

Endangered Species UPDATE

*Including a Reprint of the latest USFWS
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In this Issue

Threatened Native
American Plants

Environmental Law
and Regulation: Lucas
v. South Carolina

From the State Series:
The Endangered
Resources Program in
Missouri

Threatened Native American Plants

by

Gary Paul Nabhan

In 1992, the year of the Columbus Quincentenary and the UNCED "Earth Summit," we have been constantly reminded of the relationships between biological diversity and cultural diversity. Throughout the Americas, there have been exemplary situations where indigenous cultures have protected, managed and genetically influenced plant resources important for diet, medicine and ceremony (Anderson and Nabhan 1991). Ironically, however, the rare plants with the strongest link to preColumbian American cultures may have been most poorly accommodated by the formal government conservation programs. If this is true, as the following three case studies suggest, then threatened ethnobotanical resources deserve far more attention than they are currently receiving. I will suggest that we must forge new alliances to explore ways that may more firmly insure their conservation.

Defining "Native"

Most biologists would agree that the Endangered Species Act is intended to conserve the ecological, scientific and historic value of imperiled native species that existed in the United States at the time our government came into existence, if not at the time of the so-called "discovery" of the Americas by Columbus. The assumption commonly made is that prior to Columbus, human cultures had not significantly altered the American flora by introducing, dispersing, propagating, domesticating or otherwise manipulating wild plants. Many

archaeobotanists would claim that such an assumption is faulty (see Ford 1981). However, they might nevertheless concur that any culturally-influenced plant that is clearly documented to have wild populations in North America before 1492 should still qualify as a native species worthy of protection. In fact, it could be argued that rare, culturally-influenced native plants can receive legal protection not only through the Endangered Species Act, but through the American Antiquities Act and Historic Preservation Act as well (Nabhan et al. 1990).

In practice, however, most current conservation agencies are dominated by classically-trained biologists and natu-

ral resource managers who shy away from anthropogenic habitats and cultivated plants, considering them "manipulated," "disturbed" or "spoiled." The purists among them assume that such plants are not within their mandate, but should be relegated to agricultural or horticultural programs dedicated to conserving plant genetic resources for future crop improvements. However, the United States Department of Agriculture's (USDA's) National Plant Germplasm System (NPGS) remains preoccupied largely with the *ex situ* conservation of commodity crops. Likewise, the NPGS has no clear mandate to involve itself with *in situ* conservation of historic crops, wild crop relatives, or

other endangered plants even when they survive within our country's boundaries. Only recently has there been involvement by the U.S. National Park Service and other agencies in preserving and interpreting America's historic landscapes by registering the remnant orchards, hedges, and fields of known antiquity within their land holdings. The following cases highlight the fact that certain endangered plants of immense historic and genetic importance continue to "fall through the cracks" between agencies, and have failed to receive adequate protection from formal conservation programs of any sort.

Sonoran Panicgrass

In 1889, ethnobotanist Edward Palmer collected the type specimen of *Panicum sonorum* Beal at Colonia Lerdo, Sonora,



Mexico, less than 50 km from the Arizona-Sonora border along the Colorado River. Palmer's handwritten note on the specimen in the U.S. National Herbarium reads, "seeds used as food by the Cocopa Indians; the seed sowed in the spring on wet ground." Thus, from its original scientific description there was the implication that Sonoran panicgrass was a cultivated, if not a domesticated, grain that was ground into an edible flour by native tribes of the Sonoran Desert region (Nabhan and DeWet 1984).

Within the decades following Palmer's ethnobotanical discovery, this same prolific annual grass was recorded among the fields of Quechan and Chemehuevi Indian farmers in Arizona and California along the Lower Colorado River, and among the Guarijio Indian farmers in the uplands of Sonora and Chihuahua, Mexico. Castetter and Bell (1951) also provide irrefutable evidence that Colorado River tribes harvested one form of panicgrass from wild vegetation, while broadcasting another genetically altered form on floodplains after high waters had receded. In addition, archaeologist Wilma Kaemlein (1963) has carefully documented the presence of a pound and a half of seed of two distinct forms of panicgrass in the same twined woven bag cached in the Trigo Mountains of Arizona and radiocarbon-dated as 603 +/- 140 years. This archaeological evidence confirms the preColumbian presence of wild and domesticated varieties of *Panicum sonorum* within the present-day boundaries of the United States, such that this species must be given native plant status.

Also unquestioned is that *Panicum sonorum*—whether wild, weedy or domesticated—is now extirpated in the Lower Colorado River valley. After the damming of the Colorado near the turn of the last century, the floodwater recession agriculture of the Cocopa, Quechan and Chemehuevi Indians was destroyed, and salt cedar (*Tamarix pentandra*) has invaded much of the former panicgrass habitat. Because of its presumed extinction within the U.S., and uncertain status in northern Mexico, I proposed *Panicum sonorum* for official listing as an endangered species in 1984.

The *Federal Register* response published on December 18, 1984, concurred

that this species had been native to the U.S., where it is likely extirpated, but assigned it candidate (C-2) status, a designation indicating that insufficient data was presented to ascertain its status south of the United States boundary with Mexico (Dodd et al. 1984).

Part of the trouble is that grass specimens collected as far south as British Honduras have been assigned to *Panicum sonorum*, although they are more likely *P. hirticaule* plants found under unusual conditions than they are the culturally-influenced *P. sonorum* weeds or domesticates.

To my knowledge, most grass systematists maintain that *P. sonorum* is a distinct taxon, with the dissenting opinion being that of Dr. Alan Beetle (pers. comm.) of COTECOCA, a Mexican research organization, who is willing to accept "cultivars of the Indians as realities but also [wishes] to encompass them in a probably conservative treatment as a variety of *P. hirticaule*." With regard to its present status among the grasses of Mexico, Dr. Beetle is aware of only 20 specimens of *P. sonorum*; some of these are from historic collections in habitats where it no longer exists as the result of rangeland conversion to exotic buffelgrass (*Cenchrus ciliaris*). Buffelgrass has now become dominant on more than 400,000 hectares in the Sonoran Desert region, suggesting that its usurpation of former or potential panicgrass habitat now makes *P. sonorum* threatened or locally extirpated within a significant portion of its binational range.

Most other distinct plant and animal taxa collected in less than 20 localities in a diminished range over the last two decades would already be listed and be given high state and federal priority for recovery. To date, the geographic and taxonomic issues have not been resolved, and neither the Arizona nor the California offices of the U.S. Fish and Wildlife Service (USFWS) have funded status survey reports on the species. Nonetheless, *Panicum sonorum* fails to show up on government rare plant lists for Arizona, California, and Baja California, although it has been featured prominently in an endangered species education pamphlet for the Mexican state of Sonora. Despite the *Federal*

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Cover: Hybrid cholla cactus that resulted from anthropogenic dispersal and use by prehistoric Pueblo Indians, now endangered in New Mexico. Photo by Steve Trimble.

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Register notice, it remains unlisted by the USFWS even as a C-3, or lowest status designation and agencies in Mexico have not listed it either. Fortunately, some conservation action has occurred. After fellow staff member Dr. Barney Burns and I obtained seed and herbarium specimens from the Guarijio, Native Seeds/SEARCH placed several germplasm samples of wild and domesticated panicgrass in the U.S. National Seed Storage Laboratory in Fort Collins Colorado and in its own seed bank. Native Seeds/SEARCH, a non-profit conservation, research and education organization dedicated to native plant genetic resources and farming traditions, has also reintroduced it to Cocopa and to other Guarijio farmers, with limited success. This cereal, one of the few domesticated north of Mesoamerica, remains globally endangered and deserving of protection regardless of whether taxonomists ultimately refer to it as a subspecies of *P. hirticaule* or retain its status as a distinct species.

Hohokam Agaves

Agave murpheyi Gibson was first described in 1935 from what was assumed to be a "wild" population near Tonto Basin in central Arizona. It is now known that the site falls within a 1250 square mile area covered with prehistoric terraces, rock alignments, cobble piles and check dams built by the Indian cultures known as Hohokam and Salado for agricultural production (Nabhan et al. 1990). In 1988, I encouraged the late Rick DeLamater of the Desert Botanical Garden to verify if any of the *Agave murpheyi* clones that he had recently located in central Arizona were actually found outside of any archaeological context. From New River through Tonto Basin, he and colleague Wendy Hodgson documented clone after clone remaining on prehistoric terraces, still associated with Paleolithic "mescal" knives and nearby roasting pits for baking agave caudices known as mescal or century plant. In short, it now appears that nearly all the 60 known clones of *Agave murpheyi* in central Arizona are remnants of an extensive prehistoric perennial agriculture abandoned by A.D. 1450. The same genetic individual propagated

and dispersed by farmers over a half a millennium ago has persisted *in situ* by vegetative reproduction of basal suckers (James Hickey, personal communication, 1992; Nabhan et al. 1990). The Hohokam agave rarely sets seed, but instead produces bulbils (or clonal plantlets) on its inflorescence which root only if they fall on disturbed soil surfaces or are intentionally planted.

To date, DeLamater and Hodgson of the Desert Botanical Garden have documented the presence of two rare domesticated agave species in four central Arizona watersheds where no indigenous people currently farm. In addition, I have personally located other *Agave murpheyi* clones in the dooryard gardens of the Tohono O'odham (Papago Indians) and their Sonoran neighbors, both of whom claim that it was cultivated for roasted mescal (century plant) foodstuffs or for alcoholic beverage production up until recent decades. Although oral history describes truly wild populations as well as terraced plantings of *A. murpheyi* in far southern Arizona and adjacent Sonora, we have relocated neither, and assume that clandestine bootleggers overharvested or locally extirpated these resources.

Because this species is threatened by reservoir inundation, road building, suburban development and overgrazing, we proposed it for listing, and the USFWS responded in the *Federal Register* in 1988 by designating it as a candidate (C-2) species. Earlier consideration of *A. murpheyi* had been thwarted by one Regional Recovery Team botanist's erroneous presumption that it was a first filial generation (F-1) hybrid, and because it was so easily propagated by the horticultural trade (Frank Reichenbacher, pers. comm. 1984). Although considerable USFWS, U.S. Forest Service (USFS) and Bureau of Reclamation mitigation dollars have been spent within the last four years on state surveys in Arizona for this species and the undescribed DeLamater agave, these preColumbian domesticates have received no formal protection through the ESA. Only the interest of the Arizona State Historic Preservation Office and Tonto National Forest (USFS) has afforded formal protection of agaves found with considerable archaeology,

invoking the American Antiquities Act and state, federal and agency-specific historic preservation protocols. Recently, two sites were given Arizona Regis-TREE Awards, an honor granted to grassroots conservation efforts through a consortium of organizations coordinated by Native Seeds/SEARCH along with The Nature Conservancy and other non-profit groups. One such site is cared for by a Tohono O'odham family.

Okeechobee Gourd

A vine twining up custard apple (*Annona*) forests on the shores of Lake Okeechobee in Florida was first described by J.K. Small as a *Pepo* species in 1922 and later referred to as *Cucurbita okeechobeensis* (Small) L. H. Bailey. Although originally described as locally abundant (Small 1930), it soon became rare as its habitat suffered from a level of destruction and manipulation by irrigation engineers that is without parallel anywhere in America (Nabhan 1989). No archaeological evidence of it is known from anywhere else in its presumed historic range of Florida and the Caribbean, but tantalizing ethnohistoric anecdotes strongly suggest that its hard-shelled gourds were utilized, exchanged, dispersed and possibly cultivated for utensils, for ceremonial purposes, and for their detergent quality (Andres and Nabhan 1988). The prehistoric seafaring culture of south Florida, the Calusa, could have obtained the progenitors of this taxon through trade with island-dwelling Carib or Arawak peoples of the Caribbean, or with Mesoamericans of western Mexico, from whom raised-terraced garden construction diffused to the Everglades (Dobyns 1983). In any case, Small (1930) found the Okeechobee gourd in Seminole Indian camps earlier in this century, where it grew adjacent to the domesticated Seminole pumpkin (*Cucurbita moschata*), with which it doubtfully exchanged genes.

Although first proposed as a threatened species by the Smithsonian Institution in 1975, *Cucurbita okeechobeensis* was included only as a candidate (C-2) species in the 1980 and 1985 USFWS reviews in the *Federal Register*. However, not a single living wild gourd plant had been observed by professional bota-

nists between 1981 and 1987, when Jono Miller of the New College of South Florida guided me to a small custard apple stand where we saw only three remnant gourds on drowned vines (Nabhan 1989). It was not until 1991 that botanists Terry Walters and Deena Decker-Walters of the Fairchild Tropical Garden in Miami located 11 living plants (mistakenly referred to as 11 populations by the USFWS in a 1992 *Federal Register*). All of the known populations in the United States of this facultative perennial now occur within a few square miles of highly manipulated habitat, and it remains unclear whether sexual reproduction occurs every year, or one in ten! A 1990 survey of over one hundred botanists accomplished by the Center for Plant Conservation found this gourd predicted to be among the American



Okeechobee gourd, (*Cucurbita okeechobeensis*), the first found in six years. Photo by Gary Nabhan.

plants most likely to go extinct within a decade's time.

Although a listing package for this species had been sent to the USFWS regional office as early as 1986, the USFWS postponed listing this plant because of apparent taxonomic ambiguities. Based on one report, written by crop breeders, the USFWS declared that *Cucurbita okeechobeensis* was taxonomically indistinguishable from more common gourds in Mexico. However, there was limited evidence, since validated, that one allelic system—and possibly seed oil composition and cucurbitacin content as well—distinguished the Florida populations from Mexican *martinezii* populations at the level of subspecies (Andres and Nabhan

1988).

Fortunately, the Center for Plant Conservation and National Fish and Wildlife Foundation offered to provide the Walters of Fairchild Tropical Garden with the financial assistance to resolve the taxonomic issue. In addition to accomplishing sophisticated electrophoretic and morphological analyses of all available germplasm samples of the Okeechobee gourd and its congeneric Mexican gourds, the Walters added valuable field data on the status of both the Lake Okeechobee and the Mexican populations. Their definitive, state-of-the-art treatment of the systematics of three related gourd taxa confirms and formally adopts two *C. okeechobeensis* subspecies: subsp. *okeechobeensis* in Florida, and subsp. *martinezii* in Mexico (Walters and Decker-Walters, in press).

Fully and graciously accepting the results of the Fairchild Tropical Garden study, the USFWS has finally moved to list *Cucurbita okeechobeensis* subspecies *okeechobeensis* for endangered species protection. In its April 1992 proposal in the *Federal Register*, however the USFWS recommended against critical habitat on the assumption that such a designation would direct amateur gourd collectors to the populations (sic) and add to the threats. Yet, amateur collecting and interstate trade are not known to be current pressures on this species. Native Seeds/SEARCH's board urged immediate designation of critical habitat in July 1992, but since then the gourd's island habitats have been ravaged by Hurricane Andrew. This species is a known source of resistance to major diseases debilitating squashes in this country, and needs to be preserved both *in situ* and *ex situ*.

Recommendations

USFWS and USDA Agricultural

Research Service (USDA/ARS) efforts to date have been inadequate in keeping Native American plant resources from being locally extirpated within our boundaries. It is difficult to be sure why this is so; perhaps it is due to operational difficulties with plants that have complex cultural interactions and ambiguous taxonomic status because of such interactions. Whatever the case, new precedents for positive actions are advisable:

1) Higher funding and listing priority within the USFWS for plants of historic and genetic value might help bring new constituencies in to support endangered species protection, e.g. certain tribes and farmer crop improvement associations. In any case, Native American communities living near rare plant populations need to be more thoroughly involved in listing, protection and recovery efforts, and their intellectual property rights to domesticated or managed plants taken into consideration.

2) Better coordination between USFWS and USDA/ARS might build bridges between *in situ* and *ex situ* conservation of germplasm, and more rapid genetic/systematic screening of plant populations in question due to anthropogenic influences.

3) The critical habitat designation enabled by the Endangered Species Act needs to be made operational for more plant species, and if difficulties arise in designating critical habitat for culturally-important plant resources, other legal mechanisms such as the American Antiquities Act and Historic Preservation Act should be invoked to achieve similar ends.

4) Native Americans, historic preservation organizations, archaeologists, ethnobotanists and horticulturists should be acknowledged as allies in the conservation process, with their informal means respected for their effectiveness as much as formal means of government programs.

5) Finally, the interrelationships between Native Americans and endangered plants should be included in discussions of the reauthorization of the Endangered Species Act and the American Indian Religious Freedom Restoration Act (H.R. 2401).

continued on UPDATE page 9

The Endangered Resources Program in Missouri

by

Dennis Figg

When my father grew up in Carroll County, Missouri in the 1940s there were no wild turkeys to hunt. I grew up in the same neighborhood 20 years later when excited farmers and field hands began reporting wild turkeys in crop fields and pastures. More than a few of those reports made headlines in the local newspaper. Sightings of rare or endangered species always create a little excitement.

Wild turkey populations have changed a lot in 50 years. Now there are secure numbers of wild turkeys in every Missouri county. Last spring 345 turkeys were harvested from my home county, 32,945 throughout the state. They are far from rare, but even now the sight of a flock of wild turkeys generates excitement. The wild turkey is a restoration success story for Missourians and the Department of Conservation.

For some people the fact that wild

turkey restoration was tied to achieving a huntable population somehow lessened the original effort. I never saw it that way. The fact that wild turkeys got a lot of time, attention, and funding in the early years of the Department reflected the needs of people who supported conservation in those early years and the immediate task of restoring a native species.

For endangered species program leaders who don't have a legacy of wild turkeys it may be hard to see how this relates to biodiversity and the task of protecting and managing endangered resources today. Bald eagles and Ozark cavefish, however, have a common destiny with wild turkeys. Wild turkey restoration probably set the stage for the endangered resources program we have today. Missourians never intended to stop at turkeys, but it seemed like a good place to start.

The Early Years

From the beginning, the mission of the Missouri Department of Conservation (MDC) was centered around diminishing wildlife resources. The task described in the original initiative petition that created the Missouri Conservation Commission (circa 1936) was for "the control, management, restoration, conservation, and regulation of the bird, fish, game, forestry and all wild life resources of the state...". The poor condition of the Missouri landscape and the reality that wildlife populations were declining are the roots of conservation in Missouri. Clearly the original initiative applied to "all wildlife resources."

The Conservation Commission was created in

1937. Fish and game species were the early targets of time and money, animals that provided food for the table, furs to trade and sport for the outdoorsman. There were a lot of trees to plant, new laws to enforce and many people to educate. Undoubtedly other plants and animals benefited from those early conservation efforts, even if they weren't the target species.

A renewed vision for resource management began forming in the early 1970s. It would be called "Design for Conservation". In 1976 Design for Conservation became a reality when Missourians passed a 1/8th of 1% sales tax dedicated to conservation. Under Design hunting and fishing and forest resources remained important components of conservation, but "increased emphasis was placed on nongame management, preservation of unique plant and animal communities, and restoration of rare or endangered species."

Implementation of Design involved an important mechanism to respond specifically to this increased emphasis, formation of the Natural History Division. "Natural History [Division] was formed to address special aspects of land acquisition, and to coordinate nongame management, natural areas, endangered species programs, and interpretive programming." While coordination to promote and emphasize these issues was vested in Natural History, the scope of commitment remained Department-wide. Design did not create a concern for endangered species, that concern existed all along, but it did recommit the Department to "all wildlife".

Endangered Resources in the 1990s

Restoration of native wildlife has always been a high priority for the Missouri Department of Conservation, but protection and management of endangered resources is more than animal



Wild turkey restoration was one of the early conservation projects in Missouri. Photo by Missouri Dept. of Conservation.

restoration projects; it extends to plants, animals and natural communities. Surveys and identification, monitoring, protection and management, restoration and recovery are all elements of a successful endangered resources program. To say that everyone in the Department participates in the protection and management of endangered species is stretching the truth, but managing endangered resources is an integral part of Department activities and decision making.

Surveys, Identification and Monitoring

Department biologists conduct surveys for nongame species, many of which are known to be rare or endangered and others with a status that is poorly known. Much of the "identification" efforts for endangered resources is centered in Natural History, but endangered species surveys can be conducted throughout the MDC wherever the expertise and staff exists. During the last year Natural History biologists conducted surveys for Illinois chorus frogs, Ozark cavefish, spotted skunks, bald eagle nests, and running buffalo clover. Wildlife Division biologists conducted surveys for black bears, swamp rabbits and prairie chickens. Fisheries Division biologists conducted surveys for winged mapleleaf mussels, Niangua darters and Arkansas darters.

The most comprehensive "identification" program is the state-wide Natural Features Inventory. The first natural features inventory was initiated in 1980. Since then the Department has inventoried 90 of 114 counties with cooperative funding from the Land Reclamation Commission, U.S. Forest Service, Environmental Protection Agency, Federal Land and Water Conservation Fund, U.S. Army Corps of Engineers and The Nature Conservancy. This effort is nearing completion; the entire state should be inventoried by 1995. The inventory program is especially designed to identify and prioritize remnant natural communities.

Surveys and inventory programs will continue to be important because the MDC needs to periodically assess the status of declining plants and animals in the same way we need to stay

current on the acres of forest land, populations of sport fish and percent of land in old field condition. Understanding the current status of the remaining natural landscape is an important measure of biodiversity and this information is used to establish acquisition priorities.

The location of endangered species populations and significant natural communities are stored in the Missouri Natural Heritage Database. The Heritage Database currently tracks 7300 locations for these elements of diversity. One important function of the Heritage Database is simply bookkeeping the sites that need monitoring. As the database grows it is increasingly valuable to help determine protection priorities, to update the *Checklist of Missouri's Rare and Endangered Plants and Animals* which in turn is used to set future restoration priorities. The information is used extensively for environmental review and to answer information requests. Information requests help foresters plan the location of timber harvests, tell stream managers which stream stretches to target with habitat improvement projects and is one tool to shape Department land management. Increased use by resource managers is creating better opportunities for protection and management of endangered resources.

Protection and Management

Endangered species protection and management begins on lands owned and managed by the MDC. Management of Department lands is shaped by policies and guidelines that encourage resource managers to actively manage and restore fish, forest and wildlife resources. Still, endangered species protection and management must be integrated into existing management programs and priorities. In an effort to address the many priorities facing land managers, three levels of management intensity are assigned to MDC lands (high, medium, low).

Opportunities for management and protection of unique features, threatened habitats or rare/endangered species is listed a high priority. Interdisciplinary planning teams meet to discuss each area and identify the opportunities and obligations for each tract of land.

Area management plans consider improved habitat for a greater diversity of species and enhanced protection of ecosystems and significant natural features. This may be accomplished by emphasizing management for threatened, endangered, rare and watch list fish, wildlife and plant species on all suitable Department areas.

Interdisciplinary planning teams have broadened our approach to resource management, but land managers recognize that not every managed area can address all the resource issues that have been identified on any one tract of land. A new planning initiative is being developed to provide a regional framework for resource management.

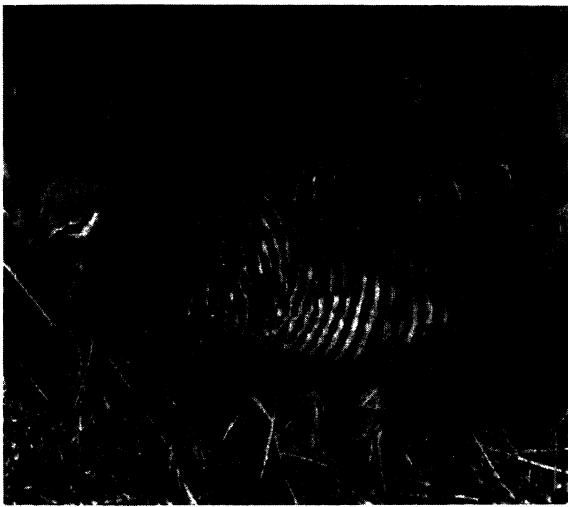
Regional planning teams will set goals and guidelines for management on a regional scale. When area planning teams meet in the future they will consider the resource potential of each particular area, including opportunities for restoration of rare species and management of remnant natural communities. Endangered resources will benefit from this approach.

Other public lands are also important to Missouri's fish, forest and wildlife resources. The MDC has a long history of cooperation with the U.S. Fish and Wildlife Service (USFWS), U.S. Forest Service (USFS), U.S. Army Corps of Engineers, National Park Service, Missouri Department of Natural Resources and other agencies. Department biologists and managers regularly consult with other agencies and participate in the protection and management of endangered resources on other public lands.

Our relationship with the Mark Twain National Forest (MTNF) is noteworthy. Forest District biologists meet at least annually with Department staff to exchange information on the location of endangered species sites and significant natural communities. The USFS manages endangered bat caves, numerous endangered species sites and natural communities like fens, glades and old growth forests. Most recently they became partners in the restoration of running buffalo clover, a federally endangered plant. Although the Department has worked most effectively with the USFS, lands managed by other federal

agencies also provide important opportunities to manage endangered resources.

Although mechanisms to effectively manage endangered resources on public land are increasing, additional attention must be directed to private lands. The majority of fish, forest and wildlife resources are located on private land, and populations of rare and endangered species are no exception. The next step in the protection and management of endangered resources is to contact private landowners and recruit their help. This is a continuation of Department efforts to enhance wildlife, forest and water quality through public awareness programs, educational services, and better



Greater prairie chickens, rare in Missouri, should benefit from habitat improvement initiatives on private lands. Photo by Jim Rathert, Missouri Dept. of Conservation.

focused technical assistance. These efforts, however, have never fully included endangered species.

Prairie chicken habitat improvement is a good example of a private land initiative. Prairie grasslands were part of the presettlement landscape in Missouri, but conversion of tallgrass prairie to other uses has affected many grassland plants and animals.

Greater prairie chickens have declined to the point where they are listed as rare in Missouri. A prairie acquisition effort that started in 1965 has brought nearly 16,000 acres of prairie grasslands into public ownership but it has not recovered this grassland bird. New efforts by the Department provide grassland management information and financial incentives to high priority areas that support remnant flocks of prairie chickens.

Natural History biologists and inventory personnel have always tried to notify private landowners about the presence of significant natural features, but their efforts have been opportunistic and not well coordinated. Increasing participation from The Nature Conservancy (TNC) has been part of the solution. TNC has a landowner contact program specifically for endangered species sites and natural communities. Through protection planning meetings, the Heritage Database has helped the Department and TNC to identify sites for TNC Registry.

Future efforts on private land will move beyond the "notification" phase to

providing better focused technical assistance in the form of endangered species management information. A pilot program initiated in January 1992 is exploring ways to educate and recruit private landowners. So far over 95 landowners have been contacted. The majority of landowners were unaware that an endangered species occurred on their property. Species addressed in the pilot program included gray bat, Ozark cavefish, Ozark trillium, knotweed leaf-flower, least tern, southern

cavefish and Missouri bladder-pod. In some instances the result is a site-specific management plan written for the private landowner in a way they can understand and implement on their own. Over the next year the Niangua darter and the Ozark cavefish will benefit by this approach using challenge grant money from USFWS.

Bringing the Public Closer to Wildlife

Although working with private landowners who have a direct impact on endangered species is important, it must fit into a larger program of educating a broad base of Missouri residents about wildlife resources. Fortunately the public is sensitive to the needs of endangered species. Despite their interest, the public may not be as informed as they

could be. There is significant public perception that the actions of public land management agencies may hinder protection of endangered species. Forest management, hunting and trapping are all suspect activities. Additional attention must be given to educating the public that endangered species can be recovered and that land management is part of the recovery process.

Judging from the phone calls and letters to the MDC there is clearly a constituency that would like to participate directly in endangered species activities. So far the Department has not effectively responded to this growing interest. While there are sound biological reasons to discourage attention to endangered species and their habitat, there may be limited opportunities for endangered plant and animal viewing.

Eagle Days programs provide one example where there is little conflict. Every winter the Department invites the public to specific areas to see and learn about bald eagles. Visitors typically hear a short indoor program about eagles, get to see a bald eagle up close, and then are directed to spotting scopes to view eagles outdoors. Four to six events are held every year. The first Eagle Day in Missouri started in 1978. Over the years the number of participants has reached 10,000 people annually.

Creating interpretive events that bring the public closer to wildlife indirectly promotes conservation of endangered resources. Programs that have been successfully developed in Missouri include Eagle Days, Day on the River, Day in the Forest, Day in a Cave, Duck Days, Ozark Glade Day and Prairie Day. As wildlife viewing becomes increasingly popular, people want to know where to go to see animals and plants in the outdoors. The MDC is developing a *Wildlife Viewing Guide* to tell Missourians where and when to experience various natural events, from Monarch butterfly migration to showy spring wildflower displays. The first issue of this report is scheduled for completion in 1993. Interpretation in Missouri has gotten a boost with the development of nature centers. Four regional nature centers exist in major metropolitan areas and the Missouri state capital, and

smaller interpretive facilities are being developed in out state areas. Nature centers are quickly becoming places where Missourians can learn about and experience wildlife, including endangered species. Nature centers may be the opportunity to involve the public directly in endangered species activities.

Planning for Restoration and Recovery

The Departments' Strategic Plan defines the current conservation program in Missouri and guides Department activities for all wildlife resources, encouraging resource managers to plan to "meet the challenges that lie ahead for the conservation of the state's fish, forest and wildlife heritage." The Strategic Plan specifically identifies the need "to restore self-sustaining viable populations of all plants and animals to their historic ranges where biologically, economically and socially feasible." Planning for restoration and recovery, as with area plans, includes participation from members of all resource divisions. There are eight functional areas for strategic action identified in the current plan and elements of the Endangered Resources Program are

productive nests successfully fledged 21 young eagles. March 1992 signaled the final release of the river otter restoration program. Since 1982, 845 otters have been released and there are many indications of an expanding river otter population in Missouri. Ambitious restoration programs in progress include peregrine falcon hacking, lake sturgeon propagation and releases, and stream enhancement for Niangua darters. A recently revised endangered bat management plan sets goals for the recovery of gray and Indiana bats. In addition, recent restoration initiatives include experimental introductions of plants (deciduous false aster, running buffalo clover, pondberry) and animals (smooth green snakes, fat pocketbook mussels, pallid sturgeon) to see if full restoration efforts are possible. Activities to secure and recover these species involve the Forestry, Fisheries, Wildlife, and Natural History Divisions of the Department.

Endangered Resource Coordination

Since the commitment for protection and management of endangered resources is distributed broadly into the fabric of the MDC, coordination is im-

portant. Someone needs to track progress and provide oversight. There are always gaps in communication to shore up and

new concepts and ideas to learn about and incorporate into the program. Someone needs to promote the program and be a link with the USFWS and neighboring states. Someone must point out gaps in our existing program and suggest ways to address them. Most importantly, someone needs to move the Department beyond successful ventures and get commitments for new initiatives. Fortunately the history of the MDC and the Strategic Plan provide strong support for endangered resources. The endangered resources program in Missouri really is an old program that has been renovated to reflect growing concerns for plants and animals and the landscape that supports them. Perhaps it is more proactive than it was in the past, recognizing that it is far less expensive and more responsible to manage plant and animal diversity before they diminish to the point of species-specific restoration efforts. Protection and management of endangered resources is not a departure from the original Department's mission, but a logical growth of the original concern for "all wildlife resources."

It is timely to address wildlife diversity and time to stop separating the consumptive users from the nonconsumptive public when in fact some of the hikers and bird watchers are hunters, and hunters and fisherman watch wildlife and feed birds along with the rest of us. You can only believe this if you grew up without wild turkeys. Who would have guessed that in one decade the number of productive bald eagle nests in Missouri could grow from zero to more than a dozen? Who among us now will bet on the recovery of the Niangua darter? Or Missouri bladderpod? Or running buffalo clover? I will. Bald eagles and blind cavefish have a common destiny with turkeys. Missourians never intended for the Department to stop at wild turkeys, we were just getting started.



On Eagle Days, visitors to Missouri nature centers can enjoy wildlife up close through spotting scopes among other activities. Photo by Kurt Jensen, Missouri Dept. of Conservation.

represented in nearly all of them.

During 1991 a decade of bald eagle hacking came to a close. This spring 10

portant. Someone needs to track progress and provide oversight. There are always gaps in communication to shore up and

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Technical Note

continued from UPDATE page 4

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Environmental law and regulation: Lucas v. South Carolina Coastal Council

by Sarah Chasis

On June 29, the United States Supreme Court handed down an important land use decision—*Lucas v. South Carolina Coastal Council*, No. 91-453. David Lucas, a real estate developer, purchased two beachfront lots on a South Carolina barrier island. His intent was to build two single family homes on those lots. After his purchase, South Carolina enacted a law prohibiting such building because of concern about the adverse impact of coastal development on barrier islands, with special concerns for erosion problems that would be created.

This case presented the Supreme Court with the issue of when does a land use/environmental law constitute a taking of private property requiring compensation under the Fifth Amendment. Because the takings issue currently plays a central role in the "wise use movement" and the debate on wetlands regulation, this case has been closely watched. While the decision was not favorable from an environmental perspective, it is very narrowly circumscribed.

In a 6-3 decision, the Court held that if real property is rendered completely valueless by a law or regulation, then the owner must be compensated (or the restriction eliminated, with compensation for the interim restriction), unless the governmental agency can show that the restriction is based on background principles of state property or nuisance law that would similarly limit the property's use. Previously, the trial court found that Mr. Lucas' property had been rendered valueless by the South Carolina Beachfront Management Act. Relying on the trial court's finding, the Supreme Court held that a regulatory taking had occurred unless, on remand to the South Carolina courts, the state could show the proposed use of the property fell within the background principles exception articulated by the Court.

The State of South Carolina, sup-

ported by environmental groups, had argued that the Supreme Court must inquire into the important public purposes served by the state's law before determining whether a regulatory taking has occurred. Rejecting that argument, the Supreme Court identified two categories of regulatory action as compensable without such an inquiry: a permanent physical invasion of property or where a regulation denies all economically beneficial, or productive use of land.

The decision is a narrow one because it is explicitly limited to the fairly rare circumstance where real property is left with *no* economically beneficial or productive use. Most environmental regulation does not result in the total elimination of all value of property. For example, regulatory actions under the Endangered Species Act should not be significantly affected because the flexibility in the Act generally allows at least some uses to proceed. If there is any remaining economic use, then the new rule of law does not apply and the courts would take into account the public purposes served by the regulation, as well as the economic impact on the landowner. Even if a regulation deprives the landowner of all economic use, government may still avoid compensating the landowner if it can show the proposed use to be a nuisance. Thus, for example, the owner of a lake bed would not be entitled to compensation when denied a permit to engage in landfilling that would flood others' land, nor would the owner of a nuclear generating plant, when directed to remove all improvements from land sited on an earthquake fault.

Because of these explicit limitations, the decision does not threaten the basic fabric of land use/zoning law or environmental regulation in this country. Despite the efforts of property rights advocates, no revolution in environmental law or regulation will result from this decision.

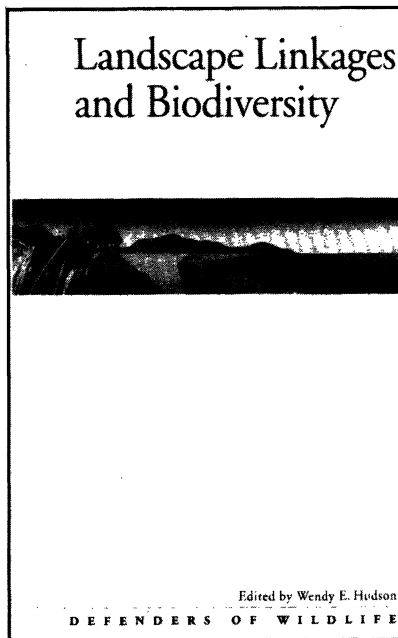
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Book Review

Landscape Linkages and Biodiversity

Edited by Wendy E. Hudson. 1991. Island Press, Wash., D.C.
Cloth: \$34.00. Paper: \$19.95. 214 pp.

Reviewed by Robert Grese



Proceedings from conferences are often disappointing when published as books; they become uneven collections of only loosely-related papers. Not so with *Landscape Linkages and Biodiversity*, a collection of essays and discussion originally presented at a 1990 symposium on biodiversity sponsored by the Defenders of Wildlife. As an outgrowth of that meeting, this book becomes an eloquent and timely call for the preservation of biodiversity at a landscape scale. It effectively links current thinking in conservation biology and landscape ecology with practical applications for managing entire landscapes.

The book is organized around three themes. The first section, "Conserving Biodiversity", describes various approaches to conservation aimed at rectifying our present dilemma. J. Michael Scott, Blair Csuti, and Stephen Caicco present "gap analysis", which utilizes GIS information as an emergency technique of reidentifying critical lands currently lacking protection. Through systems such as gap analysis, managers can begin to work at a large landscape scale, noting the mosaic of ecosystems and their linkages, rather than working on a piecemeal basis.

Reed F. Noss' essay further elaborates on this emphasis on landscape scale systems and linkages, describing how humans create artificial barriers to many native populations while eliminating many natural barriers, making isolated populations of plant and animal species more vulnerable to predation and competition from exotic species. Other essays in this section emphasize the need to counter the fragmented approaches to preserving biodiversity in Federal and State agencies, developing instead both regional and national strategies.

The second section, entitled "Conservation Corridors: Countering Habitat Fragmentation," presents arguments both for and against developing a network of corridors to counter habitat fragmentation. Blair Csuti notes that for plants and animals one must emphasize "landscape linkages" which maintain not only movement routes between preserves, but a complete range of community and ecosystem processes between larger blocks of landscape over longer periods of time. Michael Soule points out that the corridors must have a clear purpose—facilitating migration, allowing species to move between foraging sites, or allowing for mixing between isolated populations. Poorly designed corridors can serve as death traps by siphoning off healthy animals from already limited populations. Felice Pace presents a proposal for a system of corridors in the Klamath National Forest in Southern Oregon and Northern California as a strategy for combatting fragmentation of wilderness areas. Larry D. Harris and Kevin Atkins admit that while corridors are not a panacea, they may provide more natural levels and assemblages of ecosystem processes by connecting isolated blocks of landscape.

The last section, "Reintegrating Humans and Nature," examines practical ways of integrating some of the conservation ideas discussed earlier. Allen Cooperrider notes that landscape ecol-

ogy provides great promise of a way to integrate humans with the conservation of biological diversity. Gary W. Barrett and Patrick J. Bohlen suggest that far too often many landscape-related problems are approached at the wrong scale, temporally and physically. They argue for a more holistic approach merging fields as urban ecology and agroforestry, treating the landscape as one continuous system. Keith G. Hay's essay notes the current popularity for establishing greenways and suggests that these linear systems can also be used as tools for preserving biodiversity.

This last section of the book is by far the weakest, treating this difficult issue of "reintegration" only lightly. While the science of landscape ecology and the development of greenways are positive examples of efforts to link an understanding of landscape systems with physical planning, other suggestions are sadly lacking. The discussion at the end of this section is markedly superficial, avoiding the obvious question of how do we effectively reintegrate humans and nature. What is needed is a greater dialogue with those professions most directly involved with altering the face of the land—the developers, planners, engineers, architects, and landscape architects—and those responsible for policies and financial programs that shape the possibilities. The book's greatest value is its potential to serve as a bridge from the theories of conservation biology and landscape ecology to the way we actually manage land. It urges us to move beyond our current efforts of saving bits and pieces to saving whole systems. The arguments are presented so clearly and in such a compelling manner that this book should be read by scientist, policy maker and citizen alike.

Robert Grese is a professor in the Landscape Architecture program in the School of Natural Resources and Environment at the University of Michigan, Ann Arbor, MI 48109-1115.

Bulletin Board

Michigan's Natural Resources School Renamed

The School of Natural Resources at the University of Michigan has been renamed the School of Natural Resources and Environment. The Dean of the School, Garry D. Brewer said the name change conveys the School's current focus and identity more accurately.

Rare Plant Reintroduction Symposium

The Center for Plant Conservation is holding a 3-day symposium (April 20-23, 1993) to review existing reintroduction and restoration policies to develop national guidelines and a model policy for rare plant reintroductions. For registration information contact: Marie M. Brueggemann, Center for Plant Conservation, Missouri Botanical Garden, PO Box 299, St. Louis, MO 63166.

Biodiversity Information Network

A workshop, sponsored by the International Union of Biological Sciences, the International Union of Microbiological Societies and the World Federation for Culture Collections, established a Biodiversity Information Network to

solve the problem of managing global diversity information. The purpose of the Network is to support and encourage protection of the environment and conservation of the genetic resources inherent in its biodiversity. The network, primarily electronic, will disseminate and facilitate access to biodiversity information worldwide. For more information and to participate in the network, contact: Anthony Whitworth, EcoNet—Association for Progressive Communications, 18 De Boom St., San Francisco, CA 94107, Email: anthony@igc.apc.org, Tel: (907) 479-8129.

Paperless Environmental Journal

The GreenDisk is a paperless environmental journal published on MacIntosh and IBM-compatible formats. Issues contain summaries of recently published books, reports, teaching aides, etc, complete newsletters of some organizations, employment opportunity listings, and a journal section with reports and articles from the scientific community, government agencies, and environmental groups throughout the world. Subscriptions are \$35 per year for 6 issues. For subscription information write: The GreenDisk, Box 32224, Washington, DC 20007.

USFWS Endangered Species Technical Bulletin

The latest Technical Bulletin was published in the July/August 1992 issue of the *Endangered Species UPDATE*. Once the USFWS produces the next Technical Bulletin, it will be featured in the *UPDATE*.

Black-Footed Ferrets Born in Captivity

Twenty black-footed ferrets were born to five females at Omaha's Henry Doorly Zoo (Nebraska). This is the third successful breeding season for these endangered mammals. Three of the females were first-time mothers. Eighteen kits are undergoing conditioning for reintroduction into the wild. Kits from three litters will be part of the reintroduction efforts this fall into the Shirley Basin Medicine Bow area in Wyoming.

Announcements for the Bulletin Board are welcomed. Some items from the Bulletin Board have been provided by Jane Villa-Lobos, Smithsonian Institution and C. Wieser/M. Junior, AAZPA Communiqué.

Endangered Species UPDATE

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