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In this Issue

Recent Directions in Black-footed Ferret Recovery

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Black-footed ferrets (*Mustela nigripes*) remain one of the world's most endangered mammals despite 15 years of conservation efforts. Although the number of captive animals has increased and ferrets have been reintroduced into four sites within their former range, no wild population, apart from reintroductions, is known. This article briefly reviews the history of ferret decline and early recovery efforts, discusses recent successes and failures, and concludes with a discussion of future recovery challenges.

A Brief History of Ferret Decline and Early Recovery Efforts

Black-footed ferrets are obligate associates of prairie dogs (*Cynomys* spp.), upon which they depend for food and shelter (Forrest et al. 1985). Ferret decline began as prairie dog numbers and distribution declined throughout the short and mid-grass prairies of North America. Large-scale conversion to agriculture, prairie dog eradication, and the effects of plague (*Yersinia pestis*), an exotic disease (Miller et al. 1990c), contributed to the loss of prairie dogs. Prairie dog eradication continues despite range science studies which question the extent of competition between prairie dogs and livestock (O'Meilia et al. 1984; Uresk & Paulson 1989), economic analyses that indicate that eradication programs are not cost effective (Collins et al. 1984), and ecological research that illustrates the importance of prairie dogs as ecosystem regulators (Krueger 1988; Whicker & Detling 1988; Reading et al. 1989). As a result, complexes of prairie dog colonies cover less than 2% of their former range (Miller et al. 1994, 1996; Roemer & Forrest 1996).

Ferret populations became small and fragmented following depletion of their prey base. They began disappearing as a result of deterministic and stochastic factors, including both plague and canine distemper (Thorne & Williams 1988). The last known wild population of ferrets was discovered near Meeteetse, Wyoming in 1981. This population was studied until 1985 when both plague and canine distemper drove it to near extinction (Clark 1989). Eighteen ferrets, many closely related, were captured just prior to extinction of the wild population, and captive breeding was initiated (Miller et al. 1988). Captive propagation succeeded in increasing ferret numbers, and today over 350 individuals are distributed among 7 facilities in the United States and Canada. The Black-footed Ferret Recovery Plan, drafted after the Meeteetse population crash, calls for establishing at least 10 separate populations of 30 or more over-wintering adults with a minimum of 1,500 total individuals (U.S. Fish and Wildlife Service 1988).

Reintroduction of ferrets bred in captivity began in 1991 with release of young of the year into Shirley Basin, Wyoming. Reintroduction has since expanded to sites in Montana, South Dakota, and Arizona. Some advances in reintroduction techniques have occured, and some wild born animals have survived to reproduce. Although progress has occurred, ferrets remain far from recovered, and the program has been plagued by unproductive conflict and policy and organizational problems (May 1986; Clark & Harvey 1988; Clark 1989 in press; Seal et al. 1989; Reading & Miller 1994; Miller et al. 1996).

Recent Developments

Captive Breeding

After a relatively slow start in the mid-1980s, the captive population began increasing before leveling off in

Year	Females in Captivity	Litters Whelped	# Kits Born	# Kits Born per Litter	# Kits Weaned	# Kits Weaned per Litter
1987-1989	59	40	132	3.3+-1.6	105	2.6+-1.8
1990	56	32	90	2.8+-1.1	66	2.1+-1.3
1991	93	59	219	3.7+-1.6	143	1.5+-1.9
1992	126	76	250	3.3+-1.8	192	2.5+-2.0
1993	173	87	276	3.2+-1.7	116	1.3+-1.6
1994	192	75	266	3.5+-1.8	180	2.4+-2.1
1995	165	88	325	3.7+-1.7	185	2.1+-1.9

Table 1. Black-footed ferret captive breeding summary.

the early 1990s (see Table 1). As the captive population grew, it was eventually split, with about half the animals remaining in the National Black-Footed Ferret Conservation Center (NBFFCC) at Sybille, Wyoming. The remainder were maintained and bred in several sites, including the Omaha Zoo, Nebraska; the National Zoo's breeding facility at Front Royal, Virginia; the Toronto Zoo, Ontario; the Phoenix Zoo, Arizona; the Louisville Zoo, Kentucky; and the Cheyenne Mountain Zoo in Colorado Springs, Colorado. Although the captive population has been stabilized, productivity has varied somewhat (see Table 1).

Ferret reproduction and kit survival have been quite successful in 1996 with 316 kits born in 89 litters and 234 kits surviving to weaning. Approximately 125 of these animals were allocated for reintroduction into the three active release sites (Montana, South Dakota, and Arizona), and 106 kits (the most genetically valuable) were retained in the captive breeding program.

Older animals, which contribute little to reproduction, now comprise a substantial portion of the captive population, creating problems of space for younger, more reproductively valuable animals. The increase in numbers of older ferrets permitted allocation of some for exhibit at zoological parks, and today eleven zoos, in addition to those breeding animals, display ferrets.

The captive breeding program has produced many kits; however, problems associated with inbreeding may develop. There are only 7 genetic founders represented in the breeding pool. Genetic analyses initially recommended maintaining 200 breeding animals in captivity to maintain 80% of the genetic diversity of founders for over 200 years (Ballou & Oakleaf 1989); this was later increased to 240 adults. To increase the productive capacity of breeding animals, captive management strives to maintain a ratio of 3 males:5 females. Emphasis is placed on genetic management of the captive population because of the comparative ease of managing its genetics relative to wild populations (Russell et al. 1994), and because mortality of reintroduced animals is high. Therefore, only genetically "surplus" animals (i.e., high inbreeding coefficients and high representation in the captive population) and numbers produced in excess of those needed to replace loss of captive animals are available for reintroduction (Godbey & Biggins 1994). Genetic studies to determine relatedness of "founders" were called for in 1985 but never conducted and ferret lineages remain estimates based on the locations of animals captured from the wild. In addition, animals of disputed paternity entered the breeding population in 1987-88. As a result, genetic management has been compromised.

Reintroduction Research

A variety of research has occured on captive animals, the results of which have contributed substantially to ferret recovery efforts. Studies directed at increasing the captive productivity of ferrets examined reproductive physiology (Seal et al. 1989; Carvalho et al. 1991; Williams et al. 1991, 1992), artificial insemination (Howard et al. 1991, 1996), reproductive behavior (Miller 1988; Miller et al. 1996), developmental biology (Vargas 1994; Miller et al. 1996; Vargas & Anderson 1996a, 1996b), and captive management (Miller et al. 1988, 1996; Williams et al. 1991). The risk of disease (Thorne & Williams 1988; Williams et al. 1994) led to disease prevention protocols and studies directed at developing vaccinations (Williams et al. in press). Additional studies examined methods for increasing chances of post-release survival. Studies included raising animals in enriched environments and in arenas with resident prairie dogs to simulate a more natural environment (Miller et al. 1990a, 1990b; Biggins et al. 1991, 1993a; Vargas 1994), providing young with opportunities to kill prey (Miller et al. 1990a; Vargas 1994; Vargas & Anderson 1996a), providing aversive stimuli in the presence of potential predators (Miller et al. 1990b), and exploring the possibility of food im-

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printing (Vargas & Anderson 1996b). These latter studies were conducted in collaboration with test reintroductions of closely related Siberian polecats (*M. eversmanni*) and actual reintroductions of black-footed ferrets to examine effects on survivorship.

Prior to reintroducing black-footed ferrets, biologists experimented with trial releases of Siberian polecats to improve techniques. Siberian polecats which had experience killing prey, which had less contact with people, and which were raised in arenas as opposed to cages were better predators and exhibited more developed predator avoidance behaviors (Biggins et al. 1991, 1993a; Miller et al. 1990a, 1990b). Similarly, more recent releases of black-footed ferrets found that animals raised in enriched environments and those with previous experience killed prey more effectively (Vargas 1994). Nevertheless, only recently were these techniques incorporated into reintroduction protocols (Miller et al. 1996).

Other research focused on reintroduction sites. Research on prairie dogs examined colony dynamics and habitat preferences (Reading et al. 1989; Reading 1993) and developed standardized monitoring and evaluation methods for complexes of prairie dog colonies (Biggins et al. 1993b). Other studies assessed and monitored populations of potential ferret predators (Reading 1993) and sampled resident carnivores for disease, especially canine distemper and plague. Local support is crucial for conservation efforts. An evaluation of local values and attitudes found that people were often antagonistic toward ferrets, due to the perception that prairie dogs compete with livestock for forage and from the fact that ferrets are listed as endangered, which elicited fears of loss of control over public grazing lands and of restrictions on land uses (Reading 1993; Reading & Kellert 1993; Reading et al. in review). Results of these and other studies permitted site ranking on a number of biological and social science criteria and development of proactive strategies to improve a site's suitability for ferret reintroduction.

Reintroduction Efforts

Reintroduction began in 1991 with the release of 49 ferret kits into Shirley Basin, Wyoming. All animals were young of the year, released during autumn when young ferrets normally disperse. The kits were acclimated for a minimum of ten days in raised cages, given access to cages post release, and provided with supplementary food (Wyoming Game and Fish Department 1991). At least 4 ferrets survived the winter, with 2 producing litters.

An additional 90 kits were reintroduced into the same site in 1992. Seventeen of the animals released were raised in outdoor arenas. These pre-conditioned animals dispersed less and survived significantly longer than cage-reared animals (Biggins et al. 1993a; Vargas 1994). A minimum of 8 animals survived the winter and at least 4 litters were born the following summer.

A second site in Montana was biologically ready to receive ferrets in 1992, but political pressure at the state governors' level delayed release (Reading & Miller 1994; Miller et al. 1996). By 1993 field preparations for a third release site in South Dakota were also completed. However, a large decline in captive production precluded releases in either Montana or South Dakota, thus Shirley Basin, Wyoming received all 48 animals in 1993. By late 1993, an estimated 24 ferrets survived. By October 1994 about 10 adults and kits of unknown origin (none were captured) were observed.

Black-footed ferrets were reintroduced into all three sites in 1994: 41 into Wyoming, 36 into the Conata Basin of South Dakota, and 40 into south Phillips County, Montana. The fate of ferrets released in Wyoming is unknown. In South Dakota at least 8 ferrets were still alive by early December 1994 and, by July 1995, at least 4 surviving ferrets produced 5 kits in 2 litters. In Montana at least 9 animals survived the winter, producing a minimum of 5 kits in 3 litters the following summer. The Montana reintroduction included intensive telemetric monitoring of all animals and an experimental design to test preconditioning. Assessment of data from all three reintroduction sites showed a highly significant effect of pre-conditioning on short-term and long-term survival (Biggins et al. in review).

To test the potential contribution of adult reintroductions to the overall recovery effort, two releases in South Dakota used 4- and 5-year-old animals. Only the second group of 14 animals was monitored with telemetry; 12 were found dead soon after release and the other 2 signals were lost. Because of the high losses, this technique was canceled.

Plague, coupled with a flooding event, reduced white-tailed prairie dogs (*C. leucurus*) in Shirley Basin, Wyoming during 1994-95. Due to the greatly depleted prey base no additional animals were released into the site in 1995 or 1996. However, at least 5 ferrets, including kits, were discovered in Wyoming during spotlighting surveys during the summer of 1996. Researchers were hopeful that these animals survived by producing antibodies for plague, but blood tests on 2 animals did not support this hypothesis.

Thirty-three young ferrets were released in South Dakota in the fall of 1995. By late November/early December at least 16 ferrets had survived, including 9 animals reintroduced in 1995, 2 released in 1994, 3 kits born in 1995, and 2 unidentified animals. This showed an increase in the number of animals known to be alive through December from 22% in 1994 to 30% in 1995. An additional 7 animals were released into the South Dakota site in February 1996 in an attempt to reduce over-winter mortality. Spotlighting surveys during the summer of 1996 found a minimum of 9 adults with at least 5 litters and 8 kits. Of significant interest is the fact that animals born in the wild in 1995 produced litters in 1996. South Dakota released an additional 67 kits and 4 adult females during the fall of 1996.

Thirty-seven animals were reintroduced into Montana in 1995. Both lethal control of coyotes and temporary electric fences were used to reduce predation during the first couple of weeks after release. All ferrets were intensively monitored using radio telemetry for several weeks and then monitored periodically using spotlights. Thirty-day survivorship increased from 26% in 1994 to 58% in 1995. By December 1995, a minimum of 28 ferrets survived and by May 1996, a minimum of 19 animals were identified. Although coyote control and electric fences increased short-term survival, long-term survival was not affected. The timing of pre-release conditioning may be the most important variable affecting survival. Survival was greatest for ferrets raised in large, dirt filled pens or transferred into these pens at an early age. In 1996, a minimum of 10 females produced litters with at least 15 kits, including litters from wild-born females. Four kits produced in 1995 (67%) survived to the 1996 breeding season. An additional 43 ferrets were released onto Montana prairie dog colonies unoccupied by ferrets in the fall of 1996.

Arizona became the recovery program's fourth reintroduction site when 4 ferrets were released into large (980 m^2) fenced enclosures on a reintroduction site in Coconina County's Aubrey Valley in March 1996. Thirty-five ferrets were later released into ten on-site enclosures, each sub-divided into four smaller pens, constructed to exclude terrestrial predators. The site received an additional 15 kits in the fall of 1996 and the state will strive to compare behaviors and survival of kits with those of adults.

Program Organization and Management

Organization and management of ferret recovery efforts has been the subject of intense research and analysis (May 1986; Clark & Harvey 1988; Clark 1989 in press; Thorne & Oakleaf 1991; Godbey & Biggins 1994; Reading & Miller 1994; Miller et al. 1996). Despite broad recognition of many of the program's organizational problems, participants interpreted the underlying reasons for these problems differently, and the problems have been given little explicit attention despite many recommendations.

The U.S. Fish and Wildlife Service (FWS) designated Wyoming Game and Fish Department the lead agency for ferret recovery soon after discovery of the Meeteetse, Wyoming population in 1981 (Clark 1989). The state agency vigorously managed and controlled the program from 1981-1985, when the FWS took the lead in what had become a large, complex, and multi-organizational program. The program has continued to grow as the number of captive facilities and reintroduction sites has grown. At the same time, however, Congressional allocations for endangered species recovery programs have declined.

After 15 years, participants requested the FWS assume greater involvement in the ferret recovery program due in part to unresolved organizational problems, an increasingly national (even international) recovery program, and reduced funding. This, coupled with lingering uncertainty about the success of the Wyoming reintroductions, led to several changes in the mangementof the program (Miller et al. 1996). In early 1995, the FWS formed a body composed of agency representatives to oversee recovery efforts. In early 1996, the FWS assumed direct responsibility for the captive breeding facility at Sybille, Wyoming and assigned captive breeding and reintroduction specialists to assist a new part-time Recovery Coordinator. To improve coordination and management of recovery efforts, the FWS established a formal recovery implementation team in July 1996.

The FWS contracted the American Zoo and Aquarium Association (AZA) in 1995 to conduct a programmatic evaluation of the ferret recovery program. The AZA held a series of meetings on captive breeding, reintroduction and habitat conservation, and program administration and accountability. The working documents produced from these meetings are intended to help the FWS improve the program, guide recovery efforts, and draft a new recovery plan (Hutchins & Wiese 1996).

Future Challenges

Black-footed ferrets appear to be moving toward recovery, but numerous challenges, both biological and non-biological, remain. Perhaps the largest biological obstacle to recovery is posed by disease epizootics, including canine distemper and plague. Ferrets are highly and fatally susceptible to canine distemper (Williams et al. 1988). A temporary vaccine for canine distemper is now available and a vaccine for lifetime immunity is being researched (Williams et al. in press). Perhaps of greater concern is plague. Ferrets, until recently, were thought not to be susceptible to plague. However, the loss of several ferrets at two separate captive facilities has dramatically proven otherwise (Williams et al. 1994).

Reduced numbers of prairie dogs also poses a threat to ferret conservation. Prairie dogs continue to suffer marked declines across most of their range from exotic disease and other causes (e.g., poisoning and shooting). Plague epidemics have already affected the reintroduction sites in Wyoming and Montana and have periodically affected most known complexes of prairie dog colonies, with the notable exceptions of South Dakota and perhaps Mexico. Combating plague probably poses the most significant biological challenge to the conservation of ferrets and the entire prairie dog ecosystem. The FWS is coordinating research directed at decreasing plague occurence within and around ferret reintroduction sites.

Captive breeding continues to produce relatively large numbers of kits for reintroduction, but inbreeding could lead to problems with fertility, survivorship and deformities. Unfortunately, options are limited by the extremely small number of founders: only five are currently represented. Resolving issues of relatedness by performing the requisite genetic studies might aid the situation. The recovery program should also develop contingency plans in case inbreeding depression begins to affect the captive population.

Several non-biological challenges also face ferret recovery. Antipathy for prairie dogs remains prevalent among some people, especially relevant groups such as ranchers and many employees of agriculture, wildlife, and public land management agencies (Miller et al. 1990c; Reading 1993; Reading et al. in review). Inducing these people to support, or at least not to oppose, ferret and prairie dog conservation programs is crucial to long-term success. Similarly, several groups actively oppose endangered species conservation programs because of real and perceived restrictions associated with the Endangered Species Act (ESA). Anger and fears associated with several sensitive issues, including private property rights, states' rights versus federalism, and public land management, have produced a strong backlash against the ESA and individual recovery programs (Reading & Kellert 1993; Reading et al. in review). Successful, long-term conservation requires addressing these concerns effectively.

Organizational challenges have significantly affected program performance in the past and a number of issues remain unresolved. Among the most fundamental of these problems is an inability to learn more effectively, to utilize the potential of high performance teams and to prototype (Westrum 1994; Clark 1996). While some issues are being addressed in the current programmatic evaluation and re-organization effort, many important organizational challenges remain (e.g., an effective decision-making process, see Clark & Brunner 1996). Several past problems had their origins in differing biases of participants and were manifest individually and organizationally in differing values, organizational cultures, operating philosophies, goals, and control issues. These variables must be successfully addressed to reduce further polemics, goal displacement, and unproductive conflict (Miller et al. 1996; Clark in press).

On a more positive note, the world's largest prairie dog complex in Chihuahua, Mexico, is being incorporated into a new protected area. This complex could, theoretically, support over 1,200 black-footed ferret families (Ceballos et al. 1993) and is currently being assessed more fully by biologists from the Universidad Naciónal Autonomá de México. In addition, research during reintroductions and captive breeding continues to refine methods, improving chances for future success at lower costs. Finally, many dedicated professionals are committed to the recovery of this charismatic ambassador of the threatened prairie dog ecosystem, substantial progress has been made, and hopes remain high that wild, free-ranging populations of black-footed ferrets will once again roam the prairies of North America.

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Teaching Endangered Species Management

Joel T. Heinen

Inherent to implementation of the Endangered Species Act (ESA) are conflicts in the public and private sectors, and at local, regional, and national levels. Conflicts can arise from, for example, differing priorities and management styles of the individuals involved in the process (Clark and Brunner 1996). Understanding and addressing the human dimensions of these debates may help diminish the current polarization in the reauthorization of the ESA and its implementation.

Humans have a propensity for self interest (Heinen and Low 1992; Low and Heinen 1993). This inclination leads humans to discount problems, including environmental concerns, in both space and time. Thus, major environmental issues, such as species extinction, are not necessarily perceived to be as urgent as they really are. Relatively minor problems, such as household waste, are frequently perceived to be urgent simply because they are close to the actor in both space and time.

How does one design solutions based on this understanding of human nature? Solutions depend on the scale and scope of the problem and the degree of societal heterogeneity of the target group. Some environmental problems that are already perceived to be urgent, such as household waste, may be solvable through the use of education campaigns and social incentives. Examples include advertising the actions of those who recycle to neighbors and friends, thus providing a social incentive for creating recycling behavior. Many other problems, farther away in space and time, may be more difficult to solve. In cases where the impact of the problem is dispersed over time, the use of economic incentives is considered to be the most effective general strategy.

A recent review (Heinen 1995) of several private, state and federal endangered species management initiatives looked at potential solutions based both on social and economic incentives in recovery planning. Findings indicate that the ESA as implemented throughout much of its history is heavily focused on the technical aspects of recovery, and has paid less attention to the socio-economic and political dimensions. This precedent may be partly responsible for the level of conflict now witnessed.

Teaching the Issue

To provide an opportunity for exploration of the social and political dimensions of the ESA, I proposed a university course entitled Endangered Species Management. Topics included an introduction to resource law and to the ESA, legal provisions of and challenges to the ESA, organizational issues related to recovery planning, and case studies in recovery programs (e.g., the Northern Spotted Owl, the Red-cockaded Woodpecker, Red Wolf).

Students selected a Florida-based U.S. Fish and Wildlife Service recovery plan to analyze. Species chosen show a fair amount of diversity and included some resident 'charismatics' (e.g., manatees), plants, residential and migratory birds, and reptiles. Students reviewed and provided an overview of a recovery plan, including a description of the species, habitat requirements, and a synopsis of the recovery timetable.

Discussions on the overlap and differences between plans showed that many had similar habitat conservation goals, yet planning efforts were singular and disconnected. In a few cases, management prescriptions conflicted for listed species found within the same areas (e.g., water management proposals for the snail kite versus the wood stork in the Everglades). Thus the inherent inefficiency of single-species recovery planning was exposed. Subsequent study was devoted to ecosystem management, multi-species recovery planning, and case studies in habitat conservation planning.

Based on theory and analysis of the earlier case studies, students then proposed incentive-based initiatives relevant to their specific recovery plans. They presented information on education efforts achieved and further initiatives needed, and made specific recommendations for implementing both social and economic incentives to enhance recovery goals. Students were also asked to integrate their plans with plans for other listed Florida species found in similar habitats, where relevant.

Discussion indicated the last exercise was the most difficult and the richest learning experience. Students were forced to consider, in a familiar geographical context, competing demands inherent to many resource management issues when the drive for development is juxtaposed against a public will for conservation.

Exploring the short- and mid-range solutions for conservation problems within the narrow context of recovery planning for Florida species listed under the ESA provided students with a unique, integrated and interdisciplinary learning experience. Students in fields such as biology, policy, and economics gained a deeper understanding of both their own disciplines and possible interdisciplinary solutions.

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Opinion

Surprises Inherent in the No Surprises Policy

Kimberley K. Walley

On August 11, 1994, the Department of the Interior (DOI) and the Department of Commerce (DOC) jointly issued a new policy entitled "No Surprises: Assuring Certainty For Private Landowners In Endangered Species Act Habitat Conservation Planning" (the "No Surprises" policy). In doing so, they significantly revised how unforeseen circumstances are to be addressed in Habitat Conservation Plans (HCPs). The revision was made effective immediately and promulgated without opportunity for public notice and comment.

Background

Under Section 9 of the 1973 Endangered Species Act (ESA), it is illegal for anyone to "take" an endangered or threatened species. The "take" prohibition applies to any activity that would directly kill or harm a listed species, as well as many activities that cause indirect harm. In 1982, Congress amended section 10 of the ESA by adding an exception to the Act's strict "take" prohibition. This amendment allowed the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) (collectively referred to as the Services) to issue an incidental take permit (ITP) to a private party that would grant permission to "take" listed species, provided that the "take" is incidental to otherwise lawful activity and is accompanied by an HCP.

Congress modeled this ITP/HCP exception "after a habitat conservation plan developed by three Northern California cities, the County of San Mateo, and private landowners and developers to provide for the conservation of the habitat of three endangered species and other unlisted species of concern within the San Bruno Mountain area of San Mateo County" (H.R. Rep. No. 835, 97th Cong., 2nd Sess. 31, 1982). In the San Bruno HCP, the parties agreed that the FWS could impose further mitigation measures on almost 90% of the habitat in the event of unforeseen circumstances. Thus, Congress specifically stated that it "expect[ed] that any plan approved for a long-term permit will contain a procedure by which the parties will deal with *unforeseen circumstances*" (emphasis added, H.R. Rep. No. 835, 97th Cong., 2nd Sess. 32, 1982).

In 1984 the FWS adopted regulations implementing the 1982 amendments. The regulations provided that specific measures must be included in each HCP that address changing circumstances which could jeopardize the survival and recovery of the threatened and endangered species covered by the plan (see 50 C.F.R. §§ 17.22b, 17.32b). In 1990, NMFS adopted similar regulations (see 50 C.F.R. §§ 222.22).

The "No Surprises" Policy

The "No Surprises" policy, however, hardly guarantees protection of species regardless of change. Rather, under this new policy, the Services *must* provide landowners with "general assurances" designed to ensure that landowners do not have to take any responsibility for species protection if unforeseen circumstances arise, even if it means the extinction of a species. These "assurances" apply not only to threatened and endangered species covered by the HCP, but also to unlisted species covered in the plan.

According to the "No Surprises" policy, after an HCP has been approved and an ITP has been issued, the Services cannot pursue any additional mitigation measures aimed at conserving endangered or threatened species until they have demonstrated that "extraordinary circumstances" exist warranting such additional protection. "Extraordinary circumstances" are based on a number of factors, including whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the affected species in the wild.

More importantly, even if such "extraordinary circumstances" are shown to exist, the "No Surprises" memorandum states that the Services:

> "*shall not seek additional mitigation* for a species from an HCP permittee where the terms of a properly functioning HCP agreement were designed to provide an overall net benefit for that particular species and contained measurable criteria for the biological success of the HCP which have been or are being met" (emphasis added, FWS and NMFS 1994).

The policy places primary responsibility for developing mitigation measures on the Services, not the landowner. Finally, under the policy, the Services promise that any

> "[a]dditional mitigation requirements shall not involve the payment of additional compensation [by the landowner] or apply to parcels of land available for development or land management under the original terms of the HCP *without the consent of the HCP permittee*" (emphasis added, FWS and NMFS 1994).

Therefore, under this new approach to HCPs, if circumstances change for listed species or species not listed at the time of the HCP are subsequently listed, additional mitigation measures are substantially restricted. For example, if the FWS finds, after it has entered into an HCP, that a particular species needs certain additional mitigation measures, and the landowner refuses to allow the implementation of those measures, the Services must bear the burden of finding a way to implement the needed mitigation measures.

The only way the FWS could then ensure that the mitigation measures are implemented would be to buy the land in question. However, even assuming the landowner is willing to sell the property, the purchase of lands, especially lands that are attractive to developers, is extremely costly, and the Services have offered no assurance that adequate funding will be available to purchase these lands. Indeed, in light of existing budget constraints, such a guarantee is unlikely to be forthcoming any time in the foreseeable future.

Since its enactment, this new policy is being applied to HCPs at a dizzying pace. Currently, there are more than 150 HCPs being negotiated nationwide—all of which must contain assurances that all species covered in the plans are considered by the Services to be "adequately" protected by the terms of the plans (See Frampton 1995). Many of these HCPs are scheduled to last for up to 100 years, cover tens to hundreds of thousands of acres of land, and attempt to assure the continued survival and recovery of hundreds of listed and unlisted species.

For example, on July 17, 1996, Secretary Babbitt signed off on the Natural Communities Conservation Plan (NCCP) and HCP for the central and coastal subregion of Orange County, California, which is a 75-year permit for construction, infrastructure development, grazing, mining and recreation. This HCP applies to 208,713 acres, of which approximately 78% are open to development. The plan purports to adequately assure the continued survival and recovery of 47 species, including seven threatened and endangered species and four proposed threatened and endangered species.

In another example, the recently approved Plum Creek HCP in Washington covers approximately 170,000 acres, claims to adequately ensure the continued survival and recovery of 285 vertebrate species, including the threatened Northern spotted owl (*Strix occidentalis caurina*), grey wolf (*Canis lupus*), and grizzly bear (*Ursus arctos horribilus*), and is scheduled to last between 50 to 100 years. Yet timber harvest under this plan is prohibited on only about 1,400 acres, and is deferred for a 20 year period on about 2,900 acres (a total of 4,300 acres, which is approximately 2.5% of the entire acreage). These and other massive HCPs contain the "No Surprises" assurances. Thus, if the plans do not prove to adequately protect the affected species, as appears probable, it will be almost impossible to revise them.

In light of the extensive duration of these HCPs, the large area that each plan covers, and the enormous numbers of species that are supposed to be protected under each of these plans, an obvious question about the "No Surprises" policy is: How can the Services conceivably assure that all of the affected species will continue to survive and recover under the terms of these plans throughout the duration of the permit period? It is this overriding question that has caused 164 biologists, including some of the premier conservation biologists in the world, to write letters to members of the House Committee on Resources expressing their serious concern that the "No Surprises" approach in habitat conservation planning "does not reflect ecological reality and *rejects the best scientific knowledge and judgment of our era*" (emphasis added, Meffee et al. 1996; Soule 1996).

Scientific Concerns

According to these leading scientists, the "No Surprises" policy is deeply flawed for two interrelated reasons.

Changing Circumstances

The first reason is related to the fact that change does occur. It is extremely unlikely that biological conditions during the life of an HCP, especially an HCP that is expected to last for 50 to 100 years, will remain static. To the contrary, "uncertainty, dynamics, and flux" are the "best descriptors of ecological systems" (Meffe et al. 1996). Some of the sources of uncertainty include:

> "unpredictable, localized environmental events such as fires, disease outbreaks, [and] storms that alter [habitat] structure," "losses or changes of genetic structure in small populations that affect their future adaptability," "the influence of random events on survival of very small populations," and "[i]nsufficient knowledge" (Meffe et al. 1996).

Thus, according to these scientists, their "collective scientific experience indicates that there will be *many surprises* in conservation planning" (emphasis added, Meffe et al. 1996).

Uncertainty, however, is not limited to biological changes alone; common sense dictates that political and sociological changes are also likely to change over the course of time. For example, last year Congress passed the logging rider, which allowed salvage logging of dead, diseased or dying trees without the benefit of any environmental analysis. As a result of this rider, HCPs that had been developed assuming full protection of species habitat within President Clinton's 1994 Northwest Forest Plan are suddenly faced with changed circumstances that may affect the status of a species that is covered by an HCP. As such, even the FWS has acknowledged that the rider has thrown these plans "out of balance," thus requiring additional mitigation under those HCPs (Davies 1996). The "No Surprises" guarantee, however, would effectively make such changes to an HCP impossible.

This problem is further exacerbated by the fact that many of the recent, larger HCPs include numerous species which have yet to be listed. For most of these species, scientists have not even begun to assess what is required for their survival and recovery. The question arises as to how the measures in an HCP "adequately assure" the continued survival and recovery of a species if the needs of a species are unknown at the time an HCP is approved by the Ser-

(Continued on UPDATE p. 14)

AZA Species Survival Plan Profile: Red Wolves

Will Waddell

Developing recovery plans for the red wolf (*Canis rufus*) has been a lesson in making tough decisions, building partnerships and remaining flexible. Historically, red wolves ranged from central Texas to Florida and north to the Ohio Valley (see Figure 1) (Nowak 1972; Carley 1979). A combination of several factors, including substantial parasite infestation, predator control programs, and loss of habitat, contributed to a decrease in the red wolf population (Carley 1975; Nowak 1979). In 1967 the U.S. Fish and Wildlife Service (FWS) listed the species as endangered.

By the early 1970s the red wolf's range was restricted to the coastal prairies and marshes of extreme southeastern Texas and southwestern Louisiana (Carley 1979; McCarley & Carley 1979). Severely reduced numbers and interbreeding with an eastward expanding population of coyotes threatened the genetic integrity of the remaining red wolves. As a result of these circumstances, program officials in the early 1970s redirected the recovery objective from one of local preservation to planned removal of all red wolves in the wild (FWS 1990). Although extreme, the decision to remove the last red wolves from the wild could be justified through the development of a long-range objective to eventually return the species to parts of its native range.

Figure 1. Historical and current range of red wolf (*Canis rufus*). Map courtesy of Kinnard Boone of Patuxent Environmental Science Center.

Concurrent with initiating the recovery program in 1973, a captive-breeding/certification program was organized through a cooperative agreement between the FWS and the Metropolitan Park District of Tacoma at the Point Defiance Zoo & Aquarium (PDZA) in Tacoma, Washington. Program officials identified three objectives for the captive-breeding program: (1) certify the genetic purity of wild-caught wolves; (2) increase the number of genetically pure red wolves in captivity; and (3) maintain a continuing red wolf gene pool for re-establishment of the species in the wild and for distribution to selected zoos (FWS 1984).

The red wolf was approved for a Species Survival Plan (SSP) by the American Zoo and Aquarium Association (AZA) in 1984. At that time, PDZA and four other facilities housed a total population of 63 animals. As captive husbandry techniques were refined and reproduction increased, preparations to initiate a reintroduction project in 1987 progressed. This historic first attempt to restore a carnivore species considered extinct in its former range generated tremendous interest in recovery of the species (Phillips et al. 1995). The zoological community demonstrated their support for the recovery program through commitment of and cooperation between facilities: by 1991 an additional 19 facilities had become participants in the Red Wolf SSP (RWSSP). Presently, 34 SSP approved facilities are involved in the RWSSP.

The cooperative captive-breeding effort and the collective expertise and resources provided by the RWSSP have been an integral part of the recovery program. As with all AZA SSPs, a comprehensive approach toward conservation is applied to the RWSSP. Population management, training, technology transfer to the field, and reintroduction of captive animals have all been equally important components.

Free-ranging wolves are currently distributed at two mainland release sites, eastern North Carolina and the southern Appalachians (see Figure 1). Starting with the initial release in September 1987 of four adult pairs in the Alligator River National Wildlife Refuge, North Carolina, 69 captive-born red wolves have been released and a minimum of 96 pups from 35 litters have been born in the wild. Currently 89% of the free-ranging population were wild born and they have successfully formed family groups and established territories. Although there has been occasional need to return wolves to captivity, some permanently, most have been re-released.

Support from private landowners—allowing the wolves access to private land—is paramount to the continued success of the reintroduction program in North Carolina. Of the eighteen verified packs that inhabit the eastern North Carolina release area, twelve currently occupy private lands and do so without any changes to how the land is managed. Incorporating larger corporate private lands and the addition of the Pocosin Lakes National Wildlife Refuge in 1993 have expanded the original reintroduction area to a total habitat base of approximately 550,000 acres.

The release project in the southern Appalachians is centered in the Great Smoky Mountains National Park (GSMNP). The project began in 1991 as a one-year experiment to provide opportunities to gather information on interactions of red wolves with coyotes, livestock and humans (Lucash & Crawford 1993). Findings resulted in a decision to proceed slowly with a full-scale reintroduction, evaluating results and problems as they occurred and modifying management accordingly. Since 1991, 37 wolves have been released at the GSMNP and 24 pups from six litters have been born in the wild, including 14 born this past spring. The number of free-ranging wolves has ranged from a high of 16 animals to none at all. Fluctuations in the population are due to mortality of adults and offspring, removal of animals with an unacceptable tolerance of human presence, movements out of the GSMNP, the release of new individuals, and reproduction in the wild (Weller 1995). While this project has proceeded slowly, the pace does not reflect any lack of effort by project biologists; rather, it demonstrates the social and political hurdles inherent in wolf reintroduction.

In addition to the mainland reintroduction efforts, there are three island projects coordinated by the FWS: Bulls Island, South Carolina; St. Vincent Island, Florida; and Horn Island, Mississippi. The primary purpose of the island projects is to give wolves some wild experience prior to release to mainland reintroduction sites. Other objectives include prey population control, public relations, and education in local areas—all of which could be beneficial towards laying the foundation for possible mainland reintroduction in the vicinity (Henry et al. 1995).

The RWSSP's role in the recovery equation has not diminished even as red wolves increase their numbers in the wild on their own, thus reducing total reliance on captive stock for release. The RWSSP will continue to be an integral part of recovery efforts through four different arenas. First, the RWSSP will scientifically manage the population and supply wolves for release when needed to add genetic vigor to the wild population or when additional reintroduction areas are identified. Second, the RWSSP will continue to support FWS field conservation activities at release sites. A third role will include working with the AZA Canid Taxon Advisory Group and Scientific Advisory Groups in areas such as genome banking and assisted reproduction, contraception, behavior and husbandry. Finally, the RWSSP will promote awareness of the red wolf through educational programs.

The partnership between the FWS and the AZA RWSSP has been critical to implementing strategies outlined for recovery of the red wolf. Clearly the program has changed since official recovery efforts began in the early 1970s. Now, as then, flexibility is required, but always with an eye toward recovery for the red wolf and the role this unique predator plays in the biologically diverse landscape of the southeastern United States.

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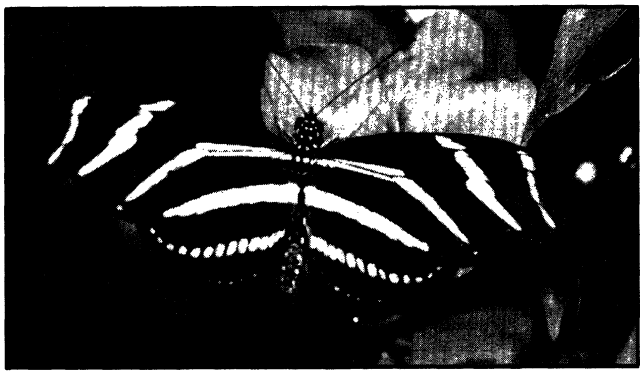
Conservation Spotlight: A Butterfly Ranch Takes Flight in Costa Rica

Butterfly ranching has proven to be a valuable conservation tool in several countries such as Papua New Guinea, where it is used as an economic incentive to protect wild butterflies and their rainforest habitat. This approach, however, has not been taken in other developing countries where very few of the numerous and prosperous butterfly farmers tie their product to the health of the surrounding eco-community. In fact, most butterfly farmers live and rear their crops in captivity, within the suburbs of large cities, ignoring the conservation potential of this 10-15 million dollar per year trade.

The Zoological Society of San Diego, in collaboration with the Xerces Society and support from the J. W. and Ida M. Jameson Foundation, has initiated a butterfly ranching program in Costa Rica which ties together economics, conservation and education. The site of the program is the small village of Barra del Colorado. The village is located along the Rio Colorado River in the wet, northeastern corner of Costa Rica and is accessible only by boat or air. While much of the economy of Costa Rica thrives on eco-tourism, economic opportunities in this remote area are few and the local economy has traditionally been entirely dependent upon fishing. As a result, the surrounding rainforest remains largely intact and is rich with wildlife, including many butterflies. The butterfly ranching program focuses on teaching butterfly ranching, opening a display to attract tourists, and funneling the money earned from tourism and exports back to the people of Barra del Colorado.

The design of the project allows for involvement of the entire community. Children are involved in the project because the butterfly ranch is being developed in collaboration with the local elementary school. Older residents of Barra del Colorado have been encouraged to plant nectar and host plants around their homes to draw butterflies from the surrounding rainforest. The process is then quite simple. The butterflies lay their eggs on the host plants. These eggs are collected and brought to the school in plastic petri dishes. The resulting caterpillars are placed on host plant cuttings maintained by the students. The caterpillars develop and eventually pupate, producing a collection of beautiful butterflies.

A live butterfly house with a walk-through display has been developed in hopes of making the community an eco-tourist destination for travelers taking wildlife tours in the canals reaching out from the Tortuguero National Park to the south. Participants in the program plan to produce enough butterflies to stock not only the school's butterfly house, but also to export pupae internationally for income. The variety of customers includes scientists for research, interior decorators using butterflies for decoration, and private collectors buying and trading perfect specimens as others do rare stamps and coins. Most significantly, the pupae can be sold to zoos and aquariums and other public attractions that exhibit live specimens for education and appreciation.


The zebra butterfly (*Heliconius charitonia*) is a distinctive species in the rainforests near Barra del Colorado. Photo by Paul Spade.

The butterflies' delicate nature, striking beauty, and interesting behaviors make them perfect ambassadors for conservation of important rainforest habitat. Collaboration with the local school in Barra del Colorado provides an excellent opportunity to educate tomorrow's leaders in the community about the importance and long-term value of their rainforest assets. The display of their product in the zoos and aquariums of the United States provides another, equally important, opportunity: to show the people of a developed, consumption-oriented country the results of a community-based program for economic development and environmental protection.

Today, the school in Barra del Colorado has a butterfly house and the beginnings of educational curricula on conservation. Additionally, income from the butterfly ranching project has funded better lights in the classrooms and books for use by the students. (*Excerpted from J. Bowdoin, AZA Communique May 1995*)

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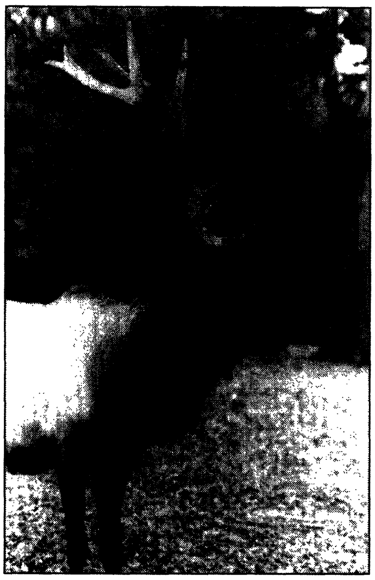
NEWS FROM ZOOS

Photo courtesy of Audubon Institute

Audubon Center for Research of Endangered Species

The Audubon Institute opened the Audubon Center for Research of Endangered Species (ACRES), located in New Orleans, LA, in June 1996. ACRES is a state-of-the-art science research facility focusing on the protection and propagation of endangered wildlife. The Center provides research labs for reproduction study, molecular genetics and cryobiology as well as a computer-linked research information bank and resource library, a veterinary clinic, and an animal health and research center. ACRES will be headed by Dr. Betsy Dresser. Partial funding was provided by the U.S. Fish and Wildlife Service (FWS) and one of the center's leading laboratories is named after the late Mollie Beatty, former director of the FWS.



Elk (*Cervus canadensis*)
Photo by Michael Hutchins

North American Faunal Interest Group Formed

A petition to form a North American Faunal Interest Group (NAFIG) has been approved by AZA's Wildlife Conservation and Management Committee. Based on the Faunal Interest Group (FIG) concept, which focus the AZA's conservation programs on biologically diverse areas of the world, NAFIG would emphasize conservation activities "in our own backyard." Specific NAFIG responsibilities would include promoting stewardship of native North American ecosystems and fauna, providing a strategic planning forum for joint development of conservation programs, promoting alliances and facilitating cooperation among AZA institutions and state and federal agencies, and serving as an information clearing house.

Conservation Award Recipients Named

Recipients of AZA's conservation awards were announced at the AZA's 72nd Annual Conference held 16-21 September 1996 in Honolulu, Hawaii. The top Conservation Award went to Lincoln Park Zoo in Chicago, Illinois, for their "Lincoln Park Zoo Scott Neotropic Fund," which provides direct support to wildlife conservation in Latin America and, to date, has supported over 86 projects in 17 countries. The Lubee Foundation, Inc. received a Significant Achievement Award in Conservation for their "Old World Fruit Bat" conservation program. The Foundation supports research in many areas including reproduction, ecology, conservation and clinical veterinary medicine as well as field research on endangered species in the Philippines, New Guinea and Malaysia. A National Conservation Award was presented to the Bronx Zoo/Wildlife Conservation Society for their reintroduction of black howler monkeys (*Alouatta caraya*) in the Cockscomb Wildlife Sanctuary in Belize, where the monkey has been locally extinct since 1978. While it is too soon to make any conclusions, this reintroduction effort has shown promise of howler monkeys establishing a viable population in this region. The National Aquarium in Baltimore also received a National Conservation Award for their "Project Reef*Action*" conservation program, a multifaceted, holistic conservation program designed to raise public awareness about the importance and plight of coral reefs.

(Walley continued from p. 9)
vices. The Keystone Report, which resulted from a dialogue between FWS officials, developers and scientists, raised this same issue. Participants stated that there was a "concern about the application of the "No Surprises" policy to unlisted species if there is no later opportunity to review whether the HCP has contributed to the decline of the species if the species is subsequently listed" (Keystone Center 1995, p. 25). Simply put, there is no conceivable way the Services can know that mitigation measures in an HCP will adequately protect a species which has been subjected to little or no scientific scrutiny prior to listing.

Addressing Change

A second gaping flaw, related to the biological and political reality of changing circumstances, is the issue of how to address change in the HCP process. A logical response to changing circumstances would be to revise the management of the HCP in response to these changes, an approach commonly referred to as "adaptive management" (See Soule 1996). However, the "No Surprises" policy simply "close[s] the door to adaptive management by saying that, once an agreement is made, new and better scientific information will not alter it" (Soule 1996) except in the unlikely event that the landowner agrees to new restrictions or the event that the Services can afford to finance the alterations themselves.

Process Considerations

The "No Surprises" policy also undermines the right of affected individuals, conservation groups, and scientists to comment on whether, and under what circumstances, an ITP/HCP will be issued. Since the policy provides that "no surprises" guarantees will be included in every HCP, regardless of circumstances, it effectively forecloses the public's ability to comment on whether such a guarantee is biologically advisable or damaging in any particular circumstances. For example, commentators criticized the application of the "No Surprises" policy to the NCCP and HCP because it restricted the FWS's "no jeopardy" duty under section 7 of the ESA. The FWS responded to this criticism by summarily stating that the HCP accurately reflects the FWS's new policy.

It is difficult to comprehend why the Services have not at least retained the regulatory flexibility to determine, on a case by case basis, whether a "no surprises" guarantee will further the purposes of the ESA in any particular instance. Instead, the agencies have, in effect, "shown their cards" before even entering into negotiations with those wishing to "take" endangered or threatened species. In other words, the policy effectively forfeits the use of a "no surprises" assurance as a bargaining chip to secure better conservation commitments because it *mandates* that *all* landowners will have the benefit of these assurances irrespective of the conservation commitments they are willing to make. Individuals now come to the bargaining table expecting that these assurances will be given by the FWS. They may even demand that these assurances will cover any species that exists, or may exist, on the land in question. Hence, the policy not only forecloses case by case public input into the degree to which particular HCPs should be susceptible to new mitigation measures, but it also ties the hands of the agencies' own biologists and other officials in negotiating meaningful, biologically sound HCPs.

Conclusion

Secretary Babbitt stated one year ago that "[i]f sound science and wise management of our natural resources guide our actions, we will benefit not only threatened and endangered species, but the human species as well" (Babbitt 1995, p. 13). However, as the "No Surprises" policy now stands, it ignores the most basic of biological principles, that nature is anything but predictable; fails to allow for the incorporation of the best scientific information into HCPs; strips the public of the ability to offer meaningful comment on HCPs; and gives away one of the Services' major bargaining chips even before the parties reach the table. Thus, if "sound science and wise management" are truly to guide the government's actions, the "No Surprises" policy, in its present form, must be abandoned.

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Bulletin Board

New Endangered Species UPDATE Format

Starting with the first issue of 1997 the Endangered Species UPDATE will change to a bimonthly format. We regret having to reduce the number of issues per year, but the change was necessitated by financial constraints and we preferred not to raise the subscription charge at this time. The change will also align our publishing schedule with the schedule of the Fish and Wildlife Service's Endangered Species Bulletin, which comes out bimonthly.

Subscribers may notice that their renewal date has changed also. We have added one or two months to each renewal date in order to ensure that each subscriber receives the eight issues promised, and also to make each renewal month coincide with a publication month.

On a positive note, we now have an email address (esupdate@umich.edu) and an operational world wide web page. The page is still under construction, but can be accessed for current and back issue articles and links to other endangered species sites. Readers can also email us directly from the web page, which is at http://www.umich.edu/~esupdate.

Eastern Cougar Conference Proceedings Available

The Conference Proceedings for the Eastern Cougar Conference, held in 1994, is the first major publication relating to the eastern cougar in the past twenty five years. It includes discussions of cougar management, public attitudes, recovery and restoration, genetics, and feline melanism. Geographic areas addressed include the southern Appalachians, Wisconsin, the Great Plains, the Great Lakes, Florida, Pennsylvania, the Western United States, and Canada. The volume is available for $29.95 from the American Ecological Research Institute (AERIE), P.O. Box 380, Fort Collins, CO 80522.

Conservation of Faunal Diversity

A new publication, *Conservation of Faunal Diversity in Forested Landscapes*, focuses on the influence of current environmental changes on forest fauna. Editors R. M. DeGraaf and R. I. Miller bring together knowledge and experience of conservation scientists worldwide. Status of key forest vertebrates, effects that environmental change exerts upon these populations, and evidence for changes in forested ecosystems are highlighted. Several chapters focus on current methods used for verifying impacts of change and disturbance on forest wildlife. Finally, the integration of landscape ecology and its application to forest wildlife conservation is demonstrated. The publication is available for $59.95 from Chapman & Hall, 115 Fifth Avenue, New York, NY 10003; Tel: (800) 842-3636.

Rare Plant Conference

The 1997 Midwestern Rare Plant Conference will be held February 19-21, 1997 at the Missouri Botanical Garden in St. Louis. The conference provides a forum for exchanging research results on rare Midwestern plants, setting regional plant conservation priorities, and developing and implementing collaborative plant conservation projects in the Midwest. For further information, contact Dr. Kayri Havens, Missouri Botanical Garden, St. Louis, MO 63166; Tel: (314) 577-9487; email: havens@mobat.org.

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

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