.

The Sikes Act provides a framework for cooperation among the DoD, Service, and state wildlife agencies in planning, developing, and maintaining natural resources on military lands while supporting military training. For its part, the Army works to conserve natural resources while creating the most realistic training possible for its soldiers. Amendments to the Sikes Act have expanded its authority to develop ecosystem-based integrated natural resources management plans (INRMPs).

As a component of INRMPs, the Army actively promotes the recovery of 188 listed species found on 102 installations (fiscal year 2005 data), and it has put tremendous effort into preventing the need to list identified species-at-risk. For example, the longleaf pine forests managed on installations in the Southeast such as Fort Bragg, North Carolina, and Fort Stewart and Fort Benning, Georgia, have been essential for increasing the

F Troop of the U.S. Cavalry poses atop a fallen giant sequoia in the 1870s.

US Army

Jonas Jordan

Prescribed burning is an important habitat management tool for red-cockaded woodpeckers and gopher tortoises at Fort Stewart, Georgia.

population of red-cockaded woodpeckers (*Picoides borealis*), an endangered bird. Fort Hood, Texas, has one of the highest populations of the endangered golden-cheeked warbler (*Dendroica chrysoparia*) thanks to habitat management and the control of cowbirds, which parasitize warbler nests. Camp Shelby, Mississippi, has prepared a candidate conservation agreement with the Service to ensure that the Camp Shelby burrowing crayfish (*Fallicambarus gordoni*) will thrive into the future. The Service determined that, with implementation of the agreement, the crayfish no longer required status as a candidate for listing. Personnel at the Yakima Training Center, Washington, have managed their population of the Columbia Basin greater sage-grouse (*Centrocercus urophasianus*) through fire control, habitat management, and population enhancement to ensure this distinct population segment (DPS) does not dwindle. Yakima's efforts over the last few years have contributed to reducing threats to this DPS.

An installation's natural resource management and conservation activities are delineated within its INRMP. These plans are essential for the Army's successful conservation programs. Because of the effectiveness of these INRMPs, Congress amended the Endangered Species Act in 2004 to allow INRMPs to function in lieu of a critical habitat designation if the Service or National Marine Fisheries Service finds that the INRMP provides sufficient benefit to a species. To date, the 11 Army installations have been excluded from critical habitat designation based on their INRMPs.

The conservation of listed species is only a small part of the Army's commitment to ecosystem health and sustainability. In 2005, the Army released its new "Army Strategy for the Environment." One of its cornerstones is a commitment to incorporate environmental considerations in all contingency and combat operations. This includes fostering an ethic within the Army that goes beyond environmental compliance and strengthens the Army's operational capability by using sustainable practices to reduce the environmental footprint.

This evolution in Army thinking has allowed for innovation and improvements in current operations. For example, Army installations such as Fort Riley, Kansas, and McAlester Army Ammunition Plant, Oklahoma, have restored cool-season grazing sites to high functioning warm-season grass prairies, which benefit both military training and conservation of prairie-dependent species.

Army installations also carry out invasive species control programs. Feral hog and cat control and the removal of such harmful plants as yellow star-thistle, purple loosestrife, kudzu, and saltcedar are just some of the invasive species battles taken on by Army installations. The Army is also active in the Partners in Flight program for migratory conservation. Army installations have set up monitoring stations and survey transects to help assess population levels of many migratory birds. Many INRMPs also contain management strategies to benefit, and minimize operational impacts on, migratory birds. Such strategies include changing the timing of field and forest activities to avoid nesting periods; protecting nests during training activities; controlling feral cats, cowbirds, and non-native birds; and educating installation staff and soldiers on wildlife conservation.

With continuing support from the Service and state wildlife agencies, the Army will continue to be a leader in the conservation of the natural resources that are so important to its training and testing missions.

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Desert Tortoises Get Help From the Marines

by Captain Aaron Otte, U.S.M.C.

USMC

A Marine and civilian biologist examine a desert tortoise.

Desert tortoises (*Gopherus agassizii*) have crawled the Mojave Desert since California's southern interior was covered with green ponds and wetlands. Millions of years have altered the landscape dramatically, turning it into an arid expanse dominated by wind, rocks, and sand. The desert tortoise has adapted to major geological and climate change and continues to dig burrows there, waiting out the harshest periods of the year in safety under ground.

In recent decades, a new tenant has arrived on the scene: the Department of Defense. In 1952, the DoD found that the Mojave Desert's wide open spaces provided an ideal backdrop for Marines to practice war fighting. The Marine Corps moved some of its units from Camp Pendleton on the California coast to what is now the Marine Corps Air Ground Combat Center near Twentynine Palms, California. A 596,000-acre (240,200-hectare) spread of rugged landscape directly north of Joshua Tree National Park, the base has evolved into the Corps' showcase for large-scale live-fire training.

The desert tortoise is an amazingly adaptive animal. However, despite the species' remarkable longevity, its survival is now in peril. In the early 1980s, human migration to the Mojave Desert rose and so did the incidence of trash scattered throughout the landscape. Benefiting from increased food (from human trash) and water, populations of the common raven, a prolific omnivore, skyrocketed. Unfortunately, the raven became one of the main predators of young tortoises. For this and other reasons, including disease, the U.S. Fish and Wildlife Service listed the Mojave population of the desert tortoise in 1990 as threatened.

For every 15 clutches of eggs laid (each clutch typically numbers 3 to 10 eggs), only one individual is likely to live to maturity. Once a desert tortoise has reached adulthood, its prospects for a long life are promising. Its shell is hard enough to protect it from all native wild animals except the mountain lion. However, during its first three to seven years of life, the reptile's shell is soft, and it fails against a wide variety of predators, most significantly the raven. Other creatures that take their toll on eggs and immature tortoises are foxes, dogs, bobcats, and badgers.

For tortoises that survive the elements and predators, there is yet another threat: upper respiratory tract disease (URTD). The primary pathway for UTRD bacteria is direct nose-to nose contact. While there is some question to whether URTD-causing bacteria are native or introduced to the Mojave Desert, the release of diseased pet tortoises does appear to exacerbate the condition in the wild. Rather than killing the tortoise directly, URTD depresses the immune system. A tortoise can survive URTD in a year when food and water are plentiful. In a bad year, however, the disease can be the straw that breaks its back, allowing death by malnutrition, predators, or other diseases.

DoD Takes Action

Two military bases within the native range of the Mojave Desert tortoise population have already acted to overcome the effects of the exploding raven population and respiratory disease. Edwards Air Force Base and Fort Irwin, in concert with the University of California at Los Angeles (UCLA), were first to open captive-breeding pens for the tortoise.

Now, the Marine Air Ground Task Force Training Command at Twentynine Palms is kicking off its own effort. The Tortoise Research and Captive Rearing Facility is a 2.25-acre (1-ha) protected enclosure located a few miles from the main base in an area that carries a high tortoise population. Its mission is to protect tortoise nests, hatchlings, and juveniles for the first three to seven years of life. The base environmental staff has been the main proponent for building the captive rearing facility. The Marine Corps recognizes the expertise of UCLA, and it is paying the university to manage the tortoise rearing facility and to provide personnel and equipment.

The much-anticipated program began operating in March 2006. UCLA staff locates female tortoises in the training area surrounding the rearing facility. With a transportable x-ray machine, tortoise handlers check tortoises to determine if they are carrying eggs. If so, staff will take them to one of three large enclosures inside the facility to lay eggs, afterwards returning them to their original location. The eggs will hatch on their own as they would in the wild. (In the wild, adult tortoises do not provide parental care.)

To prevent transfer of the URTD bacteria, personnel keep the tortoises separated in the rearing facility. Biologists wear latex gloves, disinfect equipment between uses, clean their shoes after working in the disease pen, and take other preventative measures.

Hatchlings will live in protection for two to seven years, waiting until their shells have hardened sufficiently to resist predation. New tortoises will be brought into the enclosure in coming years so that a variety of ages are represented. Once released into the wild, the tortoises will be tracked for at least one year to determine their location and overall welfare.

The captive rearing facility also provides a laboratory for scientists to study such topics as tortoise disease transmission, genetics, paternity, and diet. Because rainfall in the Mojave Desert is fickle, the rearing facility will be supplemented with irrigation when necessary to encourage growth of native plants for forage and shelter.

Efforts by Edwards Air Force Base, Fort Irwin, and now the Marine Air Ground Task Force Training Command are coordinated with those of UCLA, the U.S. Fish and Wildlife Service, and tortoise protection groups. All of these agencies and organizations want to see the desert tortoise return to a secure status, making Endangered Species Act protection no longer necessary. These captive-rearing projects will not only contribute directly to recovery by increasing tortoise numbers, but augmented populations will also provide the basis to evaluate other management efforts on the landscape, thus contributing to a comprehensive recovery strategy.

USMC

A tortoise crawls toward the shelter at its burrow at the Twentynine Palms Marine Corps Air Ground Combat Center.

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by Darbie Sizemore

Eggert's Sunflower Prospers at Arnold AFB

For more than seven years, the Eggert's sunflower (*Helianthus eggertii*) was listed as threatened under the Endangered Species Act. In 2005, however, the U.S. Fish and Wildlife Service removed this plant from the list, recognizing that it no longer needs protection under the Act. A cooperative management agreement now in place between the U.S. Air Force's Arnold Engineering Development Center (AEDC) at Arnold Air Force Base, Tennessee, and the Service deserves part of the credit for the species' recovery. The agreement requires continued management and protection for Eggert's sunflower at Arnold AFB, and will help to ensure that this wildflower remains an integral part of the base's ecosystem.

This species of sunflower, which has large yellow flowers and grows up to eight feet (2.4 meters) tall, is known to grow only in Alabama, Kentucky, and Tennessee. Eleven populations occur on base property. "Recovery and delisting of a federally listed species like the Eggert's sunflower is a first for the Air Force," says Richard McWhite, the AEDC natural resources planner. "Eggert's sunflower is an impressive member of the AEDC barrens plant community. Beginning in early August and lasting through mid-September, the bright yellow flowers of the Eggert's sunflower can be seen across the base. Aggregations, or groups, of Eggert's sunflower, while in flower, dominate a site and throw yellow blooms into the air."

When Eggert's sunflower was placed on the threatened species list, biologists knew of 34 population sites within 14 areas: one county in Alabama, five counties in Kentucky, and eight counties in Tennessee. Now, there are 73 known populations (seven that span three counties in Alabama; 18 that span nine counties in Kentucky; and 48 that span 15 counties in Tennessee). Of these, approximately 27 populations occur on public land or on land owned by The Nature Conservancy (TNC). Management plans provide for extended conservation of the species at all sites on federal lands and the TNC site. The number of secure populations exceeds the recovery goal of 20 such populations.

The Eggert's is more adaptable than scientists previously realized. It prefers rolling-to-flat uplands in full sun or partial shade. Often, it is found in open fields or thickets along wooded borders with other tall plants and small trees. It persists in, and may even colonize, roadsides, power line rights-of-way, or fields with suitable open habitat. One manage-

ment tool for this species is the use of prescribed burning to open up densely vegetated habitat. Distinguishing characteristics of Eggert's sunflower include opposite, stalkless, lance-shaped leaves that are rough and waxy on the upper leaf surfaces and white on the undersides. The plant grows in large aggregations that arise from an underground stem that may have many above-ground stems.

The distribution of Eggert's sunflower correlates strongly with the presence of barrens habitat. In eastern Tennessee, the term "barrens" refers to the unique complex of grasslands and wetlands that once characterized the Highland Rim region. The gently rolling uplands, interspersed with wet flats and depressions, appear much like the familiar Midwestern tallgrass prairie-oak savanna landscape. The barrens were historically maintained by fire and grazing, and have declined with the loss of natural ecosystem processes.

"Restoration of barrens habitat at Arnold has provided the needed open areas and barrens for the Eggert's sunflower," says McWhite. "Two thousand acres of barrens habitat have been restored recently, creating additional habitat for Eggert's sunflower."

Genetic research initiated in 1999 enabled biologists to define what constitutes a functioning population of Eggert's sunflower. This research, combined with successful habitat restoration and a cooperative management agreement between AEDC and the Service, led to the species' delisting in 2005.

Now that Eggert's sunflower is secure, the Air Force is no longer required to engage in interagency consultations with the Service for this plant under section 7 of the Endangered Species Act. Species management has become simplified by reducing the number of barrens habitat units under survey, and species monitoring is simplified and incorporated within the base's Barrens Ecological Monitoring Program. Land use restrictions for the benefit of Eggert's sunflower are no longer needed outside barrens restoration areas, and the species' annual management costs can be reduced by 40 percent due to a reduced need for monitoring and the consolidation of prescribed burn units. Recovery of Eggert's sunflower not only has conserved a colorful wildflower species but has produced several operational advantages for the Air Force.

Arnold Engineering Development Center

Darbie Sizemore is a senior public affairs writer for Aerospace Testing Alliance (ATA), the prime contractor for operations, maintenance and support, at Arnold Engineering Development Center. ATA is a joint venture between Jacobs Sverdrup, Computer Sciences Corporation, and General Physics.

In Defense of Coral Reefs

by Lorri Schwartz

Phillip Lobel and Lisa Kerr Lobel

Coral reefs are the world's most biologically diverse marine ecosystems. They consist of a vast assemblage of plants, animals, and microbes, many of which are still scientifically unknown. Reef ecosystems provide habitat and food for fish, substances for new medicines, revenue from tourism and recreation, and protection from coastal storms. However, studies over the past 10 years show that corals are deteriorating at an alarming rate. Human activities such as coastal development, destructive fishing practices, pollution, and sedimentation are causing coral reef degradation worldwide. As a result of these impacts, the National Marine Fisheries Service (NMFS) recently listed the elkhorn coral (*Acropora palmata*) and staghorn coral (*A. cervicornis*) as threatened species under the Endangered Species Act.

In response to growing concern, Executive Order (EO) 13089 (issued June 11, 1998) directed federal agencies to study, restore, and conserve coral reefs in the United States. It also established the U.S. Coral Reef Task Force to coordinated federal protection. The Task Force is co-chaired by the Secretaries of the Departments of Interior and Commerce, and is composed of representatives from participating federal agencies, states, territories, and Freely Associated States. The Department of Defense, a member of the Task Force, is represented by the Assistant Secretary of the Navy (Installations and Environment). The Task Force oversees implementation of the EO, guides coral reef initiatives, and works in cooperation with other agencies and stakeholders. It is also responsible for coordinating a comprehensive program to 1) map and monitor U.S. coral reefs, 2) develop and implement research and mitigation efforts, and 3) assess the U.S. role in international protection.

In 2000, the Navy, with assistance from the other military services, submitted the DoD Coral Reef Protection Implementation Plan. The DoD plan contains a comprehensive overview of Army, Navy, Air Force, and Marine Corps policies and programs related to coral reef protection, describes military activities potentially affecting coral reef ecosystems, and lists funding sources for conservation. It includes a discussion of DoD research, outreach, and stewardship initiatives to protect and enhance coral reef ecosystems. The plan continues to be a useful source of environmental information and requirements for military personnel, and it is an excellent communications vehicle for disseminating information to other federal agencies and the public.

The DoD uses a variety of programs to identify and avoid impacts to coral reefs, but the most important of these is environmental planning. The Navy evaluates major operations and training exercises for potential environmental impacts under the National Environmental Policy Act and the Coastal Zone Management Act. Although EO 13089 applies only to U.S. coral reef ecosystems, actions conducted internationally are reviewed under EO 12114, Environmental Effects Abroad of Major Federal Actions. Environmental plans for training and combat exercises provide for the proper management of ship and vehicular operations to avoid damage to coastlines, reefs, and beaches. The DoD also uses information from baseline ecological surveys, and innovative maneuvering techniques to ensure that coral reefs are protected during testing and training operations. The Navy

is using a marine-based Geographic Information System (GIS) system that will contain coral reef monitoring data, reef locations, habitat conditions, and related marine fisheries information. Installations near coral reef ecosystems also include ecological information on reefs and conservation measures in their Integrated Natural Resources Management Plan.

Part of the DoD Coral Reef Protection Implementation Plan addresses marine pollution. In accordance with the Act to Prevent Pollution from Ships, DoD complies with strict shipboard pollution prevention standards. Shipboard equipment has significantly reduced the amount of pollutants and waste products used on military vessels. DoD continues to develop innovative technology such as "compressed melt units," which compress all plastic waste for storage on board. This technology has allowed DoD to implement a "zero plastics discharge" policy. Now, all plastic waste is brought back to shore for disposal or recycling. Biodegradable materials such as cardboard are processed by on-board "pulpers" into a non-floating slurry that is non-toxic to marine organisms and authorized for discharge.

In addition to protecting the marine environment during normal operations, DoD assists in special circumstances, with cleaning up disasters at sea, such as catastrophic oil spills. These spills are devastating to marine wildlife and can be very detrimental to corals. The Navy possesses one of the world's largest inventories of oil pollution response equipment, and it is available from a global network of installations. In fact, Navy fleet skimmers collected half of the oil recovered from the *Exxon Valdez* spill in Alaska. Additionally, upon a formal request by the government of Yap (one of the Federated States of Micronesia), the Navy successfully off-loaded nearly 2 million gallons of oil from a sunken World War II oil tanker, the *USS Mississinewa,* which began leaking oil near Ulithi Atoll (another island of the Federated States). The DoD also has well-established compliance programs on the installation level to prevent oil spills and to provide a rapid response and clean-up.

The DoD plan also addresses the proliferation of non-native and invasive species which can damage both terrestrial and aquatic ecosystems. These intruders upset the natural balance of marine ecosystems, competing with or displacing corals and reef fish communities. The transfer of ballast water carried by large commercial ships is the greatest source of aquatic invasive species worldwide. To prevent such accidental introductions from military vessels, DoD has a "double exchange" policy. It requires that all tanks containing ballast water taken on within 3 nautical miles of shore or in polluted areas be purged twice with clean seawater while the ship is farther than 12 nautical miles from shore.

NOAA Fisheries

The elkhorn coral was listed recently as a threatened species.

Activities conducted on land and near shore are an important part of coral reef protection for DoD. Such activities as agricultural operations and dredging, can affect the health of coral reef ecosystems if responsible conservation practices are not used. Runoff from landscaping and farmland generally contains pesticides, herbicides, and fertilizers that, over time, can degrade the health of nearby waters. To prevent the introduction of these harmful substances into the marine environment, military installations use best management practices to control this non-point source pollution. The DoD also minimizes sedimentation through erosion control measures and restorative projects when appropriate, all of which is detailed in our installation Integrated Natural Resources Management Plans.

In addition to producing the Coral Reef Protection Implementation Plan, DoD developed the Coral Reef Conservation Guide, a general outreach brochure to heighten awareness within the Department. The guide provides basic information on coral reef ecosystems and discusses why their protection is important. It also gives an overview of DoD activities that could affect coral reef ecosystems and outlines laws and policies regarding coral reef protection. A DoD training course is offered periodically for natural resource managers and other DoD personnel to promote these coral reef protective measures.

It is DoD's mission to be good stewards of the lands and waters in which it operates. As evidence of this commitment, DoD continues to be an active member of the Coral Reef Task Force and work in cooperation with partners to research, restore, and protect coral reefs.

The DoD Coral Reef Protection Implementation Plan is available for download via the Defense Environmental Network Information Exchange (DENIX) at: *www.denix.osd.mil*.

Lorri A. Schwartz, with the Naval Facilities Engineering Command in Washington, D.C., can be reached at (202)685-9332.

Army's Hawaiian Plant Propagation Aids Recovery

by Michelle Mansker

Growth chambers used for seed germination trials.

Cyanea superba ***is an endangered, palm-like tree crowned by a rosette of leaves.***

US Army Guard Hawaii Environmental Staff photos

The Army Garrison Hawaii has eight training areas on the islands of O'ahu and Hawai'i (the "Big Island"). Within the boundaries of these areas, there are more than 100 endangered species, including birds, several snails, and a large number of plants. Many of the species number fewer than 50 individuals in the wild. They occur in small, widely distributed populations of a few individuals on lands of the State of Hawaii, U.S. Fish and Wildlife Service, City and County of Honolulu, The Nature Conservancy, and other private owners.

One of the Army's most important conservation measures in the Hawaiian Islands is the collection and propagation of rare plant species. Two horticulturists, one plant propagation specialist, and one propagule[1] management specialist work full-time on this effort. The Army has access to three greenhouses, a mid- and low-elevation greenhouse on O'ahu and a high-elevation greenhouse at Pohakuloa on the island of Hawai'i, with a combined growing space of over 10,000 square feet (930 sq. meters). Since 1995, the Army has shared the mid-elevation nursery on O'ahu with the State's Division of Forestry and Wildlife. Over 2,000 plants are grown each year in these greenhouses and placed into natural habitats.

The Army also has collected thousands of seeds, which are stored either at the National Seed Storage Laboratory or the University of Hawaii (UH) Seed Conservation Laboratory at the Harold Lyon Arboretum. Trials are conducted at the UH lab by the Army's propagule management specialist to determine the viability of Hawaiian plant seeds stored under various conditions. This information can then be used by anyone carrying out plant restoration in Hawaii. Growth chambers are used for studying germination requirements of these rare species in a controlled environment. This technique promotes maximum germination and the best use of a limited seed supply. The germinated seeds are then transferred to sterile media and to one of the greenhouses.

Seed storage also ensures that there is material available for reintroduction purposes should a species become extinct in the wild. In fact, two plant species, *Cyanea superba* and *Phyllostegia kaalaensis,* have been saved from extinction through these efforts. Several of the plant species managed by the Army do not produce viable seeds. In these instances, it is necessary to try alternative propagation and storage techniques. The Army has had success with cuttings and micropropagation for many of these problem

1 A propagule is a structure (such as a cutting, seed, or spore) that propagates a plant.

species. One example of a plant that does not produce viable seeds is *Fluggea neowawraea*. This dioecious (separate male and female plants) tree species is highly threatened by an introduced insect for which there is currently no control. The trees are rapidly declining in number, and cuttings are the only proven method to acquire stock for storage and propagation. Without this method, the species would surely go extinct.

The UH Lyon Arboretum Micropropagation Laboratory is a crucial member of the micropropagation effort. Micropropagation is the practice of rapidly multiplying stock plant material to produce a large number of progeny plants, using modern plant tissue culture methods. The lab grows plants through this method and disseminates them to the Army greenhouses once established in their test tubes. It also houses a "living collection" of some of the rarest Hawaiian plants that can be used for future propagation and outplanting efforts.

The combined method of taking cuttings followed by micropropagation was used for *Phyllostegia kaalaensis*. Cuttings of this critically endangered plant were taken from wild populations in 1996 and 1997. Since that time, all wild populations have been extirpated by the effects of non-native feral ungulates, weeds, drought, and possibly disease. The cuttings were preserved in micropropagation for years as a genetic back-up of plants that were also being propagated in the greenhouse. The micropropagation facility was the only facility successful in propagating clones from a few of the populations, and without this success restoration efforts with this taxon would be grim.

The final method used by the Army to ensure the availability of plant material is *ex situ* (off site) storage or the "living collection." The Army has partnered with schools, colleges, and botanical gardens to achieve this goal. This storage method is often necessary for the larger plant species and those that do not produce viable seeds. The Army is hopeful that this combination of techniques, and working in partnership with a wide variety of organizations, will eventually lead to the stabilization of some of Hawaii's endangered plant species.

Army horticulturalist Dave Palumbo tends to plants at the Army's nursery.

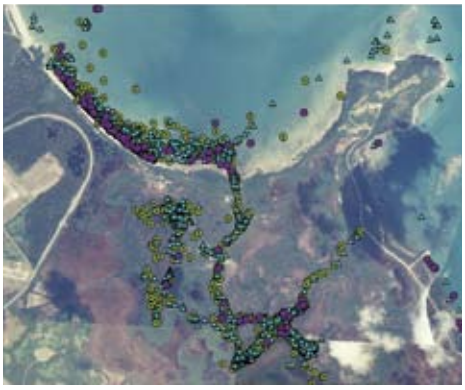
Michelle Mansker is Manager of the Natural Resource Program of the Army Garrison Hawaii at Schofield Barracks, Hawaii (michelle.mansker@us.army.mil).

Cooperative Manatee Research in Puerto Rico

by James P. Reid

USGS Sirenia Project

Researchers attach a radio transmitter to a manatee.



USGS Sirenia Project

Locations of three tagged manatees over 2 months, showing extensive use of near-shore seagrass beds in Puerto Medio Mundo and mangrove-lined creeks at Los Machos.

The Antillean manatee (*Trichechus manatus manatus*) inhabits the coastal waters of eastern Mexico, and Central America, northern South America, and the Greater Antilles. Puerto Rico may be its only stronghold in the Greater Antilles. Significant numbers of manatees occur in Puerto Rico, with the largest concentrations along the southern and eastern coasts. Unlike in Florida, where manatees make extensive use of estuarine and freshwater habitats, manatees in Puerto Rico are found almost exclusively in marine habitats. As a result, manatees in Puerto Rico are entirely dependent on seagrasses for food.

Protected under the Endangered Species Act and the Marine Mammal Protection Act, manatees in Puerto Rico are under the jurisdiction of the United States. A recovery plan for manatees in Puerto Rico, prepared by the U.S. Fish and Wildlife Service, outlines tasks to identify and reduce human-related mortality, identify and protect manatee habitat, and develop criteria and biological information needed for recovery of the Puerto Rico population. Population management and habitat protection measures specify the need for data from radio-tagged manatees on manatee movements and habitat utilization. Other specific tasks include determination of manatee food habits, mapping the distribution of seagrass beds and sources of fresh water, and establishing monitoring procedures for important habitat components. Habitat protection plans developed in Puerto Rico can serve as models for other Caribbean countries.

Scientists with the Sirenia Project at the U.S. Geological Survey's (USGS) Florida Integrated Science Center (FISC) are providing research findings to address the Service's manatee recovery efforts. Since 1992, the Sirenia Project and the Navy have cooperated on manatee research near Naval Station Roosevelt Roads in eastern Puerto Rico. The objectives of these studies have been to document manatee movements in Puerto Rico and assess the resources they depend on. This involves radio tracking manatees, mapping near-shore habitats with aerial imagery and ground verification, identifying seagrass beds, and studying manatee foraging strategies.

Radio-tracking Studies in Eastern Puerto Rico

Radio-tracking data from seven manatees tagged in the early 1990s revealed general movement patterns for manatees that used the waters off Naval Station Roosevelt Roads and Vieques Island, Puerto Rico. Satellite-determined locations and field observations identified areas where manatees feed, rest, and obtain fresh water. Several of these areas are important enough that the Navy has begun protecting them.

Mapping Benthic Habitats

As an extension of research on seagrass distribution and manatee use patterns, the Sirenia Project produced benthic[1] habitat maps in the 1990s for near-shore areas in eastern Puerto Rico and Vieques Island. This geographic information system (GIS) mapping effort used aerial photographs to delineate and map near-shore benthic habitats. The classification scheme included seagrasses, macroalgae (or "seaweeds"), hard bottom (coral reefs), mangroves, bare substrate, and dredged areas. Approximately 32

1 (of, relating to, or happening on, the bottom of a body of water)

James P. Reid

miles (51 kilometers) of shoreline were mapped at Naval Station Roosevelt Roads and 71 miles (114 km) at Vieques Island. The data were made available to the NOAA/NOS[2] Center for Coastal Monitoring and Assessment's Biogeography Program for production of a regional GIS assessment of benthic habitats of Puerto Rico and the Virgin Islands.

Seagrass Characterization Studies

Seagrass beds in eastern Puerto Rico, including those important to manatees, have been characterized and mapped in detail in order to analyze changes that occur over time or that follow specific disturbances. In collaboration with the NOAA/NOS Center for Coastal Fisheries and Habitat Research, detailed characterizations of these seagrass beds have established baseline parameters that can be used to assess the long-term ecological status of seagrass resources and associated animal communities. Detailed remapping documented changes to habitats caused by a major storm, Hurricane Georges, in 1998.

2 National Ocean and Atmospheric Administration/National Ocean Service

Changes for Manatee Habitats

After more than 60 years of naval activities in eastern Puerto Rico, over 8,000 acres (3,240 hectares) of the former Naval Station Roosevelt Roads are slated for transfer from Department of Defense to private and commonwealth ownership. Because the facility functioned as a naval port, training facility, and military quarters, security restrictions prevented non-military boating within the nearshore waters. As a result, much of the coastal area has been a *de facto* sanctuary for manatees.

With anticipated changes in land use following the end of Navy control, concern about possible impacts led the Service to request additional research on manatee activities. In coordination with Geo-Marine, Inc., the Sirenia Project began a project to identify habitat use patterns and specific resources used by manatees. With extensive seagrass beds available for forage but limited freshwater in the region, objectives included identifying freshwater sources used by manatees.

Ten manatees were tracked in May 2005 using global positioning system (GPS) tags that relay locations daily through a satellite link. They ranged over 30 miles (50 km) along the coast from Cayo Santiago to Rio Fajardo, as well as along both coasts of Vieques Island. The GPS data revealed the location and frequency of use for sites where manatees access fresh water and forage, as well as their movements among these sites. The locations also show preferential use of areas within the harbor and coastal bays, especially in shallow, near-shore seagrass beds. To better understand these findings, the Sirenia Project continues to cooperate in studies with the Center for Coastal Fisheries and Habitat Research on seagrass beds and manatee feeding strategies. Other efforts include documenting hurricane impacts and seagrass recovery within disturbed sites. Similar research along Puerto Rico's southwest coast allows for comparative analysis with manatee tracking and seagrass studies along the east coast. This information will be provided to future land managers to maintain natural resources in the region.

These projects have been a cooperative effort of the U.S. Geological Survey, U.S. Navy, Service, Center for Coastal Fisheries and Habitat Research, Geo-Marine, Inc., Puerto Rico Department of Natural and Environmental Resources, EcoEléctrica, Florida Wildlife Research Institute, Caribbean Stranding Network, and dedicated collaborators and volunteers. With continued work, the manatee may before long come closer to recovery.

Jim Reid is a biologist with the U.S. Geological Survey's Florida Integrated Science Center-Sirenia Project, based in Gainesville, Florida.

Army National Guard Discovers a Tough Little Shrimp

by Dana Quinney

A female raptor fairy shrimp.

Biologists break through the ice to survey for raptor fairy shrimp.

Idaho National Guard biologists Jay Weaver and Dana Quinney recently made a memorable discovery: a new species of giant predatory fairy shrimp. This crustacean lives in the waters of two desert playas (temporary lakes) on the Orchard Training Area in Idaho. They published the species description, co-authored by shrimp taxonomist Christopher Rogers and professor Jorgen Olesen of the University of Copenhagen, Denmark, in the January 2006 *Journal of Crustacean Biology*. There are only two other giant predatory fairy shrimp known to science; one is found in Europe and the Middle East, and one occurs in the Oregon-California desert. Many species of fairy shrimp are similar, but this new species is easily distinguished from any other kind.

The new species belongs to the genus *Branchinecta*. We gave it the species name, *raptor,* for several reasons. First, it is a ferocious predator, preying upon smaller fairy shrimp and other small creatures. Also, the known locations for the species are inside a sanctuary for raptorial birds, the Snake River Birds of Prey National Conservation Area.

Orchard Training Area

Orchard Training Area (OTA) is 138,000 acres (55,850 hectares) of desert landscape where soldiers can train on many weapon systems: Bradley fighting vehicles, M1 Abrams series tanks, Paladins (a self-propelled howitzer), attack helicopters, artillery, and individual weapons. Used by the Idaho Army National Guard since the early 1950s, OTA provides excellent training for desert warfare. In 2005, many Idaho Army National Guard soldiers were deployed to Iraq.

Managing military training on OTA presents a unique challenge. It is on Bureau of Land Management property, part of the Snake River Birds of Prey National Conservation Area. The 1993 federal law that established this special area requires that all land uses remain compatible with birds of prey, their prey, and prey habitat. Thus, the OTA has a mandate for ecosystem management not required of other military installations.

Why Author a New Species?

Why should the military identify and describe a new species? The Idaho Army National Guard environmental staff found that it is more effective to know what

exists on training lands, and then to develop and implement good management plans, than to have outside entities eventually make the discoveries and develop plans without consideration of military training needs.

By co-authoring the species, the Idaho Army National Guard will be included in scientific bodies determining requirements for the species, as well as being a member of decision-making groups responsible for conservation of rare species and the management of their habitats. This enables them to represent both the interests of the species and the interests of the military during development of management guidelines or conservation measures for the species.

What Raptor Does for a Living

Raptor (the species' common name) is a very uncommon shrimp. Adults can be almost 3.5 inches (8.9 centimeters) long, with bright turquoise blue reproductive organs. They are armed with a bristling array of hooks, combs, spines, and projections that help them detect, capture, and hold their prey.

Typically, fairy shrimp hatch rapidly after a significant rain, and they complete their life cycle within a few days or weeks. When the temporary water dries up, the shrimp die, and only their desiccation-resistant cysts remain on the dry playa bottoms. Playa lakes may remain dry for years. The shrimp cysts persist, alive but dormant, in the baking sun and winter cold until the rains once again fill the playas and the cysts hatch, producing a new population of shrimp.

The waters where raptor occurs are as brown as chocolate milk, so the species has reduced eyes. It continually swims on its back, grasping with its large, hooked front legs at other creatures it encounters. Raptor can hold as many as four killed or disabled prey shrimp as it continues to hunt.

Raptor occurs only in winter and early spring, often living under inches-deep ice. Often, when we sample for raptor, we take an ax to chop down to the water where we drag our nets—a strange variation of ice fishing! By April, it's too warm for raptor. It dies and sinks to the bottom until winter rains fall again to fill the playa.

Though many playas have been searched, raptor has been found in only two, one inside the OTA and one outside (but near its boundary). The OTA location is a cultural site where military use has not occurred for many years, and the surrounding habitat is stable. Long-term data (17 years) demonstrate the stability of the surrounding habitat.

Since raptor's cysts are not distinctive enough to search for in dry playa bottom soil, we are now associating raptor larvae with adults, so that the presence or absence of the species in a playa can be determined even during years when the water evaporates before adults have time to appear. We are also investigating conditions necessary for the species to occur and reproduce so that we can implement good management practices.

Announcing the New Species

The Idaho Army National Guard's leadership wanted to share the excitement about the newly discovered species. In March 2005, the Guard announced the new species at a military press conference. Surprisingly, the story was picked up by news agencies around the world and appeared in almost 200 newspapers, dozens of television stations (including CNN), National Public Radio, and thousands of web sites (including National Geographic). As one reporter told me, "It's good to have a significant military environmental story that is positive."

Dana Quinney is with the State of Idaho Military Division.

Scientists use nets to capture the tiny shrimp.

Partners Save the Sonoran Pronghorn

by Captain Aaron Otte, U.S.M.C.

The endangered Sonoran pronghorn (*Antilocapra americana sonoriensis*) of Arizona and Mexico is among one of the Department of Defense's most eye-catching tenants. This graceful holder of the North American land speed record can run at speeds up to 60 miles (95 kilometers) per hour, and its large eyes can detect movement 4 miles (6.5 kilometers) away. Once widespread in the southwestern desert, the Sonoran pronghorn is now restricted to three isolated herds, two in Mexico and one in America. With a total population of fewer than 500 animals, it is highly endangered.

The Barry M. Goldwater Range, one-half managed by the Air Force and the other by the Marine Corps, contains most of the Sonoran pronghorn's remaining habitat in the United States. At more than 1.7 million acres (688,000 hectares), the Goldwater Range looms large on the Arizona landscape as a prized military training area. Significantly, the 860,000-acre (348,000-ha) Cabeza Prieta National Wildlife Refuge adjoins the training range, as does Organ Pipe Cactus National Monument. All three areas come together at the Mexican border.

Marine volunteers install pipes to provide water for the Sonoran pronghorn.

Gary Hovatter/Arizona Game and Fish Department

Rallying to a Species in Need

A devastating drought in 2002 reduced the animal's numbers to an all-time low. At one point, the U.S. population fell to an estimated 21 animals. In a textbook example of a conservation partnership, the Arizona Game and Fish Department (AGFD) and the U.S. Fish and Wildlife Service responded to the threat by assembling a wide array of stakeholders to prevent the extinction of Sonoran pronghorns north of the border. The Air Force, Marine Corps, Mexican government, two Arizona hunting clubs, zoo veterinarians, and University of Arizona volunteers all played a part. By early 2004, three major recovery projects were underway with Air Force and Marine Corps help.

The first project was inspired by an interesting discovery about the drinking habits of Sonoran pronghorns. Some experts maintained the desert mammal would not drink water from artificial sources. In a last ditch effort to save the pronghorn from extinction, staff from the AGFD, the Service, and the Marine Corps carried water coolers up to 4 miles (6.5 km) off road to test this assertion. They discovered the wary desert animals were willing to drink from artificial sources. With this knowledge, the agencies resolved to drill a series of wells to create "watering holes" for the pronghorn.

The second project addressed the need to ensure long-term sources of browsing forage. Irrigation plots created on the Goldwater Range and the refuge now support the growth of

grasses, weeds, and shrubs for pronghorn subsistence.

Finally, the National Park Service, the Fish and Wildlife Service, the Air Force, and the Marine Corps spent significant funds to erect a breeding enclosure on the refuge in January 2004. The AGFD made swift arrangements with the Mexican government to integrate genetically diverse Sonoran pronghorns from one of two isolated populations south of the border. The stress of travel was fatal to four of seven Mexican animals, halting the Mexican project temporarily. In December of 2004, however, seven adults (some American and some Mexican) were captured and relocated into the breeding enclosure. The animals began feeding and forming social relationships.

In the spring of 2005, pronghorns in the captive breeding area gave birth to 10 fawns, including four sets of twins. Four died in a particularly hot, dry stretch in July, probably due to an absence of accessible forage in the pen's washes, where the pronghorns spend most of their time. In response, the partners from the recovery team beefed up irrigation in the captive breeding area, with help from 11 Marine and Navy volunteers. Civilian and Air Force volunteers assisted AGFD monitors by hanging 2.5 miles (4.0 km) of shade cloth in the pen.

Despite a wet autumn, vegetation dwindled again in December 2005, this time due to below-average temperatures. Monitors again stepped in and placed alfalfa around the pen. A volunteer group from the refuge constructed a feeder.

The AGFD monitors, with assistance from the Service and the Marines, have found occasional damage to the fence as a result of illegal human immigration from Mexico. So far, they have repaired the fence quickly and no coyotes have seized the resulting opportunity to enter the enclosure.

Back to Mexico

In January of 2006, the AGFD went back to Mexico to assess its population and to capture new pronghorns for the Cabeza Prieta breeding pen. The teams used improved tranquilizing and capture technology to minimize stress for healthy transport to Arizona. One buck and three apparently pregnant does are alive and well from the recent Mexican capture. As in 2005, the recovery team took measures to expedite the international transport process and reduce stress to the animals.

Master Sgt. Michael Burns/USAF

The Future

With assistance from the nearby Marine Corps Air Station Yuma and the Kofa National Wildlife Refuge, the pronghorn recovery team is assessing the possibility of establishing a herd at Kofa. This would bring the number of Mexican and American herds to four, with two in each country.

For now, the future of Sonoran pronghorn is looking brighter. A population that likely would have disappeared over the last five years has rebounded with the help of a few dedicated individuals from AGFD, DoD, Department of Interior, and hard-working volunteers. The Marine Corps is keeping an eye on this species, and is leaving infrastructure in place to help the Sonoran pronghorn again, as needed.

Fort Riley's Prairie Partnership

by Alan Hynek

Examining a greater prairie-chicken.

Much of the valuable training soldiers receive at Fort Riley supports the dynamics of the prairie. Native grasses that evolved from repeated disturbance by herds of bison, deer, and frequent fires are able to withstand heavy mechanized training and occasional wildfires.

Photos by Gibran Suleiman

As Lewis and Clark made their way up the Missouri River in 1804, they traversed the northeastern corner of Kansas and came upon something unexpected: the end of the deciduous forest and the beginning of the vast tallgrass prairie.

At that time, bison, elk, and white-tailed deer migrated over large tracts of land in search of newly grown grass. Their intensive grazing would annihilate large areas of prairie vegetation, and the occasional wildfire would scorch thousands of acres at a time. The prairie grasses and forbs that evolved from the repeated disturbance of fire and hoof gave rise to a resilient plant community that thrived under repeated stress.

But soon, settlers arrived and broke the soil, divided the land, and began suppressing wildfires. Later, urbanization further whittled away at what was once called an endless sea of prairie. Today, less than one percent of the original tallgrass prairie remains in good condition, mostly in the Flint Hills region of Kansas and northeastern Oklahoma.

Fort Riley is located on the northern edge of the Flint Hills, where tallgrass prairie and America's Army have coexisted for more than a century. It is currently home to four species listed under the Endangered Species Act. Fortunately, their presence does not severely affect military training. The Topeka shiner (*Notropis topeka*) resides in five Fort Riley streams, but these habitats account for less then 5 percent of the installation's acreage. The other three species—bald eagle (*Haliaeetus leucocephalus*), least tern (*Sterna antillarum*), and piping plover (*Charadrius melodus*)—inhabit boundary areas where little training occurs. Species of concern, such as the greater prairie-chicken (*Tympanuchus cupido)*, Henslow's sparrow (*Ammodramus henslowii*), dickcissel (*Spiza americana*), regal fritillary butterfly (*Speyeria idalia*), and prairie mole cricket (*Gryllotalpa major*) also reside on post. As today's military mission faces difficult challenges regarding conservation on training lands, Fort Riley is looking into the future to minimize these risks.

Prairie Reclamation

The Flint Hills receives about 30 inches (76 centimeters) of rain per year, enough to support trees in the absence of fire. Even though Fort Riley has been aggressive with the use of prescribed burning, some areas do not receive the frequency needed to keep woody plants in check. To prevent woody vegetation from choking prairie habitats, Fort Riley initiated a prairie renovation campaign in 2002.

Over the past three years, thousands of hours have been spent cutting trees

on the prairie. Areas that are near known prairie-chicken leks (open sites where the birds perform their elaborate courtship displays) and trees that fragment prairie fields were the first priority. Now, with many of those areas renovated, Fort Riley is targeting potential leks and smaller meadows. The restoration effort is already paying off; prairie-chickens have begun to reinhabit adjacent grasslands.

Partnerships

Because it was soon evident that just limiting efforts to inside the installation boundary would have a minimal effect, base personnel began to reach out to neighbors across the Flint Hills. In 2003, we formed the Fort Riley Prairie Partnership. We made a concerted effort to work with neighbors who owned at least 80 acres (32 ha) of tallgrass prairie. These efforts culminated in agreements with four adjacent landowners through the U.S. Fish and Wildlife Service and its Partners for Fish and Wildlife program.

In 2004, Fort Riley received Legacy Resources program funding to study the effects of "patch burning" in the Flint Hills. Patch burning aims to leave approximately one-quarter of a pasture as unburned prairie, leaving behind essential residue for nesting that year. To date, partners have treated nearly 50,000 acres (20,000 ha) in the Flint Hills with good success.

The partnership process really began to blossom in the fall of 2004 when Fort Riley began drafting its own Army Combatable Use Buffer (ACUB) program. Fort Riley's ACUB proposal is to establish conservation easements around the installation to preserve habitat critical for several species of concern in addition to the endangered Topeka shiner. Landowner sentiment has been favorable, with several high-priority property owners expressing interest. The Fort Riley ACUB will likely be approved soon, with funding expected in late FY 2006.

Research

The greater prairie chicken has persisted in Kansas, largely because of the unbroken Flint Hills, including Fort Riley. Unfortunately, it has declined in this region due to changes in grazing and burning practices. In the spring of 2005, Fort Riley personnel initiated a multi-year study to determine habitat use, reproductive success, and spatial relationships of prairie-chickens in relation to military training activities.

Another current research project began in 2004 to determine specific habitat requirements for the Henslow's sparrow. The main focus is to determine suitable patch size required for reproductive success. Researchers survey various sizes and shapes of unmowed and unburned prairie during the bird's breeding season to determine specific habitat requirements. This project will have significant applications on private lands as well as on Fort Riley.

Two lesser known species, the prairie mole cricket and the regal fritillary butterfly, also occur on Fort Riley, and they require very specific habitats. Additional surveys are planned for 2006 to determine a more precise record of abundance.

Fort Riley is recognized as one of the Army's premiere training facilities, and its military population will nearly double by 2011. Significant and evolving challenges remain in the effort to conserve one of the last vestiges of tallgrass prairie while maintaining Fort Riley as "America's Warfighting Center."

Alan Hynek works at the Conservation Office, Building 407, Pershing Court, Fort Riley, Kansas 66442; (785) 239-6211.

What's the Rush at Warren Grove Gunnery Range?

by Walter F. Bien

A large population of the Knieskern's beaked-rush (*Rhynchospora knieskernii*), a threatened plant, was discovered recently at the Air National Guard's Warren Grove Gunnery Range in New Jersey. Until the discovery, fewer than 50 occurrences had been documented in New Jersey. Historically, Knieskern's beaked-rush has always been considered rare, and today its range is restricted to the Pinelands region of New Jersey. The U.S. Fish and Wildlife Service listed Knieskern's beaked-rush in 1991 as a threatened species and completed a recovery plan in 1993.

Walter F. Bien

Knieskern's beaked-rush is an inconspicuous grass-like member of the sedge family (Cyperaceae) that ranges in height from 0.6 to 24 inches (1.5 to 60 centimeters). This early-successional species inhabits periodically disturbed, open wet areas with a fluctuating groundwater level.

The generic name *Rhynchospora* comes from the Greek and means "beaked seed." Prior to its listing under the Endangered Species Act, many populations of Knieskern's beaked-rush grew on private land. Unfortunately, many of these populations have been lost to development. Most of the remaining populations are on state and federally owned lands.

The Service has been working to maintain the health of the species through cooperative management. Conservation and management for Knieskern's beaked-rush involves site protection, active management, and habitat manipulation necessary to maintain vegetation in an early successional stage.

The Warren Grove Gunnery Range is located in the heart of the New Jersey Pinelands. The Pinelands are a fire-maintained ecosystem, and its native plant and animal species are well adapted to the high frequency of forest fires common to the region. The 9,416 acres (3,810 hectares) at Warren Grove Gunnery Range make up a broad mosaic of upland and lowland habitats that support a high diversity of plant species, including Knieskern's beaked-rush and the bog asphodel (*Narthecium americanum*), a candidate for listing under the Endangered Species Act. Biologists inventoried another 26 state- and locally-listed plant species during a comprehensive floral survey conducted at Warren Grove Gunnery Range in support of an Integrated Natural Resource Management Plan.

Dr. Walter F. Bien, a biologist at Drexel University, found Knieskern's beaked-rush growing in disturbed sites near and within target zones on the gunnery range. Typically, patches of plants within a local population may range from a few plants to several thousand plants spread over the population. However, at one location on the Warren Grove Gunnery Range, he estimated that more than 10,000 plants were growing in a target sight line (i.e., a strip of land on approach to a target that has been cleared of visual obstructions). The large number of sites and individual plants represent one of the largest and most significant remaining populations

Walter F. Bien

of Knieskern's beaked-rush in New Jersey. The population at Warren Grove Gunnery Range appears to be secure, and military operations, such as mechanical disturbance, ordinance delivery, and prescribed burning, appear to be providing the necessary disturbance regime required for maintaining established sites and colonizing newly disturbed sites.

The Service has identified several management needs for Knieskern's beaked-rush. These include studies of demography, reproduction, seed bank dynamics, seed viability, dispersal, seedling establishment, and habitat requirements. In addition, the Service has identified the need to assess the role that disturbance from fire plays in the ecology of Knieskern's beaked-rush. Meanwhile, the Air National Guard environmental office and the Service are working cooperatively to manage this species at Warren Grove Gunnery Range. A long-term monitoring program is assessing the effects of military operations on the plant. In addition, future research is planned to assess effects of prescribed burning on seed banks, germination, dispersal, and colonization.

Cooperators in the Air National Guard's conservation program include not only the Fish and Wildlife Service but the New Jersey Forest Fire Service, Pinelands Commission, New Jersey Department of Environmental Protection, New Jersey Office of Land Management, and scientific research partners such as Drexel University. With their help, the Guard is meeting its responsibilities under the Endangered Species Act while maintaining the military mission at Warren Grove Gunnery Range.

Walter F. Bien is Director of the Office of Pinelands Research at Drexel University in the Department of Bioscience and Biotechnology.

Woodpeckers Find a Home at Fort Bragg

by Jacqueline J. Britcher

Amy Young

Banding red-cockaded woodpeckers allows researchers to monitor the bird's status.

Opposite page: Prescribed burning at a red-cockaded woodpecker nesting area maintains the open woodland habitat needed by these birds.

Below: Banded red-cockaded woodpecker nestlings.

Amy Young

Fort Bragg and Camp Mackall occupy over 160,000 acres (65,000 hectares) of North Carolina. Both are located within an area known as the Sandhills Region, and they cover parts of six counties. These reservations, along with adjacent areas, comprise the state's largest remaining contiguous block of longleaf pine–wiregrass forest, an ecosystem that once dominated the southeastern coastal plain. Supporting military training is the Army's priority, but it is also committed to conservation. By focusing resource management at the ecosystem level over the last 15 years, Fort Bragg has made tremendous steps in habitat restoration and wildlife conservation while maintaining the military mission.

Until the late 1800s, old-growth longleaf pine forests were plentiful, but by the early 1900s these forests were being decimated due to several factors, including naval store industries (tar, pitch, and turpentine made from pines), logging practices, agriculture, development, conversion to plantations growing other pine species, and fire suppression. Only 2 to 3 percent of the approximately 93 million acres (38 million ha) of incredibly diverse longleaf pine ecosystem remains today. As a result, a number of the endemic species are now listed as threatened or endangered.

Sound landscape-level management practices and cooperative agreements with local landowners within the Sandhills are imperative for the survival of this rare ecosystem. On Fort Bragg and Camp Mackall, 23 vegetative communities support a high diversity of rare flora and fauna, including three endangered plant species, one endangered insect species, and one endangered bird species, the red-cockaded woodpecker (*Picoides borealis*) or, as it's often called, the RCW.

The RCW is the most recognized endangered species on Fort Bragg and is a focus for management efforts. It is uniquely adapted to the fire-maintained longleaf pine forests and is considered an indicator species reflecting overall ecosystem health. Since nesting and foraging habitat requirements for this bird are key attributes of the longleaf pine forest, restoration and conservation efforts for the RCW are also valuable to multitudes of other species.

An RCW family group occupies an aggregate of cavity trees, or "cluster." Over 425 managed clusters and 5,000 individual cavity trees are distributed across Fort Bragg. During the 2005 breeding season, 414 clusters were occupied with an estimated 347 potential breeding groups. Most of these clusters and cavity trees are now protected by 200-foot (60-meter) buffers, which limit some military

USFWS

training activities. Species recovery and delisting are the ultimate goal for all federally listed species, and the only way the RCW can be recovered is by habitat enhancement and protection. Fort Bragg has made significant steps towards achieving this goal.

The RCW groups on Fort Bragg comprise most of the North Carolina Sandhills East population. Fort Bragg has one of 10 designated recovery populations, with a goal of 350 potential breeding groups. The Sandhills East population includes demographically associated RCW groups on nearby lands, if the birds and habitat are protected in perpetuity. The agreement to count specific RCW groups outside the installation towards the Sandhills East population goal will continue, based on the success of the North Carolina Sandhills Conservation Partnership.

Created in 2000, the Partnership is a group of several organizations that share responsibility and management of the Sandhills ecosystem. Federal and state agencies, as well as other local interests and private landowners, participate in working groups within the Partnership to develop and implement management plans, share information, and provide assistance. In 2005, 21 RCW groups occupied Partnership lands, in addition to the 347 groups estimated on Fort Bragg. The overall estimate for the Sandhills East population was 368 potential breeding groups, exceeding the minimum 350 milestone towards long-term recovery of the population.

Fort Bragg achieved this milestone by aggressive management practices that include the restoration of foraging habitat through prescribed burning; thinning of young, thick pine stands; and mechanical and chemical treatments of hardwood midstory prior to implementing a 2 to 3 year burn cycle. Increases in the population are also attributed to another significant management tool, an artificial cavity program. Priorities ensured sufficient suitable cavities for existing RCW groups before providing recruitment clusters to establish new groups.

It is critical to continue these management programs on Fort Bragg and surrounding properties in order to ensure long-term recovery of the Sandhills East population. As dedicated management allows the population to grow, the U.S. Fish and Wildlife Service will likely reduce military training restrictions on the installation.

Fort Bragg also has programs for other listed species found on the base. Survey, monitoring, and restoration programs are in place with current or recent research projects. In support of ecosystem diversity, the installation participates in the national Monitoring Avian Productivity, Survivorship, and Winter Survival studies and other inventories for rare species such as plants, bats, aquatic wildlife, amphibians, and reptiles. Installation personnel documented new species records for the state and counties, and they discovered two species new to science, the Sandhills spiny crayfish (*Cambarus (Puncticambarus) hystricosus*) and the Sandhills lily (*Lilium pyrophilum*).

Identifying and monitoring these rare and endangered species while continuing ecosystem management will enable the Army to take a leadership role in natural resource stewardship while maintaining a sustainable environment for its training mission.

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North Carolina Plant is (Re)discovered!

by Captain Aaron Otte, U.S.M.C.

An extremely rare species of flowering plant with bright yellow bloom clusters has found a niche at Marine Corps Base Camp Lejeune in coastal North Carolina. The showy coastal goldenrod (*Solidago villosicarpa*) apparently prefers habitat adjacent to coastal wetlands at Camp Lejeune. The species was originally found in North Carolina in the 1940s and mistaken for a far-flung colony of the Midwestern goldenrod.

Then in 1991, almost five decades later, Richard LeBlond of the North Carolina Natural Heritage Program and John Hammond, a biologist at Marine Corps Base Camp Lejeune, sighted the tall beauty from a boat.

The coastal goldenrod, which is on the North Carolina endangered species list, currently occupies around 22 acres (9 hectares) on Camp Lejeune. A few other plant populations exist in Pender and Brunswick counties, where they are susceptible to development. In addition to the plants on Camp Lejeune, these are the only known populations.

Craig Ten Brink, a wildlife biologist on base, notes that the populations on Marine Corps property are in areas of relatively low training impact. A new Camp Lejeune base order allows for designation of "conservation areas" that would restrict vehicular traffic in coastal goldenrod sites, provided that it does not interfere with training. Camp Lejeune environmental personnel work closely with the training community to seek opportunities for conservation that do not affect the training mission. In addition to protecting coastal goldenrod, conservation areas are proposed to protect other species of concern on the base that are not federally protected by the Endangered Species Act.

The natural resources staff is now working on the base's Integrated Natural Resources Management Plan (INRMP) to incorporate the provision for designating conservation areas for coastal goldenrod. The INRMP also will lay out a plan to monitor the species in cooperation with the North Carolina National Heritage Program and the U.S. Fish and Wildlife Service.

DoD's Legacy Program supports activities targeting "at-risk" species and their potential habitats around DoD installations. In North Carolina, the Legacy Species-at-Risk Management Program is funding the North Carolina Heritage Program to discover more goldenrod habitat in the vicinity of the base. As a result, habitats and populations were found in several locations off Camp Lejeune. These discoveries strengthen geographic information and local awareness of the species.

The coastal goldenrod was one of four DoD pilot species for its Species-at-Risk Program in 2003. The program will serve as a template for future partnerships among the DoD, nongovernmental organizations, the Department of the Interior, and private landowners across the United States. The notion is that, by working together, these stakeholders will be able to find species at risk and take action *before* they need listing as threatened or endangered species, and thus make listing unnecessary.

Craig Ten Brink describes the Marine Base's relationship with the state agency this way: "Camp Lejeune Environmental Conservation staff maintains a close working relationship with the NC Natural Heritage. We value their recommendations. They provide a wealth of expertise and have helped Camp Lejeune determine what is present on base as well as how to best manage what we have."

Dale Suiter

The recently described coastal goldenrod has loose heads of bright yellow flowers that bloom in October. It stands three to five feet (0.9 to 1.5 meters) tall and grows on sandy soils in openings within shaded areas. It responds especially well to "blow down" areas associated with hurricanes, but biologists are not sure about the plant's interaction with other species in its ecosystem. Several types of insects land on its flowers, but no specific pollinator is known.

Of Tanks and Birds

by Charles E. Pekins

Gil Eckrich

The limestone bedrock trembles as Abrams tanks rumble by seeking their targets. Overhead, an Apache attack helicopter provides surveillance. In the distance, the din of machine gun fire and artillery is heard. In nearby vegetation, a female bird sits snugly on her egg-filled nest while her mate seeks a juicy caterpillar for its meal amidst the short-lived mechanical clamor. Such a scene is commonly encountered on the Fort Hood Army base.

Fort Hood is a 217,175-acre (87,890-hectare) U.S. Army installation located on the forested juniper–oak (*Juniperus ashei-Quercus* spp.) mesas of central Texas. The Army's largest armored force, III Corps, uses this landscape to train for battle. Federally listed golden-cheeked warblers (*Dendroica chrysoparia*) and black-capped vireos (*Vireo atricapilla*) also use the woodlands for breeding and raising offspring. Fort Hood contains the largest breeding populations of both species under a single management authority, and it is the only land manager that has exceeded recovery goals for both of these species.

Heavily armored tracked vehicle maneuvering and large weapons firing seem contradictory to endangered songbird management, but we have discovered ways to dovetail the two so that both tanks and birds benefit. Using adaptive management, mixed with vigilance and careful monitoring, we manage thriving warbler and vireo populations amidst a working military landscape.

In 1990, basic warbler and vireo life history traits were known, but a paucity of local habitat distribution, population trend, and demographic data precluded us from making any informed management decisions. Soon, biologists from the Army Corps of Engineers Construction Engineering Research Laboratory cast an unblinking eye on the warbler and vireo. Since 1995, they have been aided in this work by The Nature Conservancy of Texas. Biologists studied demographics, population trends, and identified threats to both birds. The greatest threat, nest parasitism by brown-headed cowbirds (*Molothrus ater*), was neutralized by aggressive trapping. By 2000, we were gaining reliable information on population and demographic trends, as well as an understanding of habitat distribution. Population viability analyses suggested that we greatly exceed the amount of habitat needed to maintain warbler and vireo populations at a low risk of local extirpation. Armed with this information, we prepared to take brisk management strides, but first we had to unravel a fascinating habitat relationship.

Vireo and warbler habitats are in a constant tug-of-war. Warblers prefer enduring, closed-canopy forests, while vireos prefer ephemeral, open shrublands. Fire and mechanical habitat disturbances convert warbler habitat to vireo habitat. On the other hand, without disturbance, vireo habitat converts back to warbler habitat. Consequently, vireos may be managed at the expense of warblers and vice versa. For over 40 years, military training established a balance through ordnance-ignited fires and tracked vehicle disturbance; some years favored warblers and others, vireos. Over time, counter-demographic forces, most notably increasing cowbird parasitism and too much disturbance, caused slow population declines to the point of low-to-no habitat occupancy. Once the forces were identified and remedied, warbler and vireo populations rebounded.

In 1993, we began stringent training restrictions in warbler and vireo habitat during the breeding season that affected over 29 percent of the installation. Trees and shrubs provide cover and concealment for armor units, so the habitat use restrictions hindered realistic battle training. But because multi-year demographic data suggested that we had burgeoning warbler and vireo populations, we were able to reduce training restrictions in highly prized maneuver training areas by one-third, so that only 20 percent of the installation was restricted. Soon, we were able to make management leaps-and-bounds.

Observations indicate that *moderate* amounts of training impacts (ordnance-ignited fires and small scale armor maneuvers) help maintain vireo habitat. An ordnance-ignited crown fire in 1996 converted 5,590 acres (2,313 ha) of warbler habitat to vireo habitat, enabling us to meet recovery goals for vireos with only mild impacts on warblers. Because open shrublands allow rapid vehicle movements, target identification, and concealment, quick-strike armor units prefer to assemble and maneuver in vireo habitat rather than warbler habitat. In turn, armor maneuvering at sustainable levels helps to manage vireo habitat by controlling vegetative growth. Thus, vireos benefit by habitat longevity and tanks benefit by mission readiness. In fact, training actually contributed to a 24 percent increase in vireo habitat. Vireo population and demographic trends remained stable or increased in areas where restrictions were lifted in 2000, while warbler habitat remained unaffected.

Based on our success in 2000, we were recently able to reduce training restrictions even more so that only 4 percent of the installation is now restricted, all of it in areas largely unused by armor units because of the terrain. Conflict with battle training has been virtually eliminated. At the same time, we estimate that the golden-cheeked warbler now numbers 5,374 males in 53,115 acres (21,495 ha) of habitat, and the black-capped vireo numbers 4,834 to 8,261 males within 17,215 acres (6,967 ha) of habitat. Although military training and ordnance-ignited fires can maintain and create vireo habitat, it is unwise to rely solely on this method for habitat management. For this reason, we combine passive management through military activities with active management through prescribed fire and mechanical manipulation.

Gil Eckrich

Black-capped vireo at its nest.

Fort Hood has emerged as the leader in golden-cheeked warbler and black-capped vireo management and research. Cautious, watchful management and an uncanny dynamic between military training and bird habitat have allowed Fort Hood to exceed both its endangered songbird and mission readiness goals.

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Managing Habitat for Owls at Fort Huachuca

by Chris Eberly and
Sheridan Stone

Susan C. Galentine

The Mexican spotted owl is among the species protected by environmental efforts at Fort Huachuca.

Birdwatchers know southeast Arizona as one of the premier birding destinations in the United States. The diversity of habitats on or adjacent to Fort Huachuca—from San Pedro River riparian forests to montane grasslands, high elevation riparian, Madrean woodlands, and pine–oak and mixed conifer forest—make the 73,000-acre (29,540-hectare) installation a primary destination for birders. The biggest draws at Fort Huachuca include the Mexican jay, bridled titmouse, painted redstart, gray vireo, sulfur-bellied flycatcher, elegant trogon, buff-breasted flycatcher, Montezuma quail, Gould's wild turkey, and zone-tailed hawk. However, it is the Mexican spotted owl (*Strix occidentalis lucida*) that most often attracts birders to Fort Huachuca.

The Mexican spotted owl was listed as threatened in 1993 due to the historical alteration of its habitat and the danger of catastrophic wildfire. Seventeen occupied spotted owl territories have been identified in the Huachuca Mountains, with up to eight of these occurring on Fort Huachuca itself. Because Fort Huachuca has an approved Integrated Natural Resources Management Plan (INRMP), it is exempt by law from the requirement to designate critical habitat for the owl. Also excluded were Fort Wingate, New Mexico; Fort Carson, Colorado; and the U.S. Naval Observatory Flagstaff Station in Arizona. The management plans for each of these sites incorporate considerations for, and demonstrate a benefit to, the Mexican spotted owl. The absence of DoD lands in critical habitat designation does not lessen the department's responsibility for endangered species management. Instead, it represents a partnership between the Fish and Wildlife Service and DoD and acknowledges that appropriate management plans are being implemented.

In fact, Fort Huachuca has several plans for conservation of the spotted owl and its habitat. The INRMP addresses the management of numerous sensitive species, including the owl and its habitat. It contains 18 measures to reduce impacts of military activities on listed species and their habitat. A separate Endangered Species Management Plan designed specifically for the owl is near completion. It will pull together the various conservation measures identified in the INRMP for implementation.

Management of wildland fuels and fire is a significant component to protecting owl habitat. Fort Huachuca works with the Forest Service through a mutual aid agreement, which brings additional partnerships with local fire departments. Owl habitat typically contains rugged terrain and heavy fuel loads that prevent effective prescribed burning or mechanical thinning. A comprehensive Fort Huachuca Fire Management Plan integrates fire prevention and response activities by partners to prevent catastrophic wildfires. The plan identifies areas where fire suppression will be focused, as well as areas where fire will be allowed to burn if it does not threaten habitat for the owl or other listed species. Prescribed burning in grasslands and savannahs at the base of the mountains keeps wildfires from spreading into steep, forested areas used by the owls.

The Fort Huachuca natural resources staff has to balance the demands for recreational birding access and endangered species management with the primary task of supporting the military training mission. Scheelite Canyon, a beautiful canyon with tremendous diversity, is

home to perhaps one of the best known territories for the Mexican spotted owl on public land. While this owl species can be somewhat intolerant of disturbance by humans, the nesting success in Scheelite Canyon over many years is comparable to other territories in the Huachucas. There is a high degree of awareness that recreation, wildland fire, and other human activities represent potential impacts to endangered and threatened species. Access to canyon areas is limited to daylight hours, and playing tapes to elicit bird response is prohibited. On upper canyon trails, groups are limited to 12 people, who must stay on trails and may not smoke (to minimize fire risk). Management is adaptive and active, and helps minimize soil and habitat impacts, which can reduce the availability of prey items for the owls. The Fort Huachuca staff works hard to make sure the birding public does not "love the bird to death." With their efforts, appropriate levels of recreation and other activities can be accommodated into the future.

Because Fort Huachuca is not large enough to maintain a viable owl population, efforts are also focused on region-wide initiatives and partnerships in the Huachuca Mountains. As demonstrated through initiatives such as Partners in Flight, conservation is most effectively achieved through collaborative efforts like those involving the Mexican spotted owl and Fort Huachuca. Partnerships allow recovery efforts to proceed while accommodating public recreational access and protecting the military training mission.

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Colby Henley

Colby Henley

Mexican spotted owl habitat at Woodcutters Cliff.

DoD Develops Sound Monitoring Efforts

by Alison Dalsimer and John Thigpen

Cornell Lab of Ornithology

Researchers at the Cornell Laboratory of Ornithology in Ithaca, New York, have developed an autonomous airborne monitoring system (above) for tracking bird presence and abundance in areas inaccessible by humans. This system provides previously unattainable population data on two endangered songbirds, the black-capped vireo* (Vireo atricapilla) *and golden-cheeked warbler* (Dendroica chrysoparia)*, pictured at the right. This project was awarded the SERDP Project of the Year for 2004.

Ever wonder what the Department of Defense uses its high-tech surveillance equipment for? Most would answer, "To gather intelligence on a particular target." And this would be true, especially if the surveillance subject is a threatened or endangered species.

Although training and testing are the military's primary missions, DoD (like all federal agencies) is guided by a variety of environmental laws, including the Endangered Species Act. DoD policy states: "The Department of Defense shall act responsibly in the public interest in managing its lands and natural resources." It goes on to say, "Natural resources under control of the Department of Defense shall be managed to support the military mission. . . ."[1]

1 Source: DoD's policy on natural resources, http://www.dtic.mil/whs/directives/corres/htm12/d47004x.htm.

DoD lands harbor more listed species per acre than any other federal lands. This is likely due to such factors as restricted access, limited on-base development, increasing growth and development on adjacent lands, and the successful implementation of Integrated Natural Resources Management Plans. Additionally, DoD lands have been more intensively surveyed than many federal lands, so it may simply be that the data are more complete. Knowing what's on its lands is a high priority for DoD and the dedicated natural resource personnel who manage those resources.

Acoustic Monitoring

Not surprisingly, imperiled animals frequently take up residence in live-fire ranges and other areas that are inaccessible to ground personnel. Although access restrictions provide excellent protection,

Kelly Barr

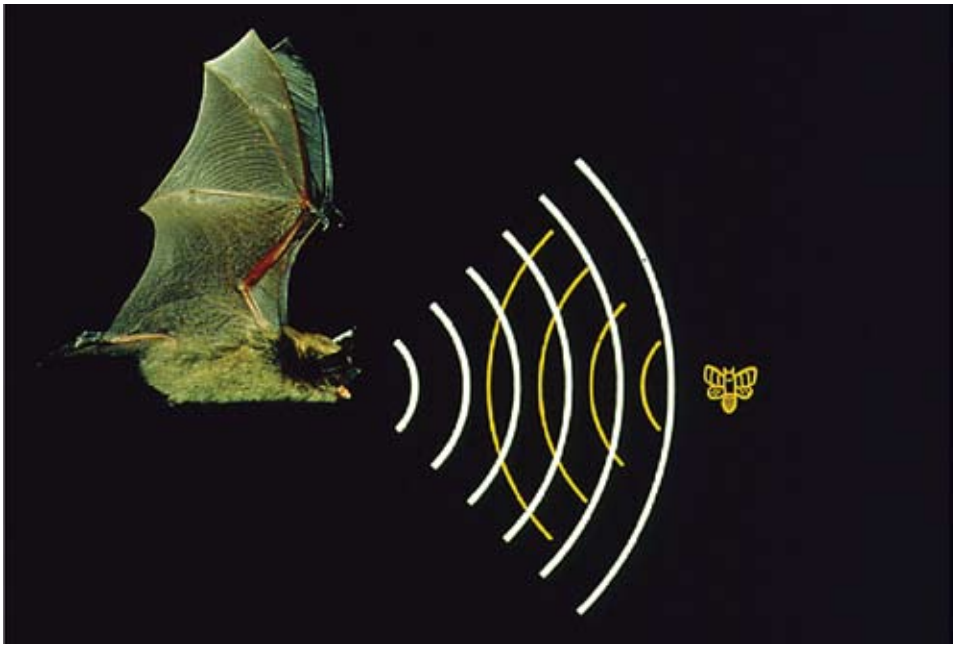

Photo courtesy of Humboldt State University

Researchers at Humboldt State University (HSU) in Arcata, California, are developing a system to monitor bats automatically and continuously for weeks or even months at a time. Because bats are nocturnal, and because it is very difficult to distinguish among their calls, they had been difficult to monitor. HSU's system provides high-resolution acoustical data recordings that will result in more reliable and consistent information about long-term trends and abundance, and will increase the accuracy and consistency of species identification.

they also pose unique challenges to DoD's species management activities, not the least of which is obtaining reliable inventory and monitoring data.

To combat this challenge, DoD's Strategic Environmental Research and Development Program (SERDP) has invested millions of dollars to develop acoustic monitoring technologies that operate independently of human presence. With funding from SERDP, researchers have developed digital acoustic recording tags and airborne monitoring systems, among other technologies, that allow DoD land managers to remotely infiltrate restricted areas and extract valuable data on threatened and endangered species.

The acoustic technologies developed through SERDP record animal sounds autonomously over extended periods, digitize the resulting data, and use it to calculate species density and track migration patterns. Personnel are now using acoustic technologies to track the presence, abundance, and movement of all sorts of listed species. This information provides natural resource managers a baseline against which to measure population size, density, and fluctuations. DoD personnel can then more effectively prioritize management actions and allocate scarce resources.

Successful Results

The acoustic monitoring investments of SERDP are beginning to pay off. At Fort Hood, Texas, personnel can track endangered birds on inaccessible bombing and artillery ranges through mobile, airborne, and long-term recording and monitoring. At sea, the Navy is gaining a greater awareness of marine mammal behavior thanks to information provided by digital acoustic recording tags attached to diving whales.

The military anticipates significant reductions in monitoring costs through the use of inexpensive autonomous monitoring equipment and the reduced need for personnel-based ground surveys. It continues to invest in autonomous detection and tracking technologies so that DoD personnel can base their management on "sound" intelligence.

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Woods Hole Oceanographic Institute

Researchers at the Woods Hole Oceanographic Institution in Massachusetts engineered non-invasive digital acoustic recording tags and attached them to a variety of whales and dolphins, including the elusive beaked whale, to monitor behavioral and physiological responses to various stimuli. For the first time, scientists were able to hear the distinct vocalizations of these whales during very deep foraging dives. This project was awarded the SERDP Project of the Year for 2005.

by Lewis Gorman

Conservation Tools Workshops in Georgia

How do you enlist the support of private landowners around military installations to promote good habitat conservation practices? This is the question a group of natural resource professionals decided to tackle in the last few months of 2005. The group included representatives of the Department of Defense, U.S. Fish and Wildlife Service, the Georgia Department of Natural Resources (GDNR), and The Nature Conservancy (TNC).

The DoD operates key installations in the state of Georgia. All four military services administer at least one installation in the state, and they are required to manage natural resources on their facilities while directing their military mission. In the past, military installations were often located in isolated areas with few residents and little development. Recently, however, growth in surrounding areas has expanded to the boundaries of military installations. Development adjacent to military installations has eliminated natural habitat and raised concerns about safety, air quality, and noise.

To perform required training, military installations need to remain in largely undeveloped areas, a requirement that benefits the conservation of natural habitats. Such habitats can become the last refuge in the area for plant and animal species, many of which are threatened, endangered, or at risk. If these habitats are reduced, the military installation's capability to support DoD training and operational requirements is eroded. "Preventing species at risk and their habitats from reaching a point where they are so imperiled they need listing under the Endangered Species Act is the direction the Service and its conservation partners want to travel," states Renne Lohoefener, the Service's Assistant Director for the its endangered species program.

Peter Boice, the DoD Legacy program's manager, remarks, "DoD Legacy gives a high rank to projects and actions that benefit species-at-risk around military installations." That level of priority resulted in the funding of a project focusing on at-risk species and their habitats around military installations in Georgia. One component of the Georgia Species-at Risk project promoted conservation partnerships with landowners and stakeholders near military installations in Georgia.

Assistance from landowners with undeveloped property near military installations is critical to expand or maintain high quality, native habitat for at-risk species beyond the installation's fenceline. The DoD, Service, GDNR, and TNC all realize the value and necessity of conservation partnerships to accomplish natural resource management goals.

Lewis Gorman

Private landowners in Georgia discuss how to apply conservation tools to their land with Julie Moore of the Fish and Wildlife Service (at left in the photo).

Funding from DoD's Legacy program allowed these agencies to spread the message of conservation partnerships and available conservation tools to natural resource professionals on military installations, as well as to landowners and stakeholders in Georgia through a series of interactive workshops.

Over 100 people participated in the conservation tools workshop, which stressed the importance of DoD buffer lands in serving conservation objectives. Presented at six different Georgia locations, conservation tools information covered Safe Harbor Agreements, Candidate Conservation Agreements, conservation easements, and conservation banks, and illustrated how private landowners can obtain financial support for good environmental practices on their lands. All those in attendance received Service literature about cooperative conservation programs, including "Conservation Profiles: Landowners Help Imperiled Wildlife," "Habitat Conservation Plans," and the *Endangered Species Bulletin*.

Conservation efforts on private lands bordering military installations not only benefit DoD, but assist the GDNR's education and conservation efforts. Jim Ozier, GDNR, discussed the state of Georgia's natural resources, highlighting key natural areas, habitats and the state's recently completed Wildlife Action Plan. DoD installations feature prominently in this plan. Realizing that conservation-minded private landowners and stakeholders would be searching for technical and financial assistance to manage their land, everyone received the updated GDNR's "Landowner's Guide to Conservation Incentives."

Sources of financial support for conservation actions were on the minds of landowners and stakeholders. The Service explained how private landowners could take advantage of programs providing funding for conservation, including the Partners for Fish and Wildlife grants and the various grant programs, such as the Private Stewardship Grants Program, Landowner Incentive Program, Recovery Land Acquisition Program, Habitat Conservation Plan (HCP) Land Acquisition, and HCP Planning Assistance Programs.

Exercises helped reinforce conservation tools concepts and potential sources of funding. Attendees then participated in a hands-on practice session with a hypothetical military installation experiencing increasing residential development pressures. During one session, the fictional situation was replaced with an actual one in which landowners near Fort Stewart needed technical and financial help to manage nearly 2500 acres of family owned land, some of it in the Altamaha River drainage, a natural resource priority area for the Georgia DNR. During this session, FWS, GDNR, DoD biologists and natural resource professionals provided focused assistance tailored to a conservation caring landowner with specific needs.

Natural resource professionals, nongovernmental organizations, and private citizens gained an understanding of conservation tools and their application on private lands. One private landowner, a retired college teacher, remarked, "I got so much from this session. I didn't have a clue all these resources were available. I think all conservation-minded landowners in Georgia would benefit from this workshop."

Workshops that provide a forum for DoD and private landowners and stakeholders can continue to enlist the support of private landowners and local planners around military installations to promote good conservation practices.

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Compatible Land Use Partnerships

by John Housein

The Taylor's checkerspot is one of the species that benefit from the buffer at Fort Lewis, Washington.

There was a time when many military installations were considered remote. They had few neighbors, generated few complaints, experienced few environmental restrictions, and conducted their business relatively unimpeded. However, that era is clearly over. As a result, the Army is redefining its relationship with its neighbors, wildlife included.

Installations that often were strategically placed in relatively unpopulated areas now support communities that have developed because of the installations. The environmental awakening of 1960s and 1970s brought about an age of new legislation and requirements. The Army manages more than 15 million acres (6 million hectares) that are home to more than 175 threatened or endangered plant and animal species and many more at-risk species. Simultaneously, technologies employed by the armed forces allow soldiers to engage the enemy over ever increasing distances. Skills required for war must be taught and practiced in order to be used in battle. These seemingly competing demands on the land base are increasingly stressing Army training.

Numerous installations across the country are experiencing training restrictions due to development, incompatible land uses around their borders, and the presence of threatened or endangered species. Collectively, incompatible land uses or restrictions that affect military training are referred to as encroachment.

Over the past 15 years, the Army has fine tuned methods of securing compatible land uses in the vicinity of Army installations to protect the Army training mission, the natural resources that sustain it, and the quality of life of the local community. The most recent initiative is the Army Compatible Use Buffer (ACUB) program, which was established to resolve installation encroachment issues. This program began when Fort Bragg received a biological opinion from the U.S. Fish and Wildlife Service that planned training activities would likely jeopardize the endangered red-cockaded woodpecker (*Picoides borealis*), or RCW. The resulting training restrictions essentially shut down several training areas on Fort Bragg. The heart of the problem was a lack of land available for habitat management. Located in the North Carolina Sandhills, Fort Bragg could not be responsible for recovering the entire Sandhills population of the RCW while conducting its military readiness mission. In order to be able to train soldiers, the Army needed to increase the habitat available to the RCW, both on and off the installation.

Fort Bragg looked outside its fences to deal with its conservation challenges. In doing so, it entered into a community

Red-cockaded woodpecker at Fort Bragg.

Photos courtesy of DoD

of diverse stakeholders. In the beginning, some of the working relationships were polarized, but over time these diverse groups managed to develop a strategy: the Army would work with its partners to conserve and restore habitat on lands near Fort Bragg by purchasing interests in land from willing sellers. The Army would contribute funds to its partners, who in turn would work to enroll private landowners in the program. This effort, called the Fort Bragg Private Lands Initiative, led to an increase in land available for RCW management.

Over the past 15 years, the Fort Bragg Private Lands Initiative has seen a significant increase in woodpecker breeding pairs, including birds on Fort Bragg. Through years of observation, research, and land management, military training and RCW conservation have become compatible on Fort Bragg and other military installations.

In 2003, citing the Fort Bragg initiative as a model, Congress expanded the authority of the armed services to enter into cooperative agreements for conservation and encroachment purposes. This was a milestone in the transition from the Private Lands Initiative at Fort Bragg to the nation wide ACUB program. To date, 14 Army installations have joined the ACUB program and six more are in the developmental stage. The program has helped to protect approximately 45,000 acres (18,210 ha) of wildlife habitat outside of military installations. Nearly $20 million in Department of Defense funds leveraged partner contributions estimated at $91 million.

The RCW will turn out to be a major beneficiary. Five Army installations (Camp Blanding, Florida; Camp Shelby, Mississippi; Fort Bragg, North Carolina; Fort Benning, Georgia; and Fort Stewart, Georgia) are protecting woodpecker habitat around the bases through this program. Fort Bragg has already achieved its recovery objective within its boundaries, and it continues to work with partners and willing neighbors to expand habitat beyond the fence-line.

Fort Lewis prairie habitat.

By working with their neighbors, defense installations are becoming more active members of their surrounding communities. Camp Blanding's ACUB happens to be a small part of the much larger Florida Forever program administered by the state. Florida Forever is a statewide land acquisition effort that protects vital ecosystem functions and services.

In the state of Washington, Fort Lewis's developing ACUB is a partnership among The Nature Conservancy, the state, and the installation. The program in this case intends to protect habitat for four candidate species so that they will not need to be listed. These species occupy a prairie ecosystem and include the mardon skipper and Taylor's checkerspot butterflies, the streaked horned lark, and the Mazama pocket gopher.

Such stories are multiplying around Army bases across the nation. Through the ACUB program, installations are working to preserve their mission, the natural resources on and off the installation, and the quality of life in surrounding communities. In so doing, the Army is sustaining the environment for a secure future.

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Defense's TES Document Repository

by A. Dalsimer, L. Wehrmeyer, and A. Shepard

*I*magine a single source for scientifically relevant, but otherwise unavailable, information on threatened and endangered species (TES). Now, imagine having that source right at your fingertips. Finally, imagine this source is free and open to the scientific community at large. Welcome to the Department of Defense's TES Document Repository.

First envisioned in 2003 by DoD's Strategic Environmental Research and Development Program and the U.S. Army Corps of Engineers' Engineer Research and Development Center, the Repository represents a compilation of unpublished but scientifically credible documents on TES of high priority to the DoD.

A wealth of such data exists under DoD ownership and control, often exclusively at the installation level. This project seeks to create and maintain a highly functional, easily accessible repository of "gray" literature (literature that has not been subjected to peer review or is not generally available) on DoD's high prior-

Primary accomplishments to date include:

- **Collecting documents on DoD's top 21 threatened and endangered species**
- **Creating guidelines for document inclusion and standards**
- **Creating metadata for each document uploaded into the database**
- **Creating and posting a PowerPoint-based User's Guide**
- **Partnering with the U.S. Geological Survey's National Biological Information Infrastructure (NBII) to build and web-enable the Repository**

Planned actions for the near future include:

- **Standardizing search functionality and appearance of results pages**
- **Integrating the Repository with other NBII TES portals**
- **Developing a protocol for reviewing included documents for potential replacement or archival**
- **Developing an online document submission function for publications cleared by the DoD/Pentagon or military service**
- **Incorporating tools for users to quickly identify new additions to the Repository**

ity species. Making this information available throughout DoD should improve the management of listed species, assist DoD in forming partnerships with other land managers, and facilitate the ESA section 7 consultation process with the U.S. Fish and Wildlife Service.

The Repository is still in its infancy; it was officially unveiled at the March 2006 National Military Fish and Wildlife Association meeting. Nevertheless, plans are in motion to expand the effort to include appropriate documents relevant to all of DoD's more than 300 TES. The effort to acquire and incorporate technical reports, management plans, and biological opinions, and links to related information continues. Once documents have cleared military service or installation security review, key data are extracted and files are uploaded to the Repository website.

Currently, the Repository houses documents related to 18 of DoD's top 21 listed species: the bald eagle (*Haliaeetus leucocephalus*), black-capped vireo (*Vireo atricapilla*), California least tern (*Sterna antillarum browni*), coastal California gnatcatcher (*Polioptila californica californica*), golden-cheeked warbler (*Dendroica chrysoparia*), Hawaiian stilt (*Himantopus mexicanus knudseni*), least Bell's vireo (*Vireo bellii pusillus*), Mexican spotted owl (*Strix occidentalis lucida*), red-cockaded woodpecker (*Picoides borealis*), southwest willow flycatcher (*Empidonax traillii extimus*), western snowy plover (*Charadrius alexandrinus nivosus*), desert tortoise (*Gopherus agassizii*), gopher tortoise (*Gopherus polyphemus*), green sea turtle (*Chelonia mydas*), loggerhead sea turtle (*Caretta caretta*), gray bat (*Myotis grisecens*), Indiana bat (*Myotis sodalis*), and Sonoran pronghorn (*Antilocapra americana sonoriensis*).

Through this platform, researchers can expand on previous studies rather than duplicate efforts, and the conservation community in general can benefit from a greater breadth of information. For more information on the Repository, contact TESRepository@hgl.com or visit the website at http://dodtes.nbii.gov.

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Proposed and final listing rules were published from January 1 to June 1, 2006, for the following species:

Proposed Rules

Gray Wolf (Canis lupus) Saying that gray wolves in Minnesota, Wisconsin, and Michigan have recovered from the threat of extinction, the U.S. Fish and Wildlife Service proposed on March 27 to remove wolves in this region from the federal list of threatened and endangered species.

In addition to the delisting proposal, the Service also proposed to designate gray wolves in the western Great Lakes region as a distinct population segment (DPS) under the Endangered Species Act (ESA). This means that the delisting would apply not only to the three states above but also to parts of North Dakota, South Dakota, Iowa, Illinois, Indiana, and Ohio into which wolves may disperse but are not likely to establish packs.

The gray wolf population in the western Great Lakes region now numbers close to 4,000 animals. The Minnesota population has steadily expanded; the latest estimate in 2003-2004 found about 3,020 animals. Wolves have become well-established in Michigan and Wisconsin, with numbers there of 405 and 425, respectively.

Once removed from the threatened and endangered species list, gray wolves in the Western Great Lakes DPS will be managed by the states and tribes. The Michigan, Minnesota, and Wisconsin departments of natural resources have developed plans to guide wolf management in the future. The Service reviewed these plans and found they established a sufficient basis for long-term wolf management. Issues such as control of problem animals, hunting and trapping, and long-term health of the wolf population will be governed by the appropriate state or tribe.

Graham's beardtongue (*Penstemon grahamii*) A herbaceous perennial wildflower in the figwort family (Scrophulariaceae), the Graham's beardtongue produces one to three stems arising from a taproot. Each stem bears a cluster of 3 to 20 lavender or pink flowers with dark violet lines in the throat of the corolla tube. This species exists as a series of small populations that extend in a narrow band from Raven Ridge west of the town of Rangely in Rio Blanco County, Colorado, westward to the vicinity of Sand Wash near the point where Carbon, Duchesne, and Uintah Counties meet in Utah's Uinta Basin. Over 70 percent of the plants occur on habitat administered by the Bureau of Land Management.

Susan Meyer

Graham's beardtongue.

Threats to the plant may include loss of habitat due to oil and gas exploration, drilling and field development, and tar sand and oil shale mining. Off-road vehicle use, overuse by domestic and wild animals, and overuse in the horticultural trade may also affect some populations. These threats, in combination with small population sizes and the limited distribution of

Drosophila differens

Kevin Kaneshiro

Tibetan antelope

the plant, make the species vulnerable. On January 19, the Service proposed to list the Graham's beardtongue as a threatened species.

Final Rules

Hawaiian Picture-wing Flies On May 9, the Service listed 12 species of Hawaiian picture-wing flies for protection under the ESA. Eleven of them were listed as endangered: *Drosophila aglaia, D. hemipeza, D. montgomeryi, D. obatai, D. substenoptera,* and *D. tarphytrichia* (all found on O'ahu); *D. heteroneura* and *D. ochrobasis* (found on the island of Hawai'i); *D. musaphilia* (found on Kaua'i); *D. differens* (found on Moloka'i); and *D. neoclavisetae* (found on Maui). The species listed as threatened is *D. mulli,* which is found on the island of Hawai'i.

Hawaiian picture-wings have been called the "birds of paradise" of the insect world because of their spectacular displays during courtship and defense of their territories. They are known for their elaborate markings on otherwise clear wings. The Service will focus on monitoring existing populations, controlling threats, and enhancing populations of these species.

The major threats to the 12 species of picture-wing flies are habitat degradation by feral non-native animals such as pigs, loss of host plants, and impacts of non-native insect predators and parasites, including ants and wasps. Furthermore, all of these picture-wing flies are now reduced to just a few populations within localized patches of their host plants, some of which are also listed under ESA.

Tibetan Antelope (*Pantholops hodgsonii*) On March 29, the Service listed the Tibetan antelope as endangered throughout its range on the Tibetan Plateau, which includes not only Tibet but also parts of India and Nepal. This action reinforces protection for an animal already protected under the Convention on International Trade in Endangered Species (CITES).

Although CITES prohibits the importation of Tibetan antelope and its products into the U.S. for commercial purposes, a black market persists, particularly in shahtoosh shawls. Shahtoosh, "the king of wools," is made from the extremely fine underlayer of hair that is removed from the animals after they are killed. Shahtoosh shawls sell for thousands of dollars and are considered status symbols by some people.

The Tibetan antelope has suffered a dramatic population decline in the past 30 years, primarily due to poaching for the wool. Habitat impacts, especially those caused by domestic livestock grazing, appear to be a contributing factor in the decline, and could have greater impacts in the near future. China and India have endorsed the ESA listing action.

Additional information on these and other listing actions is available at http://www.fws.gov/policy/frsystem/default.cfm.

by Kim Winter

The Conservation of Pollinating Species

Eric VanderWerf

'Akohekohe, a Hawaiian bird.

A lesser long-nosed bat pollinates a saguaro flower.

Pollinating animals are critically important to the maintenance of virtually all terrestrial ecosystems, yet the population status of most pollinating species often goes unnoticed. Butterflies, moths, bats, birds, bees, beetles, flies, ants, and wasps assist almost all flowering plants in their reproduction, helping them to develop the seeds, foliage, nuts, and fruits that ensure the survival of innumerable wildlife and human populations worldwide. Sadly, many pollinator populations are declining precipitously around the world.

© Merlin D. Tuttle, Bat Conservation International

In 1999, scientists and natural resource managers concerned with pollinator conservation founded the North American Pollinator Protection Campaign (NAPPC), administered by the Coevolution Institute to promote the health of resident and migratory pollinating animals. NAPPC has grown to become a partnership of more than 100 organizations, ranging from universities and environmental groups to utility companies, zoos, and government agencies throughout the United States, Canada, and Mexico (http://www.nappc.org/partners2005.html). The U.S. Fish and Wildlife Service recently signed a Memorandum of Understanding with the Coevolution Institute, giving the Endangered Species Program access to NAPPC's tri-national network of experts in pollination biology.

Prompted by a NAPPC initiative, the National Academy of Sciences (http://www.nationalacademies.org) is undertaking a study of the status of pollinating species in North America, the results of which should illuminate some of the most important species of concern.

It is unknown exactly how many federally listed animal species are pollinators, or how many federally listed plant species depend on rare pollinators for reproduction. What we do know is provided in the table. In addition to the federally listed species, there are others that may be of concern. For example, the Xerces Society maintains a Red List of Pollinators (http://www.xerces.org/Pollinator_Red_List /index.htm) that describes the pollinating butterflies, moths, and bees in need of conserva-

tion attention in the U.S., Canada, and Mexico. The society identifies 35 additional butterflies, and 58 bees, nearly half of which are *Hylaeus* species in Hawaii that either need additional study or may need additional conservation measures.

Endangered species biologists can become involved with NAPPC pollinator conservation by:

- Considering plant-pollinator relationships. Management efforts to restore healthy populations of an endangered flowering plant must also consider the animal pollinators that may assist in its reproduction. Likewise, endangered and threatened species of pollinators may have coevolved with a distinct species of flowering host plant.
- Working with NAPPC scientists to plan pollinator conservation projects throughout the United States, Canada, and Mexico.
- Creating pollinator habitats using "Pollinator Friendly Practices" guidelines, a joint project of NAPPC and the Wildlife Habitat Council. The guidelines are available online at: http://www.nappc.org. They focus attention on foraging, nesting, and reproductive requirements of pollinating species.
- Learning more about NAPPC activities at www.coevolution.org and www.nappc.org. To receive links to news articles and publications or to ask collaborating scientists about pollinators or management practices, join the pollinator listserv at: http://lists.sonic.net/mailman/listinfo/pollinator.
- Offering feedback to the National Academy of Sciences Study on the Status of North American Pollinators at: http://www8.nationalacademies.org/cp/projectview.aspx?key=BLSX-K-02-06-A.
- Contributing to or using the NAPPC conservation database about plant-pollinator relationships, by contacting info@nappc.org.

Theresa S. Talley

Valley elderberry longhorn beetle

Examples of pollinator guilds currently listed under the Endangered Species Act

Birds	At least some bird species listed as endangered are known to be pollinators. Some Hawaiian honeycreepers have a highly coevolved relationship with the plants and moth pollinators upon which they feed. For example, Hawaii's endangered palila (*Loxioides bailleui*) depends upon forests of an endemic legume, the mamane (*Sophora chrysophylla*), for nesting, shelter, and food. *Cydia* (Tortricidae) moth caterpillars also feed upon mamane and are an important food resource for palilas, demonstrating the intricate interrelationships between a pollinating bird, pollinating moth, and flowering plant.
Bats	At least three species of pollinating bats are federally listed as endangered, including the lesser long-nosed bat (*Leptonycteris curasoae*), Mexican long-nosed bat (*Leptåonycteris nivalis*), and Mariana fruit bat (*Pteropus mariannus mariannus*). Both long-nosed bats migrate north from Mexico to feed on nectar and pollen of several species of *Agave*. These bats leave the U.S. for Mexico in late summer or early fall, after the blooming period of agaves has passed.
Butterflies	There are 23 federally listed species of butterflies and skippers identified as pollinators on the Xerces Red List, with 17 recovery plans completed or in draft form. Many butterflies are listed because of their coevolved relationships with diminishing host plant populations, such as the case with the Fender's blue butterfly (*Icaricia icarioides fenderi*) and Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*) in the Pacific Northwest.
Moths	Two species of sphinx moth are listed, including the Kern primrose sphinx moth (*Euprserpinus euterpe*), which uses evening primrose plants (*Camissonia* sp.) as host plants. When this endangered moth lays its eggs on the introduced plant, filaree (*Erodium* spp.), its larvae cannot develop and soon perish, prompting its populations to decline.
Beetles	At least one of the 17 species of beetles listed as endangered may be a pollinator, the valley elderberry longhorn (*Desmocerus californicus dimorphus*). Its emergence coincides with the flowering of its host plant, the elderberry (*Sambucus* spp.), which is visited by other pollinators. Elderberries provide an important source of fruit for at least 50 species of songbirds and other wildlife.

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by Leopoldo Miranda-Castro

Forging Partnerships for Habitat Restoration

The majority of our Nation's fish and wildlife resources are found on privately owned lands. Because the habitat needs of most endangered and threatened species cannot be met solely on public lands, voluntary partnerships with private landowners are essential. Fortunately, we have an effective tool to provide landowners incentives for cooperative conservation—the Partners for Fish and Wildlife Program.

The mission of the Partners Program is to "efficiently achieve voluntary habitat restoration on private lands, through financial and technical assistance for the benefit of Federal Trust Species." Whether implementing projects ourselves or providing assistance to others, we have helped thousands of private landowners to restore and conserve important fish and wildlife habitats on their lands. Cumulatively, these lands contribute significantly to the conservation of listed and candidate species as well as keeping common species common.

The Partners Program has developed more than 1,200 agreements directly with private landowners to restore over 23,000 acres (9,308 hectares) of wetlands, 1,200 miles (1,930 kilometers) of rivers and streams, and over 100,000 acres (405,000 ha) of upland habitats for the direct benefit of listed and candidate species. Field biologists in all 50 states and U.S. Territories work one-on-one with private landowners and other partners to plan, implement, and monitor their projects.

Partners Program biologists help landowners find sources of funding and guide them through the permit-

Topeka shiner

© Michael Redmer

ting process, as necessary. This personal attention and follow-through is a significant strength of the Program. The biologists provide expert technical assistance directly to private landowners on the best and most cost-efficient practices to restore and manage fish and wildlife habitat on their lands. In many instances, they also provide cost-share financial assistance through a cooperative agreement. Any privately-owned land is potentially eligible for restoration.

Here I present a few of the successful habitat improvement projects benefiting endangered and threatened species in partnership with private landowners:

In 2004 and 2005, Partners staff at the Service's Rock Island (Illinois) Field Office worked with the Iowa Natural Heritage Foundation and two private landowners on a habitat restoration project for the Topeka shiner (*Notropis topeka*) along Cedar Creek in Greene County, Iowa. Endangered species recovery funds paid for the design and construction. The project restored the hydrology of an oxbow in the Cedar Creek floodplain and provided permanent off-stream refugia and potential spawning habitat for Topeka shiners. It also reconnected the downstream end of the oxbow to Cedar Creek to allow Topeka shiners to disperse into the watershed.

In the late 1990's, the Fish and Wildlife Service and its conservation partners identified a privately-owned remnant of native tallgrass prairie. It had survived despite a history of overgrazing, introductions of non-native forage grass species, and natural invasions of non-prairie plants. Surveys lead researchers to discover a small population of a threatened plant, the prairie bush clover (*Lespedeza leptostachya*). The landowner agreed to modify his land use practices to promote the species' recovery. These modifications include a voluntary cessation of grazing, the mechanical removal of invasive woody species, the use of prescribed fire to maintain open habitat and the control of invasive herbaceous species. Partial funding for the revised management was provided by the Service. As a result of the project, the prairie bush clover population has expanded three-fold. In addition, populations of state species of concern have also expanded. The landowner continues to gain economic benefits from the tract by harvesting and marketing local seed from the portions of the prairie that do not contain the Federal or State species of concern.

Kraig McPeek

Kraig McPeek

Two views of Cedar Creek, before (top) and after (bottom) the restoration project. Among the beneficiaries of this project is an endangered fish, the Topeka shiner.

Bridget Nielson

Right: Landowner Mike Cripps releases endangered White River spinedace at Indian Spring, Nevada.

Below: The Preston White River springfish is found at only four locations, all within a four-square-mile area in Nevada. It benefits from a cooperative habitat conservation project for another fish, the White River spinedace.

Gary Scoppettone, USGS/BRD

A partnership effort with the Service's Nevada Fish and Wildlife Office, Nevada Department of Wildlife, and private landowners created a refugium for the endangered White River spinedace (*Lepidomeda albivallis*). Partners worked together to restore spawning and feeding habitat, improve water temperature, prevent non-native fish invasion and restore adult fish passage at Indian Spring in the White River Valley of White Pine County. In addition, the partners restored 45 acres (18 ha) of alkali desert riparian habitat for migratory birds and enhanced habitat for waterfowl and wading birds. The restoration efforts also resulted in a 300 percent increase in the endemic Preston White River springfish (*Crenichthys baileyi albivallis*) and provided the private landowner with enough water to maintain farming operations.

In Montana, the streams that bisect the Two Creeks Ranch provide important habitat for bull trout (*Salvelinus confluentus*), westslope cutthroat trout

(*Salmo clarki lewisi*), grizzly bears (*Ursus arctos*), and many other creatures. Poor grazing management in the past affected the riparian vegetation as well as the width, depth and condition of the streams. The Partners Program has been working with the ranch managers since 1994 on a variety of best management practices that both benefit the ranch and its wildlife. In 2005, we constructed 1.7 miles (2.7 km) of fence along both Monture Creek and McCabe Creek and developed off-site water for livestock use. This project will significantly improve riparian conditions and water quality while improving livestock distribution and water availability.

A project to benefit Utah prairie dogs (*Cynomys parvidens*) entailed fencing 180 acres (73 ha) and treating 74 acres (30 ha) to provide optimum habitat for the reintroduction of this threatened species. The treatment included the removal of shrub vegetation and replanting with native plants. A Safe Harbor Agreement, prepared in a cooperative effort involving a conservation group, Environmental Defense, and the Service's Salt Lake City Field Office, will give the property owner assurances regarding future Endangered Species Act requirements.

For more information about the Partners for Fish and Wildlife Program, we invite you to visit http://www.fws.gov/partners.

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Craig Neudecker

Two Creeks Ranch

BOX SCORE

Listings and Recovery Plans as of July 1, 2006

GROUP	ENDANGERED U.S.	ENDANGERED FOREIGN	THREATENED U.S.	THREATENED FOREIGN	TOTAL LISTINGS	U.S. SPECIES W/ PLANS
MAMMALS	68	256	13	20	357	55
BIRDS	76	175	15	6	272	80
REPTILES	14	65	23	16	118	33
AMPHIBIANS	13	8	10	1	32	16
FISHES	76	11	61	1	149	98
SNAILS	24	1	12	0	37	29
CLAMS	62	2	8	0	72	69
CRUSTACEANS	19	0	3	0	22	18
INSECTS	47	4	10	0	61	32
ARACHNIDS	12	0	0	0	12	6
ANIMAL SUBTOTAL	410	522	156	44	1,132	436
FLOWERING PLANTS	570	1	143	0	714	599
CONIFERS	2	0	1	2	5	3
FERNS AND OTHERS	26	0	2	0	28	28
PLANT SUBTOTAL	598	1	146	2	747	630
GRAND TOTAL	1,008	523	302	46	1,879*	1,066

TOTAL U.S. ENDANGERED: 1,008 (410 animals, 598 plants)
TOTAL U.S. THREATENED: 302 (156 animals, 146 plants)
TOTAL U.S. LISTED: 1,310 (566 animals**, 744 plants)

* Separate populations of a species listed both as Endangered and Threatened are tallied once, for the endangered population only. Those species are the argali, chimpanzee, leopard, Stellar sea-lion, gray wolf, piping plover, roseate tern, green sea turtle, saltwater crocodile, and olive ridley sea turtle. For the purposes of the Endangered Species Act, the term "species" can mean a species, subspecies, or distinct vertebrate population. Several entries also represent entire genera or even families.

** Eleven U.S. animal species and five foreign species have dual status.

ENDANGERED Species BULLETIN

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