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In this Issue

Managing Endangered Species on Military Lands

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The Department of Defense (DoD) is the third largest federal land managing agency in the United States, managing over 25 million acres of land on over 425 major military installations. DoD uses these areas to maintain mission readiness. Marine and estuarine environments are used to test vessels and submarine tracking equipment, evaluate missile weapons, hold shock trials on new ships and carry out training exercises. Airspace is used to train pilots and test fighter planes as well as air-based weapons systems. Combat training exercises, munitions testing, and deployment of weapons systems are conducted on land resources.

DoD lands are found in many different habitats across the country and contain rich and varied natural and cultural resources. Limited access due to security considerations and the need for safety buffer zones have protected these resources for decades from development and other potentially damaging uses. As a result, DoD installations contain some of the finest remaining examples of rare native vegetative communities such as old-growth forest, tall-grass prairies and vernal pool wetlands. Approximately 220 different federally listed species are known to occur on at least one DoD installation—the highest known density per acre of threatened and endangered species found on any federal lands. Many candidate species may be found on lands under DoD control. More than 200 installations provide habitat for at least one candidate or listed species.

DoD embraces its stewardship responsibilities for these valuable resources. However, underlying any management decision affecting DoD lands is the fact that these lands must first be managed for the continued use of military training and testing—a situation quite different from that of "traditional" land management agencies. This is manifested in DoD's three-part conservation goal, which is to support the military mission by: 1) providing for sustained use of its land, sea, and air resources, while protecting valuable natural and cultural resources for future generations; 2) meeting all legal requirements, for example, of the Endangered Species Act; and, 3) protecting compatible multiple use of these resources. The challenge for DoD is to balance the need to maintain its access to air, land, and water resources for current military training with the need to protect and manage these resources for all desired long-term uses.

Conflicting Management Requirements

Given the complexity of its management challenge, DoD has experienced occasional conflicts between the military mission and its legal mandate to protect threatened and endangered species. During the past decade, approximately 15 installations have needed to modify or restrict military training or testing to comply with the Endangered Species Act. Required changes have included actions such as modifications to training schedules, the temporary closing of specific areas, restrictions on the types of activities permitted, and improved environmental awareness training for troops using sensitive areas. Although these modifications have not been without cost, DoD has established a good working relationship with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. Consultations have, consequently, resulted in solutions which generally meet both mission and species' needs.

Management of threatened and endangered species is likely to become a greater challenge for DoD for a variety of reasons. First, the number of species requiring protection will probably increase. Second, as military installations close and weapons systems become more sophisticated, demands for use of remaining training grounds will increase. Third, the lands surrounding many military installations have experienced rapid development over the past 50 years, resulting in many DoD lands becoming "islands of protection" in "seas of development." Lastly, there is substantial pressure on all federal lands, including DoD, to shoulder an increasing share of the responsibility to protect dwindling habitats and species. For these reasons, DoD is looking to develop regional partnerships that encourage shared responsibility for protected species management and recovery, which could reduce the potential for future restrictions on military operations.

Management of the brown tree snake (*Boiga irregularis*) calls for a multi-Service effort. Photo courtesy of DoD.

DoD Ecosystem Management

DoD is adopting an integrated, ecosystem-based approach to conservation that allows the military greater flexibility in managing its lands. Rather than be tied to the limited objective of protecting individual endangered species, DoD prefers to emphasize the overall protection of existing groups of plants and animals. Emphasizing protection of ecosystems results in continued high quality management and care, and a more cost effective means of providing resource protection. Successful management in this fashion will ultimately release DoD from inflexible regulatory demands occasionally associated with protection of endangered species.

Mojave Desert Initiatives

DoD is embracing the principles of ecosystem management on a regional scale in California's Mojave Desert, DoD's premier training and testing region. The area houses several major installations, including the Army's National Training Center at Fort Irwin, Marine Corps Ground Combat Center at Twenty-Nine Palms, Edwards Air Force Base, and Naval Air Weapons Center at China Lake. DoD conducts most of its large-scale unit training exercises and major weapons testing at these installations. DoD also protects many important natural and cultural resources in the desert, including the endangered desert tortoise (*Gopherus agassizii*), and has significant interest in the region's long-term sustainability.

To more effectively coordinate resource management goals and activities and provide for resource protection in the Mojave Desert, DoD has teamed with the Department of the Interior to collectively manage these lands. This collaborative effort allows each department to survey and inventory its lands, control soil erosion, and prepare management plans that recognize political boundaries but address biological integrity across these boundaries. An ecosystem approach will help DoD land managers and trainers better assess the quality of their lands, determine future uses, assess impacts beyond installation borders, and conserve areas that are rare and unique or harbor protected species. The Mojave Initiative will also provide DoD greater flexibility in the use of the Mojave for military activities.

Biodiversity Initiative

The Biodiversity Initiative, a two-year collaborative effort with The Nature Conservancy and The Keystone Center, is designed to enhance biodiversity management on DoD lands. The first product of this effort is the creation of the DoD Biodiversity Management Strategy, which covers three aspects of biodiversity conservation:

- a policy framework for managing biodiversity on DoD lands, including suggestions for improving current policies and programs, and for integrating mission planning with biodiversity conservation;
- an iterative, model management process designed to be a tool for making management decisions and developing integrated management and annual work plans for biodiversity conservation on DoD installations; and,
- measures of success that can be used to monitor biodiversity conservation in the context of military readiness.

A second outcome of the initiative is the DoD Commander's Guide to Biodiversity which provides military commanders with a succinct description of why biodiversity conservation is important for DoD and the nation. Lastly, the *Biodiversity Handbook for Natural Resources Managers* provides practical information for use by DoD's managers. This initiative has increased the visibility of sound natural resources management in the Department of Defense.

Supporting the Military Mission

The support of installation commanders and military trainers is essential to the effective protection of threatened and endangered species on military lands. Because commanders control most local funding and land use decisions, DoD is placing increased emphasis on explaining to them how conservation activities directly support training and readiness. The key message is that protecting and maintaining the resources on training lands is essential for their continued use and makes good business sense. For example, sound resource management helps maintain natural landscapes for

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realistic military training now and in the future, and helps keep DoD in compliance with environmental laws.

The Army's Integrated Training Area Management (ITAM) program is a premier example of how the conservation program directly supports training uses. The ITAM program integrates military training, testing, and other mission requirements with the condition of the land and its ability to support mission requirements. It avoids unnecessary and irreparable damage to vital training ranges, and provides accurate assessments of land conditions and wildlife habitat to managers and commanders. ITAM has resulted in significant savings and increased mission carrying capacity at many Army training sites. Although an environmental conservation program, ITAM was transferred from the environmental managers to those charged with operations and plans in FY 1995. With ITAM at their disposal, installation commanders can be assured that their mission is not hindered and that proper land management will accompany continued intensive training. (The ITAM program is described in more detail in the last section of this article.)

Another important conservation program which supports the military mission is the Bird Air Strike Hazard (BASH) program. BASH is aimed at minimizing collisions between military aircraft and birds. DoD has established monitoring stations across the country to determine population trends. Additional data come from DoD's network of state-of-the-art weather surveillance radar sites. Next-generation radar (NEXRAD) detects birds during migrations and provides information about their numbers, general direction of flight, and altitude. Knowledge of where birds travel, nest, and feed helps DoD avoid problem areas, and therefore saves lives and avoids the destruction of valuable airplanes. This is not a small problem — from January 1992 through June 1993, the Navy alone reported 27 major mishap bird strikes that cost an estimated $98 million.

Multi-Service Projects

Although many endangered species issues are installation-specific, some are best addressed by a coordinated, multi-Service effort. This is best demonstrated on Guam. The Air Force, Navy, Guam Division of Aquatic and Wildlife Resources, Department of the Interior, Department of Agriculture, and many others have joined forces to control the brown tree snake (*Boiga irregularis*), an invasive species. The snake has wiped out almost all of the native birds of the island, as well as many indigenous reptiles and bats. It also causes costly power outages by climbing power lines, and its mildly venomous bite is a serious threat to infants and young children.

DoD has sponsored a major research initiative on the brown tree snake, with technical assistance from the Department of the Interior. A major focus has been the development and testing of snake exclusion areas which could, if successful, permit the reintroduction of certain species currently extirpated from the island. Other efforts include work on an effective trap design for capturing snakes, the testing of attractants that maximize trap success, the testing of fumigants that kill stowaway snakes in cargo, and monitoring of snake populations. Educational materials are also being developed for and disseminated to military and civilians associated with cargo handling, as well as other interested individuals.

Summary

DoD has taken an active role in developing overall goals and guidelines for management of the Department's lands. Natural resource managers within each sector of the military (e.g., Army, Navy, Air Force, Marines) face many of the same issues as traditional land management agencies, with the added requirement that they must integrate these issues with military mission requirements. The degree to which they succeed can be critical to DoD's ability to continue essential training and testing activities on its land, air and water resources. The following articles look at specific land management efforts on Navy and Army held lands, and the next issue of the Endangered Species UPDATE will cover efforts for Air Force and Marine installations.

U.S. Navy Lands

The Navy manages 182 installations on more than 2 million acres of land. These facilities are found in 25 states, as well as in Puerto Rico, Guam, and other western Pacific islands. Installations near wetlands, riparian areas, and coastal areas contain a substantial number of listed and candidate species. Those located near urban centers, more than half of which are less than 1000 acres, are also subject to significant outside pressures.

More than 100 different listed species are known to occur on at least 92 Navy installations. To help manage these species and important ecological areas, the Navy manages five recognized ecological reserves and six formally designated critical habitats. Each year the Navy invests directly more than $3 million for the protection of these threatened and endangered species.

Not surprisingly, the Navy's endangered species management program tends to focus on marine and coastal species. Protection of these species is vital to ensure the Navy's compliance with the ESA, and thus its continued access to ports, access routes, and test areas.

Manatee Protection

At Naval Submarine Base Kings Bay, Georgia, the Navy has mounted a major effort to protect the West Indian manatee (*Trichechus manatus*). After a Navy tugboat accidentally hit a female manatee and her calf swimming near Kings Bay in 1990, the navy initiated a project to design a propeller guard for its powerful C-tractor tugs. These specially designed vessels are used to handle submarines during arrival and departure. The goal was to protect manatees from being pulled into the powerful propellers. When the first guard was installed in 1991 it was found to not only be effective in protecting manatees, but also in improving the efficiency of the tug. Similar guards have been installed on all tugs and other small vessels in the bay.

The Navy has also developed additional protective measures at Kings Bay. Places in and near Kings Bay where manatees are known to congregate have been

declared as no-entry areas. Speed limits have been posted. Artificial water discharges have been eliminated to discourage the manatees from coming near where boats operate. The Navy has also begun a manatee watch program to monitor the animals.

A similar program to protect the manatee is underway at Roosevelt Roads Naval Station, Puerto Rico, one of the world's largest and most advanced naval training ranges. In addition to awareness programs, Navy resource managers and U.S. Fish and Wildlife Service biologists are working on a pilot program to use a satellite to provide information on manatee behavior and movement.

Whale Monitoring

The Navy is providing marine scientists a powerful tool from the Cold War for learning more about whale numbers, behavior, and movements. The tool involves the Navy's formerly top secret, Sound Surveillance System (SOSUS) a series of underwater listening devices on the ocean floor. The system was built to track Soviet and other submarines by the sounds they make in the water. In order to successfully track submarines, the Navy had to distinguish and filter out the underwater sounds made by whales. In the process, the Navy learned to identify six whale species—blue (*Balaenoptera musculus*), bottlenose (*Beradius bairdii*), bowhead (*Balaena mysticetus*), fin (*Balaenoptera physalus*), humpback (*Megaptera novaeangliae*), and minke (*Balaenoptera acutorostrata*)—by the distinct sounds each makes. This information was not needed to detect submarines and, thus, was not used at first. Now, however, these listening devices are being used to study whales.

The Navy is also monitoring whales from the air. An airship is being used to observe endangered Northern right whales (*Eubalaena glacialis*) off the coasts of Florida and Georgia, the mammals' only known calving area. Information is being collected to reduce the potential for the right whales to be struck by ships or become entangled in fishing gear. This voluntary, collaborative effort between federal, state, and local agencies and nonprofit organizations is helping to protect the whale while allowing human activity in the area to continue.

Regional Planning—San Diego Bay

The Navy is leading the development of an integrated, interagency, bay-wide management plan for one of its most heavily used areas, the San Diego Bay. This effort is being undertaken in coordination with the U.S. Fish and Wildlife Service, the San Diego Port Authority, and the private shipping community. To support this effort, the Navy has initiated a series of studies to determine what species use the bay and the status of the bay's natural habitats. This information will allow the Navy to better plan for and integrate its in-water training operations, and assignment of new ships to home ports, with preservation of the bay's valuable but vulnerable natural resources.

A specific example of the Navy's management of endangered species in the San Diego Bay area involves the endangered California least tern (*Sterna antillarum browni*). The Navy and the U.S. Fish and Wildlife Service are implementing a Navy-initiated agreement which helps both agencies achieve individual program goals and, at the same time, provides enhanced management for the tern. Each year, the Navy provides a single list of in-water construction projects planned for piers and dredging in San Diego Bay, which the Fish and Wildlife Service reviews for impact to the terns. Together the agencies plan specific management goals for least tern nesting colonies on three Navy bases, as well as special projects which the Navy performs to benefit the terns. The Navy provides centrally-managed funds for the tern management and projects, rather than tying piecemeal mitigations to small projects. The Navy gains the ability to plan its projects without delays, and eliminates the need for many individual informal Section 7 consultations. The Fish and Wildlife Service gains better oversight of one of California's most endangered species. The least tern gains intensive and consistent management at some of its largest remaining nesting sites in San Diego Bay.

Old Growth Forests

Naval facilities are not usually located in the midst of a forest, but in one case, the Navy is helping to preserve one of the last stands of low-elevation Sitka spruce forest in the Pacific northwest. In 1950, the Navy purchased land to construct Naval Radio Station, Jim Creek, Washington, a key communications line between naval shore commands and U.S. submarines at sea. However, the former owner retained the logging rights to the forest, which contains Sitka spruce (*Picea sitchensis*) and western red cedars (*Thuja plicata*) 800 to 1500 years old, 250 feet tall, and ten feet in diameter. All but 225 acres had been previously logged, and in 1990 a timber company proposed to log Jim Creek's remaining tall trees. Recognizing the forest's ecological significance and its importance to the base's water supply, the Navy purchased the logging rights to the remaining stand, thus pre-

Sitka Spruce (*Picea sitchensis*). Photo courtesy of DoD.

serving a vital piece of our natural heritage, and potential nesting habitat for the threatened marbled murrelet (*Brachyramphus marmoratus*).

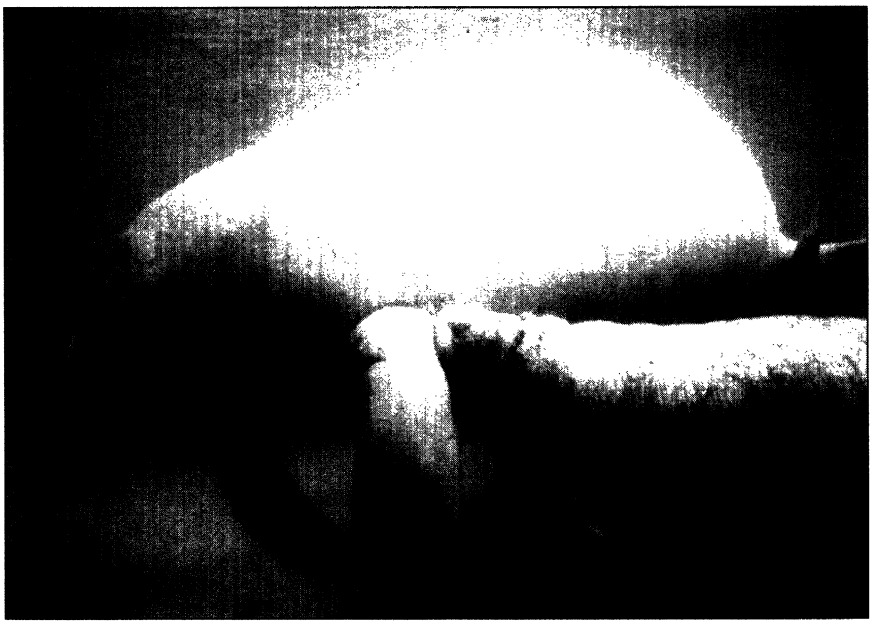
Vernal Pool Restoration

Vernal pools are shallow wetlands formed during the rainy season. The pools at Naval Air Station Miramar, California, which represent 80% of the remaining pools in San Diego County, are home to the endangered San Diego mesa mint (*Pogogyne abramsii*), San Diego button celery (*Eryngium aristulatum v. parishii*), and the San Diego fairy shrimp (*Branchinecta sandiegoensis*). In one project, Navy resource managers and local scientists used aerial photographs and field inspections to identify sites at Miramar where vernal pools once existed but had been damaged before the Navy bought the land. Thirty-three of the pools were then restored, by carefully excavating fill material without damaging the hard clay underneath. Seeds, soil, and other fill material were then added to the restored pools. The soils, which had been collected from vernal pools in an off-base area that was about to be developed, held seeds from the mesa mint and button celery, as well as eggs from the fairy shrimp. Both seeds and eggs often lie dormant for months or even years awaiting the next rainfall. This successful project added significant vernal pool habitat without impacting the military mission.

U.S. Army Lands

The Army manages nearly 12 million acres of land on approximately 120 major installations across the United States; this is almost half of the total acreage under the management of the Department of Defense (DoD). In addition, more than one million acres of mostly state-owned lands are used by the Army National Guard. The Army utilizes its land to provide realistic conditions for training and testing. Large blocks of land with varied natural terrain act as the soldiers' "classroom."

Because successful learning is so closely linked to the availability and condition of the land, the Army, perhaps more than the other Military Services, has needed to adapt to increasing pressures on these lands. With more than 85 listed species known to occur on at least 63 Army installations, increased management requirements for protected species have placed greater pressure on lands where there are few listed species. Additionally, changes in the military, such as more sophisticated weaponry, the return to the United States of many forces previously deployed overseas, base closures, and increased development pressures on adjacent non-military lands, have also increased the demand on the Army's remaining lands.



The Navy has implemented programs to lessen impacts on the endangered West Indian manatee (*Trichechus manatus*). Photo courtesy of DoD.

Endangered Species Management Plans

Each year the Army invests directly more than $7 million for the protection of threatened and endangered species on its lands. The Army specifically requires each of its installations with endangered animals, plants, or habitat to develop an Endangered Species Management Plan that protects and supports the recovery of these species and their habitats. A manual, designed to streamline the implementation process, provides a template for commanders to follow when developing these plans. The manual stresses the importance of having installation commanders, trainers, and environmental staff work together to establish and implement a plan. Guidelines are broken down into eleven different steps; examples include developing a complete inventory of the installation's lands and species; assessing military requirements and integrating them with the needs of the protected species; establishing monitoring programs; coordinating with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service; and, fulfilling NEPA requirements.

Integrated Training Area Management Program

The Integrated Training Area Management (ITAM) program is critical to the management of natural resources at more than 60 Army training installations. ITAM integrates five major elements to provide Army land managers with a comprehensive approach to land management:

- Monitoring land and resource conditions to develop an understanding of the land's ability to withstand training stresses;
- Environmental awareness among soldiers to encourage stewardship and wise tactical use of natural resources;
- Land rehabilitation and erosion control technologies to conserve resources and improve training realism;
- Integration of training mission requirements with natural resource capability to optimize land use; and,
- Threatened and endangered species management.

ITAM results in at least four long-term benefits for Army installations.

The program seeks to provide realistic training experiences which enhance Army readiness, fighting capabilities, and soldier safety and survivability. It also works to avoid extreme environmental damage and loss of land through controlled land allocation and advanced rehabilitation techniques. A focus on management over the long-term reduces the costs related to compliance with environmental regulations. Finally, the program provides a credible foundation from which to make decisions about training requirements analyses, base realignments, and acquisition actions.

One location where ITAM has successfully been adopted is Orchard Training Area, Idaho. The training area supports Army National Guard units from the Pacific Northwest with a year-round heavy armor and tank school as well as a helicopter battalion. The area around Orchard claims the nation's densest population of raptors, which are protected under the Snake River Birds of Prey Area, a designated protected area established in 1980. Fragile land surfaces and at least one candidate plant species are also managed under ITAM. As a result of ITAM military trainers are able to identify suitable training areas and to restrict ground disturbing activities to previously disturbed sites. Training schedules are now adjusted to times and locations which will minimize the impact to the vegetation and soils in the designated training area.

Technical Research Priorities

The Army is at the forefront of land-based research on protected species and other natural resource issues. Priority issues being investigated by the Army include the impact of military operations on protected species, especially blast and helicopter noise, smoke, and obscurants, and maneuver disturbances; standardized inventory and monitoring protocols; the mitigation of DoD-unique impacts; monitoring and management in danger zones; and the characterization and evaluation of threatened and endangered species habitats. Efforts at Fort Carson and Fort Bragg provide examples of how the Army is addressing management challenges of specific species.

Success Stories

Fort Carson

The greenback cutthroat trout (*Oncorhynchus clarki stomias*), a federally listed threatened species, is the only native Arkansas River drainage salmonid that still exists. Fewer than 700 pure natives to the Arkansas River remained in existence in 1978. Fort Carson has coordinated since 1981 with the U.S. Fish and Wildlife Service and the Colorado Division of Wildlife on a recovery effort for the trout. In 1981, Fort Carson filed a change of use for an existing water right and constructed a broodstock pond for rearing the trout. Initially, 40 greenbacks were transported to Fort Carson's pond. Eggs and fish from this pond have been used to establish reproducing populations within national forests. Due to the overall success of the recovery program, Fort Carson now has a limited catch and release program for this species which is sanctioned by the Fish and Wildlife Service.

In addition to the greenbacks, 34 Arkansas darters, which are listed as a state threatened species, were introduced into the same pond. Since this initial release, Fort Carson biologists have established five other broodstocks from the original population, with no detrimental effect on military training. As a result of these efforts, Fort Carson has been identified by the State of Colorado as the source for darters in the state recovery program.

Fort Bragg

The Army has a number of important training bases in the southeast, and the endangered red-cockaded woodpecker (*Picoides borealis*) has presented perhaps one of the most challenging management issues for Army owned lands. This challenge has been greatest at Fort Bragg, North Carolina. In the late 1980s and early 1990s, Fort Bragg experienced a number of significant training restrictions, including the temporary closure of several firing ranges, because of conflicts with the woodpecker. Bragg has adopted a threefold management strategy to address these concerns.

- Collaborate with the U.S. Fish and Wildlife Service to determine a reasonable woodpecker population goal for the Army base. This goal will determine the amount of land which must be managed specifically for the woodpecker;
- Develop an endangered species management plan; and,
- Initiate a training and awareness program which will help all units and personnel comply with the requirements of the endangered species management plan.

In addition, Fort Bragg is working with surrounding private landowners to encourage the voluntary adoption of "safe harbors" for the woodpecker on their lands. The landowners would be under no long-term obligation to protect the woodpecker, however, in the meantime, Bragg would benefit from a wider distribution of healthy woodpecker colonies.

The events at Fort Bragg prompted the Army to conduct a review of all its installations in the southeastern United States. In coordination with the Fish and Wildlife Service, the Army has reviewed existing endangered species management plans, evaluated the viability of existing populations, and developed standard management guidelines for the woodpecker for all its installations. The guidance document provides information on such management tools as prescribed burns, protection of nesting trees, and control of understory growth.

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Report from the Field

The Growing Role of Corporations in Species Protection

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Christina R. Soto

Approximately 25% of private property in the United States is owned by corporations. With development and habitat fragmentation resulting in loss of habitat for many species, the opportunity to engage corporate landholders in proactive management of their lands cannot be overlooked. Habitat enhancement efforts that protect and possibly increase populations of endangered and threatened species not only benefit listed as well as unlisted species but also benefit the corporations—by increasing employee awareness of environmental issues, reducing costs, and linking the corporations to the surrounding community.

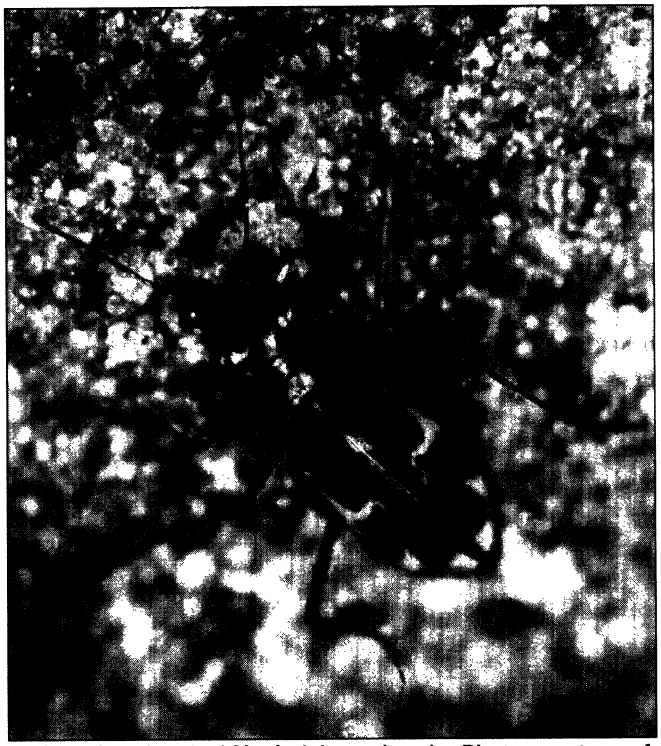
The Wildlife Habitat Council (WHC), a nonprofit organization established in 1988, is a joint effort by conservation and corporate communities to enhance private lands for the benefit of wildlife and plants. More than 100 corporate members are managing 327,000 acres at 410 locations worldwide. These efforts are often collaborative, with neighboring corporations or local groups working together to develop viable strategies for proactive land management. WHC hopes that these efforts will result in changed attitudes of corporations and other private landowners' views of endangered and threatened species. The following case studies illustrate how three different companies have developed land management approaches that benefit endangered or threatened animal or plant species.

Protecting Habitat of Threatened Species

Baltimore Gas & Electric's (BGE) Calvert Cliffs Nuclear Power Plant (CCNPP) in Lusby, Maryland, is located on the western shore of the Chesapeake Bay and provides about 1,700 acres of habitat for wildlife. Habitats range from hardwood forest and marshland to the sheer cliffs and beachfront on the Chesapeake that provide habitat for the threatened Puritan tiger and Northeast beach tiger beetles (*Cicindela puritana* and *Cicindela dorsalis dorsalis*).

Habitat management efforts began at CCNPP in 1982 when a long-term management program for the woodland was developed in cooperation with the Maryland Department of Natural Resources. Early efforts involved a forest management plan that included both fire control and techniques for improving plant diversity. Assessment of the existing habitat resulted in the discovery of a bald eagle nest. A buffer has been established that restricts access around the nesting site during the breeding season. The nest is now monitored by CCNPP in cooperation with the U.S. Fish and Wildlife Service.

With WHC's help, CCNPP expanded its habitat enhancement program. In May 1993, CCNPP entered into a partnership with The Nature Conservancy (TNC) to protect the Puritan tiger beetle and Northeast beach tiger beetle habitat. These beetles are federally threatened species that require steep, eroding banks void of vegetation and disturbance. To protect and monitor the beetles, TNC and BGE conduct an annual census of the beetle populations at the Calvert Cliffs site, restrict public access to the cliffs and beachfront, and provide an educational sign about the beetles and their cliff habitat on the CCNPP nature trail. BGE's efforts have not only helped protect the beetles' habitat, thus helping beetle populations, but have also raised public awareness of the species and its plight.



Puritan tiger beetle (*Cincindela puritana*). Photo courtesy of Baltimore Gas & Electric.

Protecting Species Before Listing

The Unimin Corporation's Emmett Facility, in Emmett, Idaho, is a 510-acre mining and processing facility located approximately 25 miles northwest of Boise. The property contains the Aase's onion (*Allium aaseae*), endemic to the lower foothills of the Boise Front, which ranges from Boise to Emmett. The onion was designated as a federal Category 1 candidate for listing as an endangered species. Unimin recognized the onion's importance to the region and developed a management program to include population studies and plant relocation.

Unimin signed cooperative agreements in 1986 and 1987 with the Bureau of Land Management (BLM) to research the life history and habitat ecology of the species, and to conduct

large scale surveys for Aase's onion. These studies have provided a valuable base line of information for future work on the species and have guided decisions made for the conservation of the species (Prentice, 1995).

Resources for a two year study of the extent and range of the Aase's onion on BLM and private land were provided by Unimin. New populations were found and each was mapped and rated according to population size and vigor. Six exceptional onion populations were named Areas of Critical Environmental Concern (ACEC) by the BLM, an important step in the conservation of the species (Prentice, 1995).

The initial stages of Unimin's onion protection program included seed and bulb test plots to determine the success of germination, emergence, and survival. The most successful method was found to be hand planting the bulbs in suitable soils. Techniques such as planting bulbs in wire cages were also employed to protect bulbs from predation. As of fall of 1994, a total of 230 bulbs were planted. Long-term survival seems likely because bulb division has occurred in all of the plantings (Prentice, 1995).

Unimin's efforts revealed that onion populations are larger and more widespread than previously thought. The company has also successfully demonstrated that the species can be transplanted in reclaimed areas. Unimin is ensuring the plant's continued existence and providing the means by which the onion can be propagated, which may help keep the species off the endangered or threatened species list.

Ecosystem-Based Efforts

Amoco Chemical Company's Cooper River Plant, located on approximately 6,000 acres along South Carolina's Cooper River, has been instrumental in developing a cooperative project for WHC's "Waterways for Wildlife" program. The project started in 1989 when Amoco and DuPont Company simultaneously implemented habitat enhancement programs at their respective sites, which straddle the river. Although each program was independently certified by WHC, the area seemed ideal for a voluntary, broader-based habitat management program for the Cooper River. Bayer Corporation also contributed to the Waterways program when they implemented a wildlife habitat enhancement project on the river not far from the Amoco and DuPont sites. Plantation owners also saw a need for cooperative action to protect the local ecosystem when Hurricane Hugo devastated the Lowcountry forests. With WHC's staff support and Amoco's leadership, the project expanded into a cooperative program that now includes more than 50 private landowners, local businesses, conservation groups, and government agencies.

In its own environmental efforts, Amoco has worked to protect the threatened least tern (*Sterna antillarum*) by preserving the tern's habitat. The least tern, once nearly hunted to extinction for its plumes, has experienced drastic population declines in the latter half of the twentieth century because of coastal development. Least terns traditionally nested on sandy beaches, but as development has increased along the coastline of South Carolina and other states, the terns have been forced to seek alternative nesting sites such as dredge spoils and rooftops (Mead, 1994).

In 1990, a small colony of least terns began nesting on gravel dikes between wastewater treatment ponds at the Amoco facility. Through the volunteer efforts of Amoco employees, the 7,500 square-foot site has been enhanced for least tern nesting by adding additional sand and pebbles, installing small ponds for drinking and cooling, erecting a predator-control fence, and building shelters to provide shade. If nests are found outside of the designated area, the nest location is marked and roped off until all the eggs have hatched. During the nesting season, all nests are inspected on a monthly basis to monitor nesting success. Afterwards, the area is cleaned and prepared for the following year's nesting season (Mead, 1994).

Both Amoco and the terns gain something from these efforts. Nesting pairs of terns have increased from four to twenty, and the 1993 season saw 35 fledglings. Amoco employees have learned about conservation and wildlife management, and employee morale has increased. Through newspaper articles, field trips, and school presentations, Amoco has reached out to the

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Least tern (*Sterna antillarum*). Photo courtesy of The Dow Chemical Company, Freeport, Texas.

AZA Species Survival Plan Profile: West Indian Rock Iguanas

Rick Hudson

The West Indian rock iguanas, *Cyclura spp.*, are a group of large, ground dwelling, herbivorous lizards that inhabit Caribbean islands throughout the Greater Antilles and the Bahamas. There are eight species with a total of 16 recognized taxa, including subspecies. Rock iguanas inhabit fragile ecosystems and most have suffered greatly over the years because of man's activities and introduced animals. All 16 taxa are currently protected under Appendix I of the Convention on International Trade in Endangered Species (CITES); three are listed as endangered by the U.S. Fish and Wildlife Service and the rest are listed as threatened. A more accurate assessment of the state of the iguanas is their classification under the new International Union for the Conservation of Nature (IUCN) categories; IUCN has recently classified all but four taxa as either critical or endangered. Today, West Indian rock iguanas are recognized as the world's most endangered group of lizards, with several species verging on extinction.

Zoos have long been concerned with the plight of these impressive dinosaur-like lizards. However, only recently has a coordinated effort been made to protect rock iguanas. At the inaugural meeting of the American Zoo and Aquarium Association's (AZA) Lizard Advisory Group (LAG) in 1990, *Cyclura spp.* were designated as their highest conservation priority. Zoos have since played key roles and provided strong leadership for several landmark events, described below. These events, plus the tremendous efforts that have gone into forging *in situ* partnerships to aid in the recovery of two critically endangered rock iguanas, have recently culminated in the formation of the AZA's first lizard Species Survival Plan (SSP) for the West Indian rock iguanas.

This SSP concentrates on two of the most critically endangered lizards in the world, the Grand Cayman iguana (*Cyclura nubila lewisi*) and the Jamaican iguana (*C. collei*). Though the Rock Iguana SSP will be concerned with managing captive populations of these two threatened lizards as a hedge against extinction, the primary focus will be to utilize these zoo-based programs to generate support for *in situ* conservation and recovery programs.

Jamaican Iguana

The Jamaican iguana has a remarkable story which has been highly publicized in recent years. Feared extinct for nearly half a century, this iguana was rediscovered in 1990 when a pig hunter's dog captured an adult specimen in a rugged region of southeastern Jamaica, known as Hellshire Hills. Listed as critical by the IUCN, and regarded as possibly the world's most endangered lizard, the Jamaican iguana survives as a remnant population, estimated at between 50 and 200 individuals. This population remains intact primarily because of the remoteness and inaccessibility of the harsh, dry ecosystem in which it lives.

Subadult male Jamaican iguana (*Cyclura collei*) in the head-start facility at Hope Zoo, Jamaica. Photo courtesy of Rick Hudson.

Fortunately, two active nesting sites were discovered and hatchlings have been collected annually, since 1991, for head-starting at the Hope Zoo in Kingston. Threats to the iguana's survival include predation of nesting females by hunter's dogs and habitat disturbance by charcoal burners. The single most important factor in suppressing growth of this population, however, is the introduced Indian mongoose (*Herpestes auropunctatus*). Mongoose predation, primarily on juvenile iguanas, results in low recruitment rates, which leads to an aging population. A Population and Habitat Viability Assessment workshop in Kingston, in 1993, focused international attention on the plight of the Jamaican iguana. Workshop results suggested that if this trend was not reversed extinction of this small population was likely.

More than ten U.S. zoos have supported the Jamaican iguana conservation and recovery program, channeling more than $30,000 in funding through the LAG since 1992. Conservation efforts have focused primarily on field research undertaken by the Jamaican Iguana Conservation and Research Group in Hellshire Hills. Conservation efforts include protecting nesting sites, working to deter hunters and charcoal burners from the core iguana area and, more recently, controlling predators and radio-tracking released iguanas. A new iguana management/head-start facility was constructed in 1994 at the Hope Zoo with funds raised through the Fort

Worth Zoo. The facility now supports a population of more than 100 iguanas. Additional funds to support field research have come from the Zoological Society of San Diego and Walt Disney World Company, through AZA. The Indianapolis Zoo, which has provided consistent support to the program since its inception, maintains the *Cyclura spp.* studbook, a genealogical record for the captive population.

In order to guard against catastrophic loss of this large captive group in Jamaica and to avoid an "all eggs in one basket" scenario, 12 captive-raised iguanas were imported to the United States in 1994 to form the nucleus of a satellite population outside of Jamaica. These were selected from the six wild clutches available from 1991 to 1992. An additional 12 were imported in 1996, chosen based on DNA analysis, which identified new genotypes not represented in the 1994 importation. A solid founding nucleus of 24 young Jamaican iguanas is now distributed among six U.S. zoos providing ample genetic material from which to manage a healthy captive population. Reproduction is expected soon and the LAG's goal is to expand this captive nucleus to 200 individuals. Expansion, however, will require the commitment of more than just the handful of zoos now devoting resources to rock iguanas. Offsite breeding facilities being developed by a growing number of zoos can ultimately offer the space and conditions needed to manage these iguanas long-term. The challenge will be to bring these facilities into the Rock Iguana SSP.

Grand Cayman Iguana

The Grand Cayman (GC), or blue, iguana is endemic to Grand Cayman and is considered one of the world's most endangered large lizards. At the time of its description in 1940, this iguana was already considered rare and nearly extinct. Today the blue iguana clings to a precarious existence, threatened primarily by habitat disturbance and feral cat predation, and survives at low densities in fragmented habitat. It is listed as critical by the IUCN and current estimates place its total population at 100 to 200 individuals remaining in the wild.

Grand Cayman iguana (*Cyclura nubila lewisi*). Photo by Rick Hudson.

Zoos began acquiring captive-bred specimens of GC iguanas in 1990 in order to develop a managed captive population. Unfortunately, a hybrid problem was discovered in this captive gene pool. Genetic markers for each subspecies, developed by Dr. Scott Davis at Texas A&M University, were used to identify and "weed out" hybrid iguanas, which allowed the program to start over with new stock from known, pure GC iguanas. The remaining gene pool, however, was severely limited, with only three males and one female as potential breeders—not the optimal founder number from which to build a population. Further analysis revealed that this population was descended from one pair of iguanas.

During this same time the National Trust for the Cayman Islands (NTCI) launched their own program to conserve the GC iguana. A multifaceted approach was implemented that included field research, habitat acquisition and protection, and a captive/head-start component to produce iguanas for release into depleted areas. In order to determine parentage of the small numbers of iguanas in U.S. zoos and to examine genetic diversity in the population on Grand Cayman, the Fort Worth Zoo was awarded a 1994 Institute of Museum Services grant. This project initiated the LAG's working relationship with NTCI, resulting in a strong partnership that has since channeled funding and logistical support to assist the NTCI program. For example, a new iguana management facility has been built at the Trust-managed Botanical Garden site, funded through the Milwaukee County Zoological Society.

Additional funding is being sought under the SSP for feral predator control and habitat enhancement for nesting females. An agreement was recently reached to manage both the U.S. and Grand Cayman captive populations as one entity, with bloodline exchanges occurring as needed to ensure maximum genetic diversity within the total captive gene pool. This decision was based on DNA analyses and the need to optimize the genetic and reproductive potential of the limited captive numbers. Because of this program's strong *in situ* captive component, the GC iguana program is fast becoming a model for cooperative endangered species management.

From Captivity to the Wild

The past five years have seen remarkable progress toward uniting and integrating the in-country recovery programs for these two

(Continued on UPDATE p. 14)

Conservation Spotlight: Mission in the Mariana Islands

AZA-Zoos Help Save Endangered Birds of Micronesia

The Commonwealth of the Northern Mariana Islands, a group of small tropical islands in northwestern Micronesia, is inhabited by an array of endemic tropical birds. Like other island ecosystems, the Mariana Islands have been subjected to a variety of pressures that have dramatically affected populations of native species. Several species and subspecies of birds have been forced to extinction and others are now considered to be highly endangered. Recognizing the need to preserve the Islands' biodiversity, the Marianas Archipelago Rescue and Survey (MARS) project was started in 1992 to help the Rota bridled white-eye (*Zosterops conspicllata*), a candidate endemic subspecies, the endangered Mariana crow (*Corvus kubaryi*), and the non-endangered Mariana fruit dove (*Ptilinopsu roseicopilla*). Funded by the U.S. Fish and Wildlife Service (USFWS) in conjunction with the Division of Wildlife of the Commonwealth of the Northern Mariana Islands, the project currently includes nine AZA-accredited institutions: North Carolina Zoological Park, Philadelphia Zoological Garden, National Zoological Park, Memphis Zoological Garden and Aquarium, St. Louis Zoological Park, Louisville Zoological Garden, Houston Zoological Gardens, San Diego Zoo and Honolulu Zoo.

Bird species in the Commonwealth of the Northern Mariana Islands face many of the same problems that have plagued bird populations on Guam, the southern most island in the Mariana Archipelago. All of the native forest birds on Guam are presently extinct in the wild; two species, the Guam rail (*Rallus owstoni*) and the Micronesian kingfisher (*Halcyon cinnamomina cinnamomina*), survive in captivity in U.S. zoos. Habitat destruction and alteration resulting primarily from World War II, introduction of predatory species, such as the brown tree snake (*Boiga irregularis*), and introduction of competitive species, such as the black drongo (*Dicrurus macrocercus*) all contributed to the catastrophic extinction of Guam's entire native forest avifauna. Similar types of forces face species found in the other islands of the archipelago; pressure from rapid development is an additional factor for the Mariana Islands.

The MARS project addresses these problems through a combination of captive population management, research, education and support for habitat conservation. During the past few years, field trips have been taken to the island of Rota to collect Rota bridled white-eye, the Mariana crow and the Mariana fruit dove in order to develop protocols for captive management. These species were selected because they were all endemic and taxonomically unique with a high chance of success for captive management. Also, captive facilities and expertise already existed and habitat was still available if reintroduction became a necessity or a possibility. An additional field trip is presently being planned to obtain additional founding stock of Mariana fruit doves to bring the total captive founding population to the planned 15 pairs.

Another aspect of the MARS project has been to conduct an historical avifaunal survey of the Mariana Islands. A research team, including a paleontologist and archeologist, a museum bird curator, and two zoo biologists, took a five-week field trip to three of the islands in the archipelago in 1994. This team investigated rock shelters and caves looking for fossil and subfossil bones of birds in sediments. Although still preliminary, results have identified a number of birds that were not previously recorded as being from these islands. Also, several species of birds historically known to be only from Guam may have occurred on other islands in the archipelago as well. Additional surveys are still needed to complete the analysis of the avifauna of the past for these islands. This information is valuable because it may help identify additional relocation sites for extant birds, if needed.

The MARS project plans to expand in the future. Educational material will be developed with local educators for school programs throughout the Mariana Islands. Local aviaries, built in snake-free areas of the islands, may be established by local biologists so that captive bred birds can eventually be released on appropriate islands. Captive birds in zoos or local aviaries could also be used for research purposes on the islands. Ultimately, local commitment and assistance will be key to the future development of the MARS project and the continued survival of the bird populations in the Mariana Islands. *(Excerpted from Swaringen and Bowdoin, AZA Communique August 1995 and personal communication, John Groves.)*

For more information, contact: John Groves, Curator of Reptiles and Amphibians, North Carolina Zoological Park, 4401 Zoo Parkway, Asheboro, NC 27203. Tel: (910) 879-7620.

NEWS FROM ZOOS

Photo by Rich Block
Indianapolis Zoo

Workshop in Methods of Primate Conservation

A workshop on "Methods of Primate Conservation" will take place from August 9-11, 1996 at facilities provided by the Chicago Zoological Park (Brookfield Zoo), immediately before the International Primatological Society's (IPS's) Annual Conference. Dr. Jeanne Altmann, outgoing Vice-President for Conservation of IPS and Research Curator at the Brookfield Zoo, will lead the workshop. Instructors will be drawn largely from Brookfield Zoo staff which has outstanding expertise in primate behavior, nutrition, genetics, veterinary care, education and conservation outreach. Participants are primarily mid-career scientists from developing countries. The workshop includes intensive training in genetics, nutrition and behavior as well as topics such as international conservation efforts, public education, primate health and captive management. (Photo: Lowland gorilla (*Gorilla gorilla gorilla*))

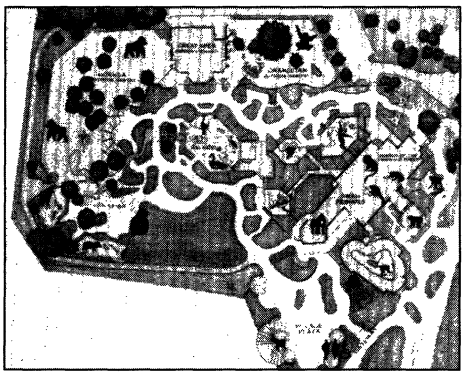


Photo courtesy of Denver Zoo

Denver Zoo's Primate Panorama Opens

As part of its Centennial Anniversary Celebration, the Denver Zoo opened its Primate Panorama on July 30. The seven acre indoor-outdoor exhibit boasts one of the largest outdoor zoo areas for the endangered lowland gorilla in the United States. The Panorama also allows new- and old-world monkeys, lemurs and orangutans to be observed in natural habitat settings.

Three States to Reintroduce Captive-bred Black-footed Ferrets to the Wild

The black-footed ferret is the most endangered carnivore in North America—virtually eliminated in the wild by disease, habitat loss and poisoning of their principal prey, the prairie dog. The last wild ferrets were brought into captivity in 1987 to become part of a collaborative captive breeding and reintroduction program involving federal and state wildlife agencies, and several zoos. The U.S. Fish and Wildlife Service recently announced that the captive breeding effort, organized under the auspices of the American Zoo and Aquarium Association's (AZA's) Species Survival Plan, has produced a record 231 surviving young. In an attempt to reestablish black-footed ferret populations throughout their native habitat, captive-bred ferrets will be released in October 1996 in Arizona, Montana and South Dakota. (*The collaborative program is described in the News from Zoos section of Vol. 13 Nos. 1&2 1996 issue of the UPDATE.*)

Calendar

September 17-21, 1996:
The AZA Annual Conference will be held in Honolulu, Hawaii. For further information, contact Ken Redman, Honolulu Zoo, 151 Kapahulu Avenue, Honolulu, HI 96815; Tel: (808) 971-7174; Fax: 971-7173.

October 6-10, 1996:
The National Conference of the American Association of Zoo Keepers will be held in Detroit, Michigan, at the Cobo Conference/Exhibition Center. For further information, contact Michelle Seldon-Koch, Detroit Zoological Institute, P.O. Box 39, Royal Oak, MI 48068-0039; Tel: (810) 398-0903; Fax: (810) 398-0504.

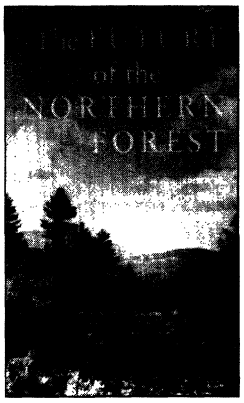
October 10-12, 1996:
The Zoo Registrar Association will hold its annual workshop at the Phoenix Zoo. For further information, contact Nanette Bragin, Phoenix Zoo, 455 N. Galvin Parkway, Phoenix, AZ 85008-3431; Tel: (602) 914-4377; Fax: (602) 914-4364; E-mail: nbragin@Phoenix-zoo.org.

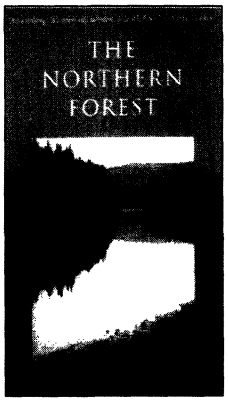
Book Review

Reviewed by John Watson

The Future of the Northern Forest
Edited by Christopher McGrory Klyza & Stephen C. Trombulak. 1994.
University Press of New England. Hanover, NH. $19.95. 258 pp.

The Northern Forest
By David Dobbs & Richard Ober. 1995. Chelsea Green Publishing Company.
White River Junction, VT. $23. 356 pp.





There is a parable, often told by environmental educators, of five visually-impaired people trying to describe an elephant. Each person has a different part of the elephant—one the trunk, one the tail, one an ear—and the picture that each draws of an elephant is quite different. This story illustrates the complexity of an elephant, and suggests that to properly comprehend a subject we must step back a bit and at least see it from several angles.

Complex environmental issues are like elephants, and the issues of the Northern Forest are an excellent example. The forest stretches along the Canadian border, from the coast of Maine across northern New England to the Adirondacks near Lake Ontario, and south as far as Glens Falls, NY. It is a vast area of near-wilderness, totalling 26 million acres, that contains an amazing array of wildlife, including a number of threatened and endangered species. It is especially unique for a wild area because so much of its history over the last 350 years, continuing to the present day, is inextricably tied to the people who live there. Where western forests are often known for their solitude, sparse populations, and lack of human influence, the Northern Forest is and has been largely a "working forest," which has been shaped, and in some ways protected, by human use. It is also a forest that is privately owned for the most part, by paper companies to the north, and smaller landowners to the south. This pattern of private ownership, and the tradition as an industrial forest, has in the past decade been challenged by threats to traditional land uses. The threat that these lands would be sold in large scale to private development, taking them out of logging production and threatening to change the ecological character of the forest, first prompted widespread regional, and in some cases national, concern. It is the complexity of these issues that make the story of the Northern Forest especially relevant to issues we face in many parts of the country today.

Two recently published books attempt to provide one part of the picture of the Northern Forest. While they take widely differing approaches, each contributes a valuable piece to our understanding of the issues. In *The Northern Forest*, authors David Dobbs and Richard Ober set out to gain an understanding of the Forest and its issues by closely examining the lives of the people living there. It is a narrative, seemingly unacademic approach, but numerous facts and historical accounts are woven into their portraits of four groups of people in the region. The stories are of hunters in Maine worrying about maintaining access to their favorite hunting grounds, and making sure there will always be ducks to hunt; loggers in New Hampshire considering different methods of commercial logging and their long-term effects on the land; a family in Vermont trying to maintain their land and lives, making ends meet by sugaring, Christmas tree farming, small scale logging, and whatever else will pay the bills and keep the land; local governments in New York dealing with differing opinions on the impact on private property owners of attempts to preserve the Adirondacks. These accounts are well researched and compassionately written; the reader feels the respect for the land that so many of the people there have. The controversial issues of logging, clearcutting, species conservation, public land access, impacts of regulations on private owners, are all presented through the eyes and lives of the people who live there. Many readers who may have previously thought of these issues in black and white will likely see their opinions taking on shades of gray as they read of loggers, farmers, and hunters whose need for the land is matched by their respect for it.

While the accounts written by Dobbs and Ober are compelling, and insightful, a book written from an argument-by-anecdote perspective begs for further documentation. It is this void that *The Future of the Northern Forest*, a contributed volume edited by Middlebury College professors Christopher Klyza and Stephen Trombulak, attempts to fill. Where Dobbs and Ober are compelling in their storytelling, this volume takes a more scientific, academic approach. Chapters cover many aspects of the Forest, including natural history, the history of the Native Americans in the region, the present timber industry, and the current political context. Where Dobbs and Ober told of the sale of land for vacation home building through the eyes of the affected local people, Middlebury College economist Thomas Carr presents statistics showing the number of vacation homes being built in

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(Young and Soto continued from p. 8)

community, working to increase environmental awareness and illustrate that industry and wildlife can be compatible (Mead, 1994).

Conclusion

Companies have unique opportunities to create large-scale models and reproducible examples of proactive management for threatened and endangered species for other corporations and private landowners to follow. BGE, Unimin, and Amoco illustrate how corporations, in conjunction with the WHC's Wildlife at Work program, can expand programs beyond endangered and threatened species management to include other species as well.

Engaging corporations and private landowners in management of endangered and threatened species requires a number of attitude changes. Many people view the presence of endangered and threatened species on their land as a threat to their rights as private property owners. However, the three companies highlighted in this article demonstrate that corporate landholders are willing to act in favor of endangered species and can have a positive impact on the management and protection of natural resources.

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Prentice, C. 1995. Summary of conservation efforts supported by Unimin Corporation for *Allium aaseae* Ownbey Aase's Onion at Unimin Sand Mine Freezeout Hill near Emmett, Idaho. 15pp.

John H. Young is Director of the Wildlife Habitat Council's Great Lakes Regional Office and Coordinator for the St. Clair River Project, a WHC Waterways for Wildlife program. He can be reached at 2000 Second Ave., Room 1020, WCB, Detroit, MI 48226. Christina R. Soto is writer/editor in the Communications Department of WHC at 1010 Wayne Avenue, Suite 920, Silver Spring, MD 20910.

(Hudson continued from p. 10)

critically endangered iguanas with conservation programs in U.S. zoos. Pilot releases for Grand Cayman iguanas have already demonstrated that captive-raised iguanas can survive in nature without any pre-release conditioning. The first releases of head-started Jamaican iguanas, in March, 1996, were successful and more scheduled. Survival rates, assessed using radio-tracking, strongly suggest that captive-raised iguanas can indeed be used to augment and restore populations that have been extirpated in nature. It appears these iguanas have innate or instinctual survival abilities, thus making them excellent candidates for these types of recovery programs.

To fully restore these populations, however, control of feral mongoose and cat must be implemented. Most importantly, habitat preservation measures must be intensified. These activities are costly and drive the price of these recovery programs even higher. Substantial financial support from several zoos and conservation funds raised through the LAG have already assisted both these programs. Given the long-term nature of these planned reintroduction projects, the primary focus of the AZA Rock Iguana SSP will be to increase the level of support, both logistical and financial, to these programs through an aggressive and collaborative campaign involving zoos, funding agencies and universities.

The primary challenge in the next decade will be determining how to finance and sustain existing reintroduction programs aimed at restoring species in the wild and preventing the extinction of these iguanas. The dedication of a small group of highly motivated individuals has created an infrastructure for implementing solid conservation actions and achieving notable milestones, with minimal support, for both the Grand Cayman Iguana and the Jamaican Iguana programs. It is hoped that with the backing and guidance of the AZA Rock Iguana SSP these endangered lizards will receive the support they so urgently need.

Acknowledgments

Support for the Jamaican and Grand Cayman iguana programs has been provided by the Ministry of Agriculture/Hope Zoo and Gardens, University of the West Indies, National Wildlife Foundation, Natural Resources Conservation Authority of Jamaica, World Wildlife Fund, Environmental Foundation of Jamaica, National Trust for the Cayman Islands, Fort Worth Zoo, Zoological Society of San Diego, Jersey Wildlife Preservation Trust, Indianapolis Zoo, IUCN Conservation Breeding Specialist Group, National Zoo FONZ, Bermuda Zoo & Aquarium, Columbus Zoo, Toledo Zoo, Audubon Zoo, Gladys Porter Zoo, Denver Zoo, Sedgewick County Zoo, Central Florida Zoo, Zoological Society of Milwaukee County and the Foundation for Wildlife Conservation, John G. Shedd Aquarium, Institute of Museum Services, International Partnerships Among Museums (IPAM), and Walt Disney World Company through the AZA Conservation Excellence Campaign.

Rick Hudson is chair of the AZA Lizard Advisory Group, Species Coordinator for the Rock Iguana SSP and Assistant Curator of Reptiles at Fort Worth Zoo, Fort Worth, Texas.

(Watson continued from p. 13)

the region, and uses census numbers to compare employment in the traditional resource sectors compared to the newer tourism-based economy. Differing viewpoints are represented by a variety of authors, from environmental activists to professional foresters, with heavy input from the academic community. This is a book which appears to cover all the issues before trying to be readable, but editors Klyza and Trombulak have done a commendable job of making the chapters work together as a volume, and the book is ultimately a good read as well as an invaluable reference.

The two books take the reader down two different paths, but ultimately to a similar conclusion. The multiple perspectives in *The Future of the Northern Forest*, each well researched and argued, and the accounts in *The Northern Forest*, showing people trying their best to maintain the land and their way of life, ensure that a reader will be challenged to find a simple solution to the complex issues of the Northern Forest.

John Watson is currently working as a technical advisor for the Ann Arbor Community Development Corporation. He is pursuing a joint degree with the University of Michigan's School of Natural Resources and Environment and the Business School.

Bulletin Board

Wild Earth Special Issue

The First Thousand Days of the Next Thousand Years: The Wildlands Project at Three, a special publication dedicated to The Wildlands Project, is now available from Wild Earth. The Wildlands Project is working to map and implement an interconnected ecological reserve network for North America. This gives an overview of the Project's mapping and reserve design work to date. Sample copies of this special issue are available for $5 from *Wild Earth*, POB 455, Richmond, VT 05477.

New CITES Checklist

The Checklist of CITES Species provides alphabetical lists of the species of fauna and flora listed in Appendices I, II and III of CITES. The checklist is designed as an aid to management and scientific authorities, customs officials, and all others involved in implementing and enforcing the Convention. Copies are available in the three working languages of the Convention from: CITES Secretariat, Case Postale 456, CH-1219 Geneva, Switzerland; Tel: (22) 979-9139; Fax: (22) 797-3417; E-mail: cites@unep.ch.

Texas Endangered Animals

Endangered and Threatened Animals of Texas features descriptions of each animal, its habitat and life history, threats to the animal, the reasons for its decline, recovery efforts, and resources for more information and public involvement. The book sets forth for the first time a comprehensive set of approved management and conservation guidelines for various species, including the bald eagle, golden-cheeked warbler, black-capped vireo and the Attwater's prairie chicken. Information draws from the results of studies conducted by the Texas Parks and Wildlife Department, USFWS, U.S. Natural Resources Conservation Service, Texas Agricultural Extension Service, Texas Department of Agriculture, and research scientists from across the United States, Canada and Mexico. The book is available for $19.95 at major bookstores in Texas or through the University of Texas catalog at (800) 252-3206.

Wildlife CD-Roms

Wildlife Worldwide, produced by National Information Services Corporation (NISC), is the world's largest index to literature on wild animals, birds, reptiles, and amphibians with over 485,000 full bibliographic records. Extensive keyword indexing permits flexible subject searching and taxonomic and geographic identifiers are also helpful. One can search by species in a province, state, country, or even a community, park, lake, or stream.

Species Information Library, compiled by the Fish and Wildlife Information Exchange (FWIE) at Virginia Polytechnic Institute and State University, contains complete accounts of thousands of North American animals. Both CD-ROMS are available by contacting NISC, 3100 St. Paul St., Baltimore, MD 21218; Tel: (410) 243-0797; Fax: (410) 243-0982; E-mail: sales@nisc.com.

Announcements for the Bulletin Board are welcomed. Some items from the Bulletin Board have been provided by Jane Villa-Lobos, Smithsonian Institution.

Endangered Species UPDATE

School of Natural Resources and Environment
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