Endangered Species UPDATE

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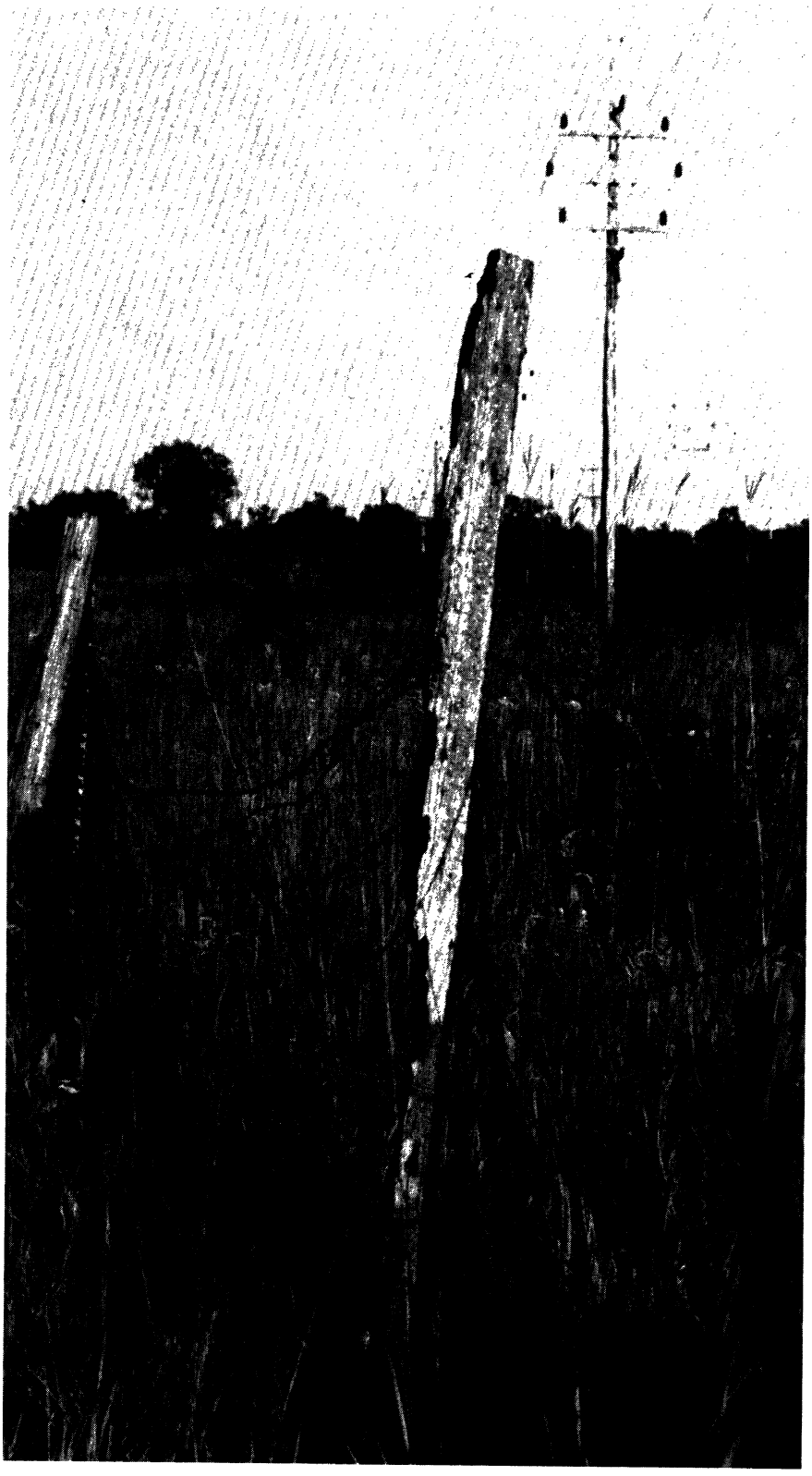
THE UNIVERSITY OF MICHIGAN
School of Natural Resources



In this Issue:

The Role of Restoration in Conservation Biology

by Evelyn Howell

As modern civilization continues to gain more influence over the earth's natural systems, conservationists are finding it increasingly difficult to focus only on pristine environments. Indeed Soulé predicts that "the scavenging and rehabilitation of degraded places may become the dominant activities of conservationists in the 21st Century" (Proceedings Conservation 2100 Conference manuscript). The reestablishment of habitat has, of course, long been considered an important tool in species preservation and management. In recent years, restoration efforts have spawned a movement that has supported several national conferences (notably the "Restoration Symposium", Madison, Wisonsin, 1984 and the "Restoring the Earth" Conference, Berkeley, California, 1988), the Restoration and Management Notes Journal, and a professional organization, "The Society for Ecological Restoration". Given this interest as well as the continued loss of existing natural systems, it is useful to explore the links between restoration and conservation, and to consider both the problems and opportunities in the use of restoration to preserve and manage biological diversity.

The terms "conservation," "restoration," and "preservation," although generally understood, do not have consistent meanings in the literature. Therefore, it is helpful to establish a framework before proceeding with the discussion. "Conservation" is here considered to be the broadest concept, referring to a large set of activities undertaken to ensure the continuance of natural selection and its products. These products can be landscapes, ecosystems (a concept that implies attention to the interactions of components), communities, species, populations, or even functions and processes.

photo by Robin Loznak

Restorations may function as barriers to the invasion of unwanted species and provide microclimatic protection for species in the interior.

Conservation activities can be thought of as comprising a continuum on which "preservation" is at one end and "restoration" at the other. "Preservation" activities apply to situations in which most of the desired products are present, for example, an unplowed, ungrazed prairie or an oldgrowth stand of timber. "Restoration" in contrast applies to situations in which most of the desired products are missing. Examples include: the creation of a prairie in an abandoned horse pasture (Curtis Prairie, University Arboretum), the reestablishment of salt marsh along coastlines disturbed by dredging and construction (Jordan 1983), the reshaping of river channels (Glass 1987, Holtz 1986), the reestablishment of understory in a grazed woodlot (Howell 1986), reintroduction of extirpated species (Morton 1987), and the revegetation of denuded mined sites (Bradshaw 1986). Both preservation and restoration involve "hands-on" approaches, dynamic long-term commitments, and active management.

Most restoration efforts to date have been at the level of the "community," and most have involved plants. Three general approaches have been used that differ in the degree to which they resemble natural models. Scientific restorations (also called "restorations of form", Cairns 1986) attempt to establish complements of native species that

mimic as closely as possible the patterns, abundances, proportions and relationships of pristine communities. The assumption is, that in so-doing, natural selection and other community functions and processes will continue. Functional restorations ("restoration of services", Cairns 1986) establish processes similar to those performed by natural communities; however, the vegetation structure and composition do not necessarily replicate those of natural communities, and in some situations, the species are not necessarily natives. With this approach, individual species are not as important as the life-forms (shrubs, trees) or roles (nitrogen-fixer, spring bloomer) which they represent. Aesthetic restorations establish the "visual essence" (Morrison 1975) of natural communities, often using a simplified array of species. Showy species or those visually prominent because of size or unusual form predominate.

Plant community restoration can be considered a conservation effort in and of itself, or, if the functional approach is taken, as a tool for the protection of individual species through the creation of habitat (Soulé Proceedings Conservation 2100 Conference, Cairns 1986, among others). In either event, the use of restoration as a tool for the protection of biological diversity has great promise. The opportunities , however, must be viewed with some caution given the current limitations of restoration ecology.

Constraints . . .

Four areas in particular are problematical and need attention before restoration is widely promoted as an avenue for the protection of endangered resources.

Unpredictable-Incomplete Results

The field of restoration is still in its infancy. Much work needs to be done before practitioners can be confident of meeting their goals. Most restorations are accomplished with little or no documentation and with no provisions for monitoring longterm results. Consequently, it is difficult to determine what leads to success or failure, and it is risky to rely only on the successful creation of habitat in any particular instance.

Plant community restorations have been established on a variety of sites and at a variety of scales (Howell 1986; Kline and Howell 1987). They have succeeded, at least in the short term, in increasing the number and coverage of native species. It is less clear, however, that they have reestablished community processes or that the plantings will persist and reproduce. Much remains to be learned, particularly with regard to the establishment of conservative species and community dynamics (Kline and Howell 1987).

Plant community restorations that have been started from scratch, in areas containing few desired species, soils having exotic seed banks, or in which no soil is present (such as mine tailings) do not completely resemble their natural models. They often lack diversity and/or are characterized by species patterns and abundances unlike those of pristine areas. To some extent, this situation is a result of our lack of knowledge about the workings of communities and the restoration process (Ashby 1987, Kline and Howell 1987). However, it is also true that implementation procedures driven by limited time, budgets, and plant material availability affect the results (Cottam 1987).

Two of the oldest prairie restorations in the United States, Curtis and Greene Prairies at the University of Wisconsin Arboretum, are 50 and 40 years old respectively, a relatively short time given the age of natural remnants. Greene Prairie was planted by a single individual with careful attention to nuances of microclimate; Curtis Prairie was less precisely designed. Although both prairies have diversities comparable to known remnants, Greene Prairie has densities and distribution patterns much more in keeping with natural models (Cottam 1987). Change is still occurring in both areas and is expected to continue (Blewett 1981). It is possible that, in time, both will approach truly "natural" conditions.

Endangered Species
UPDATE

A forum for information exchange on endangered species issues

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Instructions for Authors:

The Endangered Species UPDATE welcomes articles related to species protection in a wide range of areas including but not limited to: research and management activities for endangered species, theoretical approaches to species conservation, and habitat protection and preserve design. Book reviews, editorial comments, and announcements of current events and publications are also welcome.

Readers include a broad range of professionals in both scientific and policy fields. Articles should be written in an easily understandable style for a knowledgeable audience. Manuscripts should be 9-12 double spaced typed pages. For further information please contact Kathryn Kohm at the number listed below.

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Cover:

Shanghai Prairie in
Washtenaw County Michigan

Photo by Bob Grese

If restoration is to become a viable conservation tool, careful, long-term research and documentation is necessary to increase our knowledge and make restoration efforts more reliable.

Restoration as a Mitigation Tool:

The fact that restorations are possible has led to an interesting dilemma in that some people are tempted to view the destruction of natural areas with less alarm. Mitigation agreements increasingly grant development rights in one area for the promise of the restoration of communities in another. Given the unreliability of restoration efforts to date, such tradeoffs are to be avoided. Restoration should be viewed as a complement to, not a substitute for, preservation. As such, restoration should be attempted only if doing so does not use resources that could otherwise be used for preservation.

The Ecotype Question:

The recent interest in plant community restoration has led to a situation in which the demand for native plant materials is beginning to exceed the supply. Most practitioners attempt to use local natural seed sources in order to best ensure the survival of the plantings. However, when project demands exceed supply, many turn to distant suppliers of mass-produced material. This leads to the "ecotype question" (Schwarzmeier 1973)—the concern that: a) nursery-grown plants of distant origin may be overly aggressive in plantings and form monotypes; b) large numbers of these individuals may swamp the gene pool of endemic populations of the same species, or c) hybrids may develop which change the ecological relationships of the community. Experience in using Nebraskan nursery-grown strains of *Panicum virgatum* in Wisconsin indicates that at least the first concern has some merit. In several Madison-area prairie plantings, the Nebraskan strains have outcompeted native *Panicum* and excluded other species as well. It is a concern that plantings with such nursery stock may in the long run prove more detrimental to native remnants than plantings of non-related exotics. Large-scale habitat restorations must consider this and other problems of supply.

Single-Issue Solutions:

A concern in any project which focuses on the conservation of particular species is that attempts to manage populations inevitably affect other ecosystem components. As a result, situations can arise in which other species are endangered even as the target species prospers. A prime example is the management of deer herds in the upper Midwest which is thought to negatively affect the regeneration of hemlock. In short, conservation efforts of any kind that are single-issue oriented should be viewed with caution.

For this reason, attempts at functional restorations, especially those accomplished with a simplified array of species, even though they may be successful, should not be used as a substitute for the more-difficult-to-establish, more complete habitat restorations.

Opportunities . . .

Despite the drawbacks of restoration as a conservation tool, several important opportunities exist. These include, but are not limited to, the four areas of interest discussed below.

Restoration of Remnants:

Plant communities that have been restored on sites retaining the skeletons of natural conditions have fared better than projects started from scratch. For example, Holtz and Howell (1983) document the return of prairie to a former oak barrrens site after the oak woods that had invaded the area following European settlement was cut and burned. Five years after this restoration attempt, more than 65 forb and 13 grass species covered the area. A similar example is described by Vogl (1964). Species composition, patterns, and structure in such restored remnants closely resemble those of pristine conditions. Given limited resources, it might be advisable to concentrate restoration efforts on those situations in which success appears most likely. In general, the more native species and the fewer exotic species present, the better, and the more that the human-caused disturbance has resembled "natural" disturbance patterns (fire frequency, for example) the better. Many such opportunities exist, ranging from grazed woodlots to mowed highway rights-of-way.

Selection of Habitat Type:

In the same way that it is useful to select potential restoration sites based on the probability of success, creating habitat for particular species requires attention to the degree to which an increase in habitat is related to conservation success (Rabinowitz *et al*, 1986). It would seem that conservation by means of habitat restoration would be most easily accomplished either for species with limited ranges and narrow requirements, or for those with small area requirements and wide ranges of tolerance to environmental conditions. Similarly, relatively sedentary species such as perennial plants would be easier to protect than those which spend time or life stages in many different habitats. Exceptions to this would be situations in which habitat restoration is required for only one or two weak links in the chain, or the related situation in which the establishment of corridors between existing sites accomplishes the objectives.

Species which might prove particularly challenging are those requiring ephemeral vegetative conditions—those arising after a disturbances such as windthrow and fire. Although it is possible through management activities to simulate such conditions, being able to provide them in the requisite pattern and frequency is more problematic. Restorations provide opportunities to recreate such conditions without interfering with the management of relatively intact remnant communities.

Restoration of Buffer Areas:

One of the major issues facing conservation biologists is the need to conserve large, contiguous plots of land (Westman 1985) in a condition as free

(continued on Update page 4)

as possible from the affects of modern civilization. This need has been defended on the basis of both the provision of maximum species diversity, and the preservation of species confined to the interior of communities. Given the isolated condition and relatively small size of most existing pristine areas, the restoration of buffer zones around them may greatly enhance their ability to function as reserves. Restorations may function as barriers to the invasion of unwanted species and provide microclimatic protection for species in the interior.

Restoration of buffer areas may prove to be the most important use of this conservation tool. It potentially greatly increases the land available for reserves. However, it is particularly important in such cases to consider the "ecotype question" discussed above in order to not endanger the continuation of the very remnants the restorations are designed to protect.

Research and Education:

Attempts to restore habitat provide insight into natural ecosystem processes and can provide valuable sites for research and education. Bradshaw (1987) even considers restoration to be "an acid test for ecology"—a means to demonstrate what we know and don't know about ecosystems. Management manipulations on restored sites can be made with less caution than is necessary on pristine sites, and success and, to an even greater extent, failure become opportunities for learning. Of course this value should not come at the expense of conservation. Research opportunities need to complement, not replace species preservation.

Common Goals:

Conservation biologists and restoration ecologists share the common goal of protecting biological diversity. Restorationists have worked primarily at the level of communities and dealt with highly disrupted systems; conservation biologists have usually focused on species and populations. The work of the two groups is complementary. Given the continuing destruction of natural systems, it is important to have several conservation approaches available as opportunities arise. However, the scarcity of time and money available for such efforts necessitates the setting of priorities. To insure success, the preservation of pristine units (species, communities, etc.) is the strategy of choice followed by the restoration of disturbed remnants. The restoration of species or communities starting from scratch is perhaps the least attractive alternative, but one that will likely become increasingly important.

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Book Review

Biodiversity

Edited by E.O. Wison

In tropical forests, on coral reefs, and in threatened habitats, countless plant, animal, and microbial species face possible extinction - their names unknown, their numbers uncounted, their value unreckoned. Although popular attention has focused on the plight of more visible and widely known species - the whooping crane or the African elephant, for example, most experts agree that the loss of less obvious organisms could be much more devastating. This is the subject of Biodiversity, a new book for scientists and nonscientists alike. It calls attention to a most urgent global problem: the rapidly accelerating losses of plant and animal species to increasing human population pressure and the demands of economic development.

Based on a major conference sponsored by the National Academy of Sciences and the Smithsonian Institution, Biodiversity creates a systematic framework for analyzing the problem and searching for possible solutions. The book explores biodiversity from a wide variety of viewpoints. Chapters by Harvard entomologists E.O. Wison and population biologist Paul R. Ehrlich of Stanford University provide overviews of what biodiversity is and why its preservation has become a critical problem.

Other chapters examine differing estimates of current rates of species loss and consider how humans depend on plant species for foods and drugs. There are also chapters that describe how modern reproduction technologies are being mobilized to breed rare and endangered animals; the roles of zoos and botanical gardens in species preservation; the development of economic and conservation policies to protect diversity; and the contributions - past and potential - of the emerging science of restoration ecology.

The volume concludes with an exploration of the aesthetic and cultural values of biodiversity, with essays by a Christian theologian, a Hopi Indian, a San Francisco poet, and a scientist, James E. Lovelock, creator of the Gaia Theory.

Biodiversity is largely a nontechnical presentation of the many complex issues related to biodiversity. The volume is divided into twelve topic areas:

- Challenges to the Preservation of Biodiversity
- Human Dependence on Biological Diversity
- Diversity at Risk: Tropical Forests
- Diversity at Risk: The Global Perspective
- The Value of Biodiversity
- How is Biodiversity Monitored and Protected
- Science and Technology: How Can They Help?
- Restoration Ecology: Can We Recover Lost Ground?
- Alternatives to Destruction
- Policies to Protect Diversity
- Present Problems and Future Prospects
- Ways of Seeing the Biosphere

As a whole or by individual sections, this volume will be a valuable, timely resource for everyone concerned about mankind's impact on and relationship to the myriad other species with which we share the Planet Earth.

Biodiversity: the Videotape

The concluding session of the National Forum on Biodiversity was a 2-hour long teleconference, relayed via satellite to more than 100 sites throughout the United States. The 45-minute videotape, adapted from this teleconference, opens with an introductory film clip that provides an overview of biological diversity. The balance of the videotape consists of discussion among the teleconference panel. They review the biodiversity problem, discussing the causes of the crisis; the importance of biodiversity to human welfare; and the steps being taken - as well as the steps still needed - to control the rapidly escalating rates of habitat destruction and species loss, and to repair at least some of the damage. The teleconference panel consisted of E.O. Wilson of Harvard, Peter H. Raven, Director of the Missouri Botanical Garden; Thomas E. Lovejoy, World Wildlife Fund - U.S., Michael H. Robinson, Director of the National Zoo, Joan Martin-Brown, United Nations Environment Programme; and Paul R. Ehrlich, of Stanford University.

The book and videotape are available from the National Academy Press, 2101 Constitution Ave. NW, Washington D.C. 20418. The paperbound book costs $19.50, the videotape costs $24.50, and the book and videotape set costs $37.40.

Using the Endangered Species Act to Resolve Conflict Between Habitat Protection and Resource Development

by Dennis D. Murphy and Kathy E. Freas

The bay checkerspot butterfly, (*Euphydryas editha bayensis*), was listed by the U.S. Fish and Wildlife Service as a "threatened species" on September 20, 1987. The listing, seven years after receipt of a citizen's petition, ended one of the most protracted listing battles since passage of the Endangered Species Act.

A positive consequence of the resolution of the controversy is a conservation agreement among the U.S. Fish and Wildlife Service, Waste Management of California, Inc., and the City of San Jose. This plan, designed and implemented more than a year before formal listing of the species, uses provisions of Section 7 of the Endangered Species Act, and relies on extensive biological information already available on the butterfly. The agreement, which allows development of an extensive landfill operation and provides for the protection of bay checkerspot habitat on the same site, serves as a model which may guide resolution of future conflicts between endangered species protection and urban land development.

Primary habitat of the bay checkerspot is provided by large areas (>800 acres) of topographically heterogeneous outcrops of serpentine-derived soils and its associated grassland community in the San Francisco Bay Area of California. These large habitat islands support what have been termed "reservoir populations" of the butterfly which are sufficiently robust to persist through periods of environmental stress (drought) which predictably occur several times in a century. Smaller secondary habitat islands support "satellite populations" which, because of their size, are more vulnerable to environmental variation and are subject to extirpation on a scale of decades. Together, reservoir and satellite populations form a mosaic distribution, collectively referred to as a "metapopulation" that shifts temporally through the habitat. Satellite populations which go extinct may be recolonized by individuals from nearby reservoir populations.

Two decades of habitat fragmentation concomitant to the expansion of Bay Area suburbs and the freeways that link them, and several drought years pushed the bay checkerspot to the brink of extinction. Two metapopulations of the bay checkerspot butterfly remain; one each in San Mateo and Santa Clara Counties. The San Mateo reservoir population has been greatly fragmented and the likelihood of long-term persistence of that population is low. This leaves the metapopulation in Santa Clara County, centered at Kirby Canyon ,as the only population of the butterfly likely to persist. At this very location, Waste Management, Inc. sought permit for one of the largest sanitary landfills in North America.

The proposed landfill required construction of freeway access, necessitating involvement of the Federal highway Administration. Section 7 of the Endangered Species Act requires Federal agencies to ensure that activities which they authorize are not likely to jeopardize the continued existence of a listed species or destroy or adversely modify its habitat. Treating the butterfly as a listed species, Waste Management, Inc. and the City of San Jose initiated a plan designed to minimize alteration of critical habitat to assure that the landfill did not jeopardize the *Euphydryas* population. The plan includes the creation of "The Kirby Canyon Habitat Conservation Trust Fund" into which Waste Management, Inc. deposits $50,000 annually to fund conservation of the butterfly. Other elements of the program include: 1) ongoing biological research designed to provide monitoring data and guide program design; 2) habitat acquisition, including land set aside to conserve the highest quality butterfly habitat adjacent to the landfill; 3) habitat management concentrating on a grazing regime that favors the grassland successional stage that maximizes the density of the larval host plants of the butterfly; 4) restoration and revegetation activities following completion of land fill activities; and 5) offsite recovery, including attempts to reintroduce bay checkerspot butterflies into unoccupied, but suitable habitat patches nearby. After extensive consultation, the plan was approved by the USFWS on June 15, 1986, more than a year before the formal listing of the butterfly as a threatened species.

The probability of success of the plan is enhanced by three factors. First, the area disturbed for the landfill (467 acres) represents only 15% of the total butterfly habitat at this site (3365 acres). Second, development of the landfill will disturb no more than 150 acres at any one time. Third, butterfly survival is higher on cooler slope exposures within the habitat. Because the landfill is situated primarily on warmer slopes which are less favored by the butterfly, only 5-9% of the best quality habitat will be disturbed by the landfill.

The great likelihood of the success of this agreement reflects the ecological characteristics of the target species and the geographic scale of the land use planning involved. The importance of detailed studies of the population ecology of the butterfly and recognition of the role of specific demographic units within the regional metapopulation of a species are underscored in this situation. Incorporation of these considerations and use of existing legislation designed to protect species make this agreement a valuable model for resolution of protection and development conflicts, especially in urban corridors.

Bulletin Board

1st International Symposium on the Spectacled Bear

The First International Symposium on the Spectacled Bear will be held at the Lincoln Park Zoo, Chicago, Illinois on October 14-15, 1988. Topics focusing on current field studies and captive management/reproduction of the spectacled bear will be highlighted. For further information contact Mark Rosenthal, Curator of Mammals, Lincoln Park Zoo, 2200 N. Cannon Drive, Chicago, Il 60614, (312) 194-4660.

National Collection of Endangered Plants Brochure

An attractive brochure is available to clubs and individuals who would like more information on how to sponsor a species in the National Collection of Endangered Plants. It answers questions about the National Collection and describes the benefits a sponsor receives. The brochure is also suitable as a handout or for display with an endangered species exhibit. To obtain copies, write or phone the Center for Plant Conservation at 125 The Arborway, Jamaica Plain, MA 02130-3520 or (617) 524-6988 for a free supply for your organization.

Captive Breeding Training Program

The International Training Center For The Captive Breeding of Endangered Species, operated by the Wildlife Preservation Trust, is offering a program designed to train individuals in the techniques of captive breeding of a variety of endangered animal species. The International Training Center is an educational facility for training in captive breeding and species conservation; it combines dormitory, classroom, and research facilities for students, staff, and visiting scientists. The program consists of six, ten, or sixteen weeks of intensive work in all divisions of the zoo. Trainees work side-by-side with zoo staff on a daily basis. They also participate in weekly seminars on topics ranging from pathology to animal behavior to zoo design. The program is designed for individuals with previous practical experience with animals: zoo and animal center staff and postgraduates in conservation-related fields. Starting dates may be arranged. Applications are due by June 1st and may be obtained along with further information from: Training Program, Wildlife Preservation Trust International 34th Street and Girard Ave., Philadelphia, PA 19104, (215) 222-3636.

Announcements...

for the Update Bulletin Board are welcome. Send materials to: The Endangered Species Update, the School of Natural Resources, The University of Michigan, Ann Arbor, MI 48109-1115

Summer Course on Captive Breeding

The International Training Center For The Captive Breeding of Endangered Species will also be offering a summer course July 30 to August 20, 1988 on the role of captive breeding programs as an aid to conservation. This year's course will provide an introduction to many practical aspects of captive management and supply detailed information relevant to conservation. The program is intensive and includes lectures and discussions, practical instruction, and the research, preparation, and presentation of individual projects using Trust facilities for behavioral observation, laboratory investigation, record research and reference material. Application deadline is April 30. For more details contact: Summer School Coordinator, Jersey Wildlife Preservation Trust, Trinity, Jersey, Channel Islands, British Isles.

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