

# Endangered Species UPDATE

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# A Reintroduction Program for the Conservation of the Black Howler Monkey in Belize

by

Robert H. Horwich, Fred Koontz, Ernesto Saqui, Hermelindo Saqui and Kenneth Glander

The reintroduction of black howler monkeys (*Alouatta pigra*) into the Cockscomb Basin Wildlife Sanctuary (CBWS) in Belize was considered as part of a broader effort to conserve the species. The goal was to re-establish a viable population of *A. pigra* in the Cockscomb Basin (a fully protected area where the species had become locally extinct in 1978) by transferring wild-caught animals from the Community Baboon Sanctuary, an area about 100km north of the Cockscomb Basin that contains a healthy population of howlers. The establishment of the CBWS area as a protected area with its recent enlargement to over 100,000 acres created a situation of safety for the species from hunting which caused its earlier local extinction.

The project was preceded by a careful investigation including a trial of the capture technique, a survey of howler populations and habitats surrounding the area of reintroduction, a survey of the availability of food resources and a study of the phenology of the food resources, before a decision was made to proceed with the reintroduction.

## Black Howler Status and Conservation in Belize

While once thought to be a subspecies of the mantled howler (*Alouatta palliata*) which ranges throughout Central America, increasing morphological, behavioral and genetic evidence has defined *A. pigra* as a separate species (Smith 1970; Horwich 1983; James, pers.comm.). Due to its limited range within the Yucatan Peninsular area in southern Mexico, northern Guatemala, and Belize, the species is listed as "threatened" under the U.S. Endangered Species Act, Appendix II of CITES, and "insufficiently known" by IUCN (Wolfheim 1983; IUCN 1990). Although its range has been shrinking into isolated

islands (Horwich and Johnson 1984, 1986) there are still healthy, growing populations in Belize.

One of the most populated areas for the black howler occurred on private lands of subsistence farmers along the Belize River in Belize. The Community Baboon Sanctuary was thus established, on the premise that only a limited amount of tropical forest can be maintained in its pristine state, and that management practices of private lands under slash and burn cultivation could insure a better environment for the howler monkeys (Horwich and Lyon 1987). The program included seven basic steps which interwove four main goals of conservation, education, research, and tourism (Horwich 1989, 1990). History and details of the program are reported elsewhere (Horwich 1986, 1988, 1990; Horwich and Lyon 1987, 1988, 1990).

Since the Community Baboon Sanctuary was on private lands which

were not totally protected, and since there were no major howler populations on totally protected lands in Belize, a reintroduction of howlers into CBWS was considered as early as 1986. At that time, the project proposed to research a method for translocating howlers and to highlight Cockscomb for both conservation and ecotourism.

However, a survey in March 1991 of known howler habitats in the vicinity of Cockscomb Basin indicated few howlers and a major threat to all rain forests in the area from a rapid expansion of the citrus industry. One small howler population was noted along the Sittee River, in an area only about 10km from the northern boundary of the Cockscomb, but we concluded that the location made these monkeys unlikely migrants into the Basin because of intervening higher areas, >300 meters, altitudes that seem to be avoided by *A. pigra* (Horwich and Johnson 1986). Two howlers were re-



Female black howler monkey (*Alouatta pigra*) carrying infant while foraging. Photo by Jon Lyon.

ported in 1990 to have lived for about a year near Maya Center, a village situated 9km from the sanctuary's eastern boundary, and were thought to have dispersed from the same small population along the Sittee River by outskirting the high Cockscomb Basin's perimeter. These two animals eventually disappeared; one animal was killed by villagers, the other moved east, away from the Basin (Saqui, pers. obs.). No other black howlers have been reported in the area, nor have any howlers been seen inside the Basin since 1978 (Saqui, pers. obs.; Kamstra 1987).

*Alouatta pigra* is not confined to undisturbed rain forest as was once thought (Smith 1970) but can utilize all successional stages of forest including secondary growth (Horwich and Johnson 1984). The species is highly arboreal, and does not normally travel on the ground, preferring to use aerial pathways. This arboreality makes natural recolonization of disturbed areas difficult or slow at best even when impediments to their survival have been removed as in Cockscomb Basin.

There is a wide variety of reasons to relocate animals, from conservation to compassion (Caldecott and Kavanagh 1983; Campbell 1980). Although rapid forest destruction may be making translocation an unrealistic prospect in many areas (Strum and Southwick 1986), it is still possible in Belize. Since the basic points for reintroduction at Cockscomb were met (Konstant and Mittermeier 1982; IUCN 1992), reintroduction through the translocation of wild animals was deemed a necessary alternative to natural recolonization.

Because howlers are adaptable to small areas and can utilize all ages of forests, reintroduction becomes a distinct possibility once an area has been made safe for them from hunting and major forest cutting. It can also be used when areas become too minimal and when major forest destruction can be foretold. Since howlers can be successfully captured with a very low mortality rate (Glander et al. 1991) and since a great deal of food choices have been recorded, reintroduction has great future potential (Strum and Southwick 1986).

## Previous Howler Reintroductions

Despite the favorable possibility of reintroducing howlers, few reintroductions have been carried out (Konstant and Mittermeier 1982). Only 8 species of primates have been translocated with only 3 studied following the translocation (de Vries 1991). *A. palliata* has been successfully captured and marked in a number of situations in Costa Rica (Scott et al. 1976; Glander et al. 1991) and Mexico (Estrada, pers. comm.; Garcia-Orduna et al. 1987; Silva-Lopez, pers. comm.). In Mexico, Garcia-Orduna et al (1987) have moved a troop which was captured in an area of forest which was slated for destruction. The troop proved to be so disease-ridden due to its already deteriorated environment, that they were kept in captivity for a number of months (Silva-Lopez, pers. comm.) but have since been released on an island.

A serendipitous translocation of *A. pigra* was believed to have occurred in Belize. An informant noted that two juveniles were captured and escaped in an unpopulated area which is not very favorable habitat. However, they survived for two years and the informant noted that they are now breeding.

Red howlers have been translocated on large scales in Venezuela and Suriname to rescue them from flooded areas. However, in both cases there was no follow-up to measure the success of the reintroductions (Konstant and Mittermeier 1982).

A recent translocation of howlers occurred in Costa Rica in 1989 (de Vries 1991) as a rescue operation due to the construction of a hydroelectric dam. Two or three partial troops were captured with drugs, held overnight for 1-2 nights and released at two sites about one kilometer from each other. They were released in areas where there were no howlers residing but the area was adjacent to resident troops. De Vries (1991) noted a breakdown of the troop structure and a return to solitary living which he attributed to foraging technique and secondarily to interactions with resident howlers. The translocated animals also exhibited a high degree of movement following translocation and some had to

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**Cover:** A black howler monkey (*Alouatta pigra*) in Cockscomb Basin Wildlife Sanctuary in Belize. Photo by Andrew Goldberg.

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be recaptured as they moved out of the study area.

De Vries (1991) mainly discussed the ecological follow-up of the translocated animals in comparison with some residents. The release was a hard release and there was little description of how the animals were held overnight. There was no mention of a survival rate or how long each was under observation. Of the 13 animals captured, 3 died in the translocation process and a fourth died at an estimated 2 months post-release. Four of the 10 originally released were recaptured after 6 months; no others were mentioned and presumably died or dispersed out of the study area.

### Trial Howler Capture

Two major aspects of howler monkey biology were investigated before the reintroduction program could be carried out. We wanted to be sure that the capture technique used by Glander (Glander et al. 1991) could be successfully used on *Alouatta pigra*. Secondly, we wanted to investigate what type of food plants were available at Cockscomb, how many of them overlapped with available food at the Community Baboon Sanctuary, and what was the seasonal availability of fruits at both areas.

In 1990, using Glander's (Glander et al. 1991) methodology, 47 black howlers were captured without a loss or major injury. Once a monkey was darted and drugged, it was caught in a net by a team of people on the ground. In some cases, a monkey remained clinging to the branch and had to be captured by climbing the tree and releasing the grasping limbs. The howlers were then quickly weighed and measured and limb prints were taken. Pelage and other body marks were noted for later field identification. Each monkey was then marked by attaching a plastic tag on a metal chain around the leg. Additionally, blood was taken from all animals by Dr. Roxie James to begin gathering a genetic base for the population.

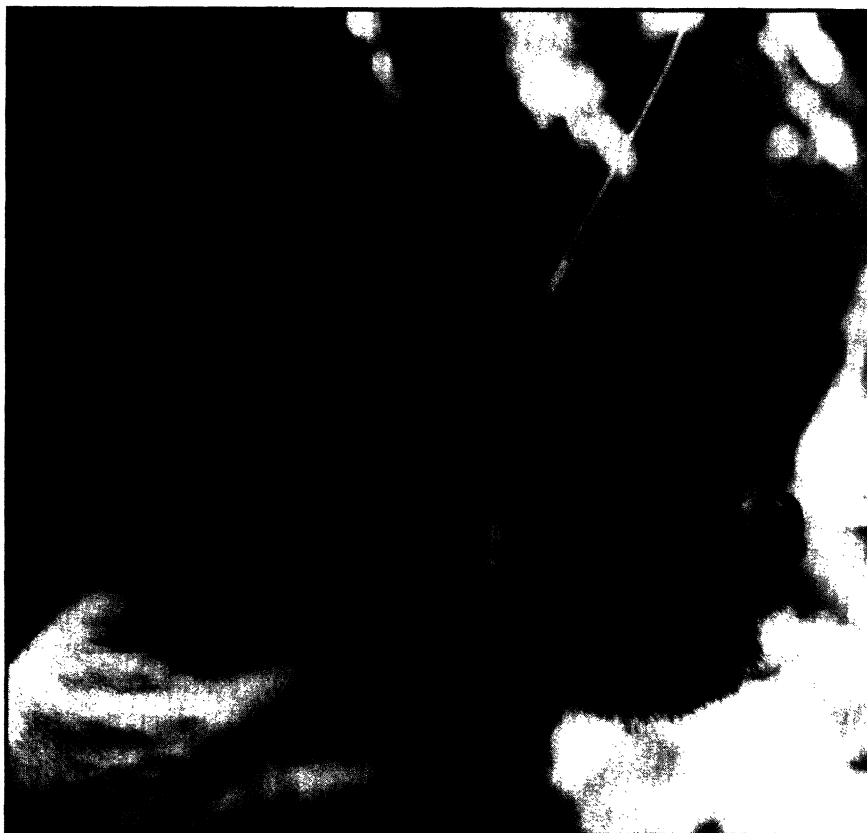
### Howler Ecology and Selecting Release Time

The black howler, like the other

five howler species found throughout Central and South America, is the most folivorous of the new world primates (Eisenberg et al. 1972). Although they lack a modified digestive tract found in many herbivores to accommodate a high cellulose leaf diet (Milton 1980), howl-

from any species (Glander 1977, 1982). The new leaves contain high protein content and low cellulose (Milton 1979).

Research on *A. pigra* indicates it uses a low number of plant species per month, depending on them for most of its needs (Horwich and O'Connell,



Adult, female black howler with a ball-chain radio collar used to track and monitor the monkeys after release. The transmitters were designed to have a longevity of 12 months. Photo by Fred W. Koontz.

ers do maintain a sluggish lifestyle, resting often over 70% of the day, allowing microbial fermentative digestion (Milton and McBee 1983) to better utilize its food resources (Milton 1980; Milton et al. 1979). *A. pigra* conforms to the howler lifestyle resting at times as much as 80% of the day (Horwich and O'Connell, unpubl. data).

Howlers utilize flowers, leaves, and fruit, specifically selecting the new leaves and ripe fruit when available. However, they are capable of eating mature leaves as well, especially before the main fruit production in April-May (Lyon, Young and Horwich, unpubl. data). Despite their use of mature leaves, the howlers' food supply is not unlimited as once thought since they only utilize about 20% of the available tree species and then select only specific individual trees

unpubl.). The part of the plant they feed on depends on the season, and the species variety may increase during periods of low fruit production in December and January. A list of species at the Community Baboon Sanctuary was compared with that known from the Cockscomb Basin (Kamstra 1987). An assessment of the environment of Cockscomb indicated an estimated 60% tree species overlap between the Community Baboon Sanctuary and the Cockscomb Basin (Young, pers. comm.) Lists of flora used by howlers in other areas were also used to help in determining potential food sources within the sanctuary (Coelho et al. 1976; Schlichte 1978; Estrada 1984; Estrada and Coates-Estrada 1986a & b).

Four years of phenology from the Community Baboon Sanctuary was

available indicating a high level of fruiting in May. Additionally, the Cockscomb staff began a similar phenology study a year previous to the 1992 translocation. Data similarly indicated that May should be a good time for the translocation.

### Individual Marking and Radio Telemetry

We tagged all adult monkeys with small (2.75cm diameter) Plexiglas donuts on ankle chains. This type of marking is moderately successful; some chains may slip off and a few may cause superficial leg injury when the chain wears into the skin which may scar around it. Individuals from each of the three troops were tagged with a troop color (blue, yellow, orange) for ease in sighting changes in troop cohesion.

Due to the large hyoid bone which occurs both in females and especially in males, attaching radio transmitters to black howlers is problematic. Six females were fitted with ball-chain collars and modest-sized transmitters (Model 125, Telonics, Inc., Mesa Arizona). This design allowed the transmitter canisters to rest posterior to the hyoid bone. Gas sterilized implantable transmitters were surgically placed between the shoulders of four males, one female, and one juvenile female by veterinarian Dr. Wendy Westrom (Configuration 2A, Telonics, Inc., Mesa, Arizona). Signals from all six subcutaneous transmitters were lost at about six weeks post-release. Two of the subcutaneous units were found on the ground, suggesting that despite being sutured in place under the skin, the units came out. The ball-chain collars, however, performed well for 6–10 months post-release, because they enabled us to locate the monkeys while they were establishing their new home ranges. Twelve of the original 14 translocated animals have been followed on a regular basis for ten months, by a combination of radio tracking and visual searching for the monkeys.

### Mapping and Selection of Release Sites

Prior to release, in January 1992,

approximately 15 kilometers of paths encompassing 6 square kilometers were mapped with tape measures and compasses. Trees along the trails were tagged with trail numbers approximately every 50 meters and other landmarks and waterways were mapped as well. Additionally, many trees labelled for the phenology study were included in the map.

Three release sites were selected which were thought to be over one kilometer apart. We hoped this distance between the release sites would prevent initial troop interactions and the consequent stress from having to immediately defend territories before having sufficient time to orient themselves to the area and its food sources. Once the mapping had been accomplished, two of the sites turned out to be only a half kilometer apart but since cages had al-

ing. Following measurements, blood removal, health checks, ankle tagging and transmitter attachment, all howlers were placed singly (except for females with infants) in air kennels (used for pets). The kennels were then loaded in the vans and driven 5 hours to the site. In the second move, the kennels were carried to the helicopter for the 45 minute flight to Cockscomb.

Although we intended to keep the newly captured howlers less than a week in the release cage, we felt strongly that a short period of captivity would accomplish the following goals: 1. allow observation of animals for health reasons and observation of transmitter collar placement, 2. acclimate the troop to the new environment, and 3. reduce a stressful dash for freedom and encourage group cohesion upon release.



One of the holding enclosures used to acclimate the monkeys for two days before release. These are built in advance at the release sites. Photo by Fred W. Koontz.

ready been built, the sites were used anyway. All sites contained known food trees nearby.

### Caging, Transport and Captive Care

Two transfers were made a week apart, first using vans and then a British RAF helicopter. Capture proceeded as in 1990. The troop to be translocated was located the evening before for ease in location and capture the next morn-

Cages 8' x 12' x 10' (width x length x height) were constructed from lumber and chicken wire at each of the three release sites. Each cage had a front door and an upper release door. Cages were provided with a series of branches and shelves including a feeding shelf which was located in front of the release door. Animals were provided with wild foods collected at the Community Baboon Sanctuary as well as fruits and vegetables purchased at a market. Dishes of water were also provided.

All troops were maintained for two days and nights, then released in the late afternoon. One troop was kept an additional night in traveling cages at the Cockscomb office because of lateness of arrival at Cockscomb. Observations were made on all troops from a blind. Most of the animals ate some of the wild and market foods and drank some water. All attempted to push against the wire to escape but this became more reduced during the second day. We decided to release them, because they were settling down, and, before any depression set in. We released them by opening the release door and allowing them to leave at their will. This occurred slowly but was sometimes hampered by one animal's escape which caused the others to push at the wire again, not knowing about the open door. In one case, all animals left the cage except for an infant who pushed at the cage corner crying. He was quickly captured and released to his mother who was waiting 15 feet above.

### Monitoring and Success Rate

Once released, troops were radio tracked and observed with short visual checks every 1-3 days and with prolonged observations after a month. There was some indication that close following of the first troop may have encouraged flight and consequent troop breakup and dispersal. After 6 months, four of the 6 ball-chain collars had failed but monkeys could still be visually located within their established range.

Continual monitoring indicated successful long term survival rate of most of the animals translocated. After 10 months of observation, at least 12 of the 14 howlers are alive. Only one male and a juvenile were not seen again after 2 months. The juvenile is believed dead but the male was displaced and not seen again although roaring was recorded in the direction of his flight. Additionally, two infants, conceived in their original habitat, were born at Cockscomb in August 1992 and two other infants were born in January 1993. A total of 16 black howlers are now living in the Cockscomb Basin.

In contrast to the Costa Rican translocation, dispersal from the release sites

was low. All animals remained within 2km of the release site and often moved in the vicinity of the release site. Although their total home ranges varied from 100-400 acres, they spent most of their time in considerably smaller core

could probably have been avoided had the release sites been one kilometer apart as planned. The second troop, along with the female from the first troop, have formed a loose association within a core area. Four have stayed together and

the females with young (including the two infants born in August) have formed an association at times. The third troop (one male and two females) have been very cohesive and remained in a core area of about 60 acres. They conceived and gave birth in January to two infants at Cockscomb.

We feel two factors led to less dispersal and more troop cohesiveness than occurred in the Costa Rican translocation: a lack of resident howlers in the area and the use of holding cages for acclimation. The holding cage seemed to allow the howlers to assess that they were in a totally different forest and to settle down before release. It also allowed us to adjust the collar of one female who had worked it partially off which might have

caused her major problems. We feel the cohesiveness would have been even better had we been able to keep troops from meeting early after the reintroduction. Thus far, there has been little howling due to this lack of intertroop interactions.

### Future Releases

We are encouraged by the survival of at least 12 of the 14 animals translocated (86%). We will carry out two additional translocations into the same area in May 1993 and in 1994, after which we hope to have about 60-70



Mr. Ernesto Saqui, Director of the Cockscomb Basin Wildlife Sanctuary (Belize Audubon Society) radio tracking the released black howlers. The animals have been monitored for the ten months since release. As of March 15, 1993 at least 12 of the 14 translocated animals are alive, and an additional four babies have been born. Photo by Fred W. Koontz.

areas, especially after they became established at about three months post-release.

The first troop (one male, a female and her infant, and an old female) showed initial dispersal, possibly because we followed too closely after release. The old female dispersed about one kilometer and has been living alone. The other female and male came together again, but at eight weeks post-release, when they had an aggressive interaction with the large second group (two males, three females, one juvenile, and an infant), the male from the first troop left and was never seen again. This early interaction

howlers living in the Basin. Following that we will continue to monitor the situation for a few years to assess whether additional moves are necessary.

For the May translocation, three larger cages, 8' x 16' x 10' have been constructed about one kilometer from each other, and over 1.5 km from the core areas of all other howlers in the park. Larger cages will be used because larger troops were found in the new donor area. Currently, observations on social behaviors, food utilization, and territory size are being made on 4–5 troops located in the donor area. Three transports are planned, two by van, and one by helicopter. We will attempt to capture 3–4 troops totaling 25 animals. We will monitor all adult females by ball-chain collars, we will try to do the same on several males as well. As before, continued monitoring will be done on all animals during the year to follow.

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# Idaho's Nongame, Endangered and Watchable Wildlife Program

by

Wayne Melquist

The American public is showing a heightened awareness and interest in the comprehensive conservation of the country's wildlife resources. Idaho, too, is clearly experiencing these changes. The number of adults participating in watching and photographing wildlife, maintaining birdfeeders, and other forms of nonconsumptive wildlife-associated activities continues to grow throughout the United States and in Idaho.

The Idaho Department of Fish and Game (Department) is moving into a changing era of wildlife management with programs directed towards the conservation of all Idaho wildlife. We are broadening our constituency beyond the hunting and fishing public. Getting people involved in wildlife viewing often gets them involved in wildlife conservation. We believe it is crucial that they become wildlife advocates and supporters of the Department's programs and policies. In order to gain and maintain the support of Idahoans who do not hunt or fish, the Department is expanding its emphasis on nongame and watchable wildlife.

## Funding for the Program

Current funding for the Nongame, Endangered and Watchable Wildlife Program (Nongame Program) comes from a variety of sources, including an income tax check-off, Federal Aid funds, state and federal agencies (primarily through challenge cost-share projects, grants, trusts, direct donations and the sale of goods. The Nongame checkoff was first established

on the 1981 state income tax form. Donations declined from those early years to a low of \$55,000 in 1988, partly due to an increasing number of competing check-offs.

Because the Nongame Program has had to rely on checkoff revenue as the primary funding source, staff spend considerable time searching for outside funding, which is generally dedicated to specific activities. With outside funds, the Nongame Program's annual budget currently exceeds \$700,000. Such tenuous funding has substantially increased the administrative workload and precluded long-term program and project commitment and development. Consequently, the Nongame Program has had a difficult time growing to meet expanding needs because we have had to rely on unstable, year-to-year funding from outside sources.

During the 1992 legislative session,

a Wildlife License Plate bill was passed. The vehicle license plate will depict a mountain bluebird—Idaho's state bird, perched on a syringa—Idaho's state flower. A portion of the proceeds from sales of the plate will go to help Idaho's nongame and other watchable wildlife. The plates will be available for \$35.00 starting July 1, 1993; renewals cost \$25.00. The Department will receive \$10.00 from each set of plates sold. Sample plates with up to 5 letters or numbers will be available for \$30.00, with \$18.00 going to the Nongame Program. This should give a big boost to managing Idaho's diverse wildlife and providing more viewing opportunities.

The Department has been reluctant to spend hunting/fishing license dollars for nongame, although some license funds have been used in the past. Many states use license dollars to support nongame and watchable wildlife programs. Because 80% of the state's fish and wildlife are classified as nongame, the Department would prefer a funding base that allows nonconsumptive users the opportunity to shoulder more of the financial burden of managing this resource.

## Program Goals

The Nongame and Endangered Wildlife Species Management Plan (1991-95) states that the ultimate goal of the Program is to insure the viability of nongame populations, including threatened and endangered species, and their habitats in Idaho. Clearly, it is not possible nor practical to address the needs of each and every species in order to



The Idaho Bluebird license plate. Photo by Idaho Department of Fish and Game.

continued on UPDATE page 8

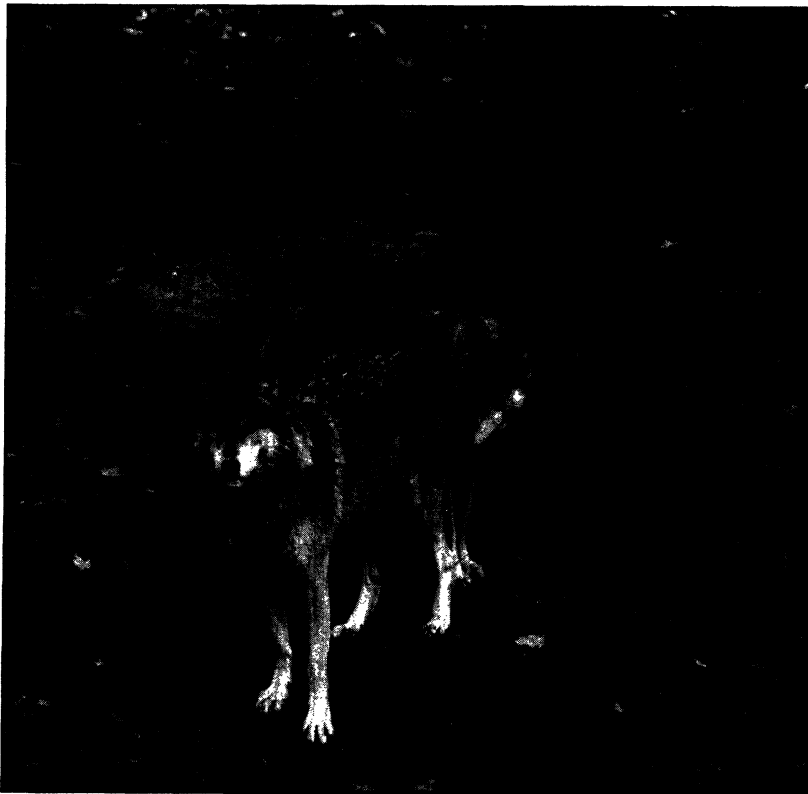


# Endangered Species UPDATE

April 1993 Vol. 10 No. 6 Supplement

School of Natural Resources and Environment  
THE UNIVERSITY OF MICHIGAN

## Special Insert



Future conservationists face the challenge of preparedness in their fight to preserve the world's remaining biodiversity. Uniting the experience of established professionals with the "eagerness-to-learn" of those new to careers in conservation can strengthen the support system for this profession.

The following pages contain career advice from conservation professionals with varying ranges and levels of experience, all of whom are past authors of articles in the *Endangered Species UPDATE*. This special insert is designed as a career sampler for students and other people interested in the work of biodiversity preservation.

The intent of this supplement is to show newcomers the kinds of work being done by established conservationists. Examples of the variety of professionals I interviewed for this supplement include: environmental lawyers, curators of botany, wildlife biologists, university professors, and program directors for endangered species management.

More importantly, students and others will get advice on how they can move ahead in their area of interest. Novices will not be the only beneficiaries of this sharing of career advice; seasoned professionals will be rewarded with a more well-informed group of young professionals to continue their work tomorrow and beyond.

## CAREERS:

Advice from leading  
environmental professionals on  
how to get started

Compiled and  
edited by  
Lisa S. Yee

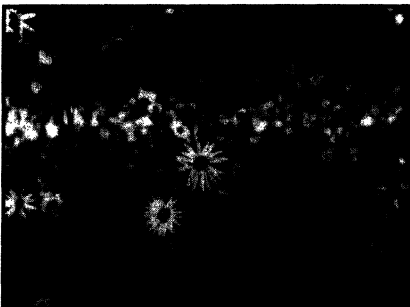
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**Marc Liverman**  
**Grassland Habitat Biologist,**  
**Oregon Dept. of Fish and Wildlife**

**What advice do you have for students interested in careers in conservation?**

Twenty years of sustained activism on conservation issues since the first Earth Day have increased awareness, inspired research and legislation, and contributed to many legal victories. However, not one environmental problem has been truly "solved". Indeed, new problems like global warming and ozone depletion, are being added each year to the list that already includes endangered species, militarism, over-population, petroleum dependency, pollution, solid waste, and more.

But this should not discourage you from seeking a conservation career; it should make everyone want one. Opportunities are unlimited! Traditional tracks like engineering, law, and natural resources are options for people inclined towards graduate school, since higher degrees are increasingly a standard requirement. But don't overlook art, business, economics, education, journalism, marketing, public health, psychology, sociology, statistics, women's studies and other tracks. Few jobs have conservation or environment in the title, but every job will make an impact if the person working at it has an environmen-



**Prairie dock (*Silphium terebinthinaceum*).**

tal interest and philosophy.

The environmental issues we confront are so pervasive, complex, and stubborn that it is unreasonable to expect any one profession to solve them; whole generations of conservationists working in all fields are needed. Moreover, it is

impossible to predict which professions will eventually make the greatest contribution overall. Technical information is obviously important, but cannot succeed without a base of sustained social commitment and action. My advice is follow your heart and aptitude, use your head, THINK BIG, and never give up your educational values, no matter where your conservation career leads you.

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**Sylvia Taylor, Ph.D.**  
**Adjunct Faculty, University of Michigan, former Endangered Species Coordinator (Wildlife)**  
**Michigan Department of Natural Resources**



**Michigan's endangered Kirtland's warbler.**

**How did you get to work with the endangered Kirtland's warbler and what specific advice do you have for students with similar interests?**

I became involved with Kirtland's warbler management without previous interest in the species but with knowledge of its habitat. I switched from teaching to working for the state to cover forestry impacts by new freeways for the Michigan Department of Transportation. My Ph.D. in botany qualified me for only a bachelor's level forester position. State service had no positions for botanists despite a great need for botanical knowledge. However, since I also covered botanical environmental impacts, I was loaned to the Michigan Department of Natural Resources (MDNR) for botanical expertise.

I took a demotion transfer to the MDNR to cover plants for the new En-

dangered Species Program. One year later I was promoted to Coordinator and became responsible for Kirtland's warbler management. I broadened my credentials to become a Certified Wildlife Biologist and was promoted to Nongame Supervisor. I transferred to a field supervisor position and spent the rest of my career involved in direct management of wildlife including Kirtland's warbler.

My advice to students with similar interests is to enter the employment field with highly developed and needed skills not previously recognized in position descriptions.

**Explain the importance of being a specialist versus a generalist for students interested in working to preserve biodiversity.**

Those with a generalist nature should consider becoming specialists to gain the following advantages: 1) knowledge held by relatively few people, 2) respect of others for this knowledge, 3) preparedness for self-education in other fields. A generalist with a specialty has the advantage of being able to adjust to new employment situations by taking a step backward to a lesser position in a related field, then rising quickly "in the ranks" because of highly developed learning skills and previously unrecognized applications of the specialty.

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**Edward T. LaRoe, Ph.D.**  
**Director of Cooperative Research Units, U.S. Fish and Wildlife Service**

**What qualifications are necessary for doing field research with endangered species?**

I can't identify any specific qualifications necessary to conduct field research on endangered species. One of the problems with endangered species is that the great variety of taxa, causes of endangerment, and situations require professionals with a variety of qualifications. Resource managers need sci-

entists qualified in all aspects of biology, including professionals in non-traditional fields such as invertebrate zoology and botany.



Endangered invertebrate, Karner blue butterfly.

In addition, scientists who work on endangered species should possess some special qualifications. They need an especially innovative attitude to work on endangered species, especially the really critical ones where only a few individuals survive. This often limits the research opportunities and can require great creativity. These scientists also need some skills in public relations, as they often need to explain the significance of their research to the public and decision-makers, under conditions of great controversy.

Finally, I'd recommend that scientists fully understand the legal and administrative regulations relating to endangered species, especially those pertaining to harassment and permit requirements.

#### What coursework do you recommend?

Take as broad a variety of courses as you can. You should be well grounded in all aspects of biology—ecology, systematics, genetics, concepts such as minimum viable populations—as well as science in general, especially chemistry. Also in law, economics, and maybe public administration. The problems of endangered species management are very pervasive and require many skills. You need coursework that teaches skills in analysis and communication. In short, I recommend being well-versed as a generalist.

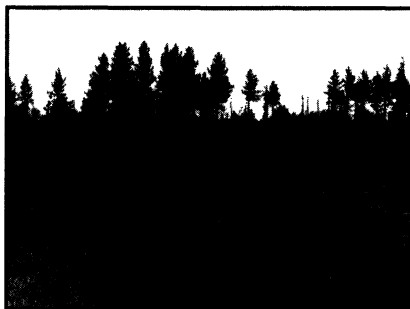
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#### Burton V. Barnes, Ph.D. Professor of Forest Ecology University of Michigan

#### What career advice or insights would you offer students interested in natural resources and environment issues?

First of all, many of the students I teach and work with are highly motivated, engrossed in their studies, and appear "to have it all together." They don't need advice. However, a mentor is still a good idea. A role model, a person willing to talk about what's happening in real world ecosystems, can be very helpful.

Second, have you ever thought much about what you are really doing? Make sure you are in touch with the major ideas and concepts of the day. What are the key "objects-of-interest" in the field? How do you conceive things in relation to current wisdom? For example, in one of the essays in his book *Home Place*, J. Stan Rowe writes: "Biology by itself is incomplete. Organisms do not stand on their own; they evolve and exist in the context of unified ecological systems that confer those properties called life." Is your viewpoint ecocentric or homocentric—ecosphere or organisms? How you conceive things can make all the difference in the world—to the ecosystem that is!



Jack pine forest in Michigan.

Third, despite all the information and knowledge poured into your brain—can you do anything? In the years ahead, we expect there will be a premium on people who can communicate; who have a strong quantitative training; and who have solid field training and experience. Field studies are critical. Knowledge of

the earth sciences is key to our understanding of landscape and waterscape ecosystems, their organisms, and how whole ecosystems will change in the future. Thus it would be wise to invest in field courses offered by schools and colleges and especially field stations that emphasize field education in ecology and training in ecosystem concepts and skills.

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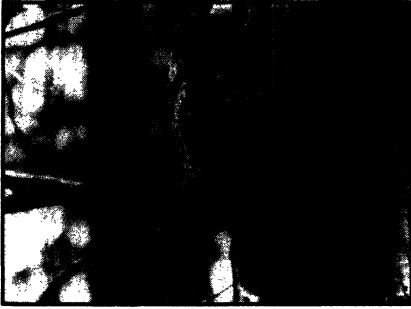
#### J. Michael Scott, Ph.D. Leader, Idaho U.S. Fish and Wildlife Service Cooperative Research Unit, University of Idaho

#### What specific advice do you have for students interested in preparing themselves for a career like yours?

Acquire a solid academic background in your area of expertise. In addition, get as much hands on experience as an undergraduate and graduate student as you can. Equally important is that you learn to work and get along with people. The complexity of, and multiple ownerships involved in many issues we face today in conservation biology require interdisciplinary efforts. These efforts often involve individuals from several federal agencies as well as state and private groups. This requires that you build partnerships. In doing so always deal with issues on top of the table. Never let someone you are working with get blind-sided by an issue. Finally don't expect to get rich, but do expect to make a difference.

#### What careers most effectively address biodiversity preservation?

Almost any career can be effectively used to protect biodiversity. We need knowledgeable and committed lawyers. I have seen lawyers such as Mike Sherwood and Michael Bean who have significantly contributed to our ability to save species. In the political arena the contribution Al Gore has made as a legislator and more recently as an author is difficult to overestimate. However there is no substitute for committed bi-



Northern spotted owl.

ologists. They provide all the raw data needed to make the case for biodiversity. The spotted owl issue is an excellent example of what a solid team of research biologists can do. But whether you end up working as a biologist, manager, administrator, or teacher in natural resources you can make a difference!

The bottom line is, whatever field you choose—law, biology, education, politics, even business—if you retain a commitment to protecting biodiversity, then you can, through example, make a difference.

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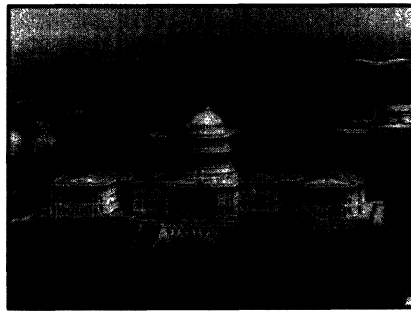
**Michael J. Bean, Attorney  
Chairman of the Environmental  
Defense Fund's Wildlife Program**

**What specific advice do you have for students who want to pursue a career in environmental law?**

I recommend getting into the best law school you can; law is still a profession where academic credentials determine where the doors will open for you. A number of schools offer good environmental law programs, but if possible I would choose a school on the basis of its overall stature rather than its environmental law program.

If your desire is to work for a public interest environmental organization, don't expect to land a job there immediately. Most of the major environmental organizations hire lawyers with at least a few year's experience elsewhere. The U.S. Justice Department is a good place to acquire a lot of useful experience, particularly litigation experience, very quickly. So too are many state attorney general offices.

Though probably few students who think they want to become environmental lawyers have working for corporate law firms in mind, most of the practitioners in the field do exactly that (or work directly for business corporations). This too can be good experience and even offer opportunities to do some good things for the environment. The danger of this path, however, is that you might end up doing something quite different after law school than what you had originally contemplated. Most law graduates are burdened with heavy debt, but have the chance to make a lot of money in traditional practice. The alternatives, particularly in the environmental area, are few and much less remunerative. The temptation to take the easier to find, and much higher paying, jobs has seduced a great many people who originally intended to "do good" with their environmental law careers.



United States Capitol building.

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**Pamela Pride Eaton  
Program Director for Refuges &  
Wildlife, The Wilderness Society**

**What advice do you have for students interested in getting work experience with endangered species policy issues?**

I recommend one to two seasons of field work even if you plan to be a policy analyst or lobbyist for your career. It is important to understand the scientific basis for policy concerning endangered species and to have a clear sense that it is the animal's needs and behaviors (or plants as the case may be) that must be at the core of any endangered species policy, if it is to be successful. There are

numerous programs offering small stipends or scholarships for field assistants. If all else fails, volunteer your help to a local researcher or even your local zoo.

**How did you become a member of the Endangered Species Coalition Steering Committee?**

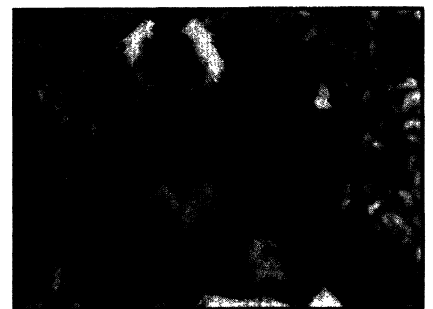
As Program Director for Refuges and Wildlife, I represent The Wilderness Society in the Endangered Species Coalition. The Coalition Steering Committee is made up of representatives of seven to eight groups most actively involved on a day-to-day basis in renewing and strengthening the Endangered Species Act. Reauthorization of the Endangered Species Act is one of The Wilderness Society's top legislative priorities for the 103rd Congress.

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**Don Lindburg, Ph.D.  
Behaviorist, San Diego Zoo**

**What specific advice do you have for students who want to become involved in zoo captive breeding programs?**

Behavioral students who want to work with captive wildlife should structure their training in light of the special problems encountered in the captive milieu. It is rarely the case that, in traditional degree programs in animal behavior or comparative psychology, one will find courses that are focused on these concerns.



Lion-tailed macaque at San Diego Zoo captive breeding program.

The captive situation is a special kind of observational field, lacking many

of the attributes of the wild such as predator avoidance or natural foraging opportunities. At the same time a regimen of unavoidable experiences in the form of high frequency contact with humans and perhaps conspecifics, exposure to unfamiliar stimuli, and limited mental or physical activation is commonly encountered by zoo animals. Training that instills a fundamental understanding of species' biological requirements is essential if one is to work under these conditions.



**Snow leopards have had much success in captive breeding programs.**

Working in the captive sector is very much a matter of small populations which are, additionally, dispersed among a variable number of institutions. Genetically mandated procedures designed to increase founder representation or to preserve gene pool heterozygosity have a behavioral dimension that is often overlooked. An understanding of mating systems, mate selection, social hierarchies, xenophobic responses, and numerous other social phenomena are prerequisite to intelligent management of small, captive populations.

Endangered species are often fairly fragile, not well represented in captive collections, and not amenable to invasive techniques commonly employed in cutting-edge research. It is imperative that students-in-training learn fundamentals of research design and quantitative skills that are appropriate to working under these limitations.

Finally, in addition to obtaining relevant training, it would be advantageous for those interested in this type of career to pursue internships or volunteer opportunities that familiarize the student with the special workings of the zoo or aquarium. These opportunities are best realized if the zoological institution is in

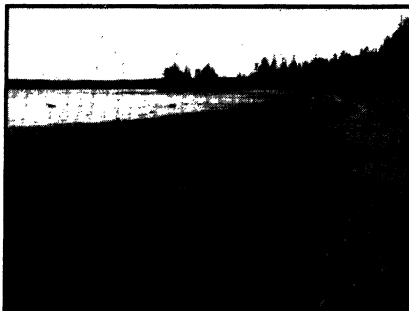
the same community, and has a history of working with students.

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**Anton Reznicek, Ph.D.**  
**Curator of Vascular Plants, Univ. of Michigan Herbarium**

**What is the outlook for students interested in working with rare or endangered plants?**

The situation for students interested in working with rare or endangered plants has, I think, never been better. There is a great deal of interest in government and the private sector in natural heritage and threatened and endangered species issues, with jobs available at a variety of training levels. As conservationists, we also need to have good people fill these posts, so that good people will be available for eventual promotion into policy-making positions. Overall, I think there has been an important shift in focus from viewing rare plants as merely evolutionary curiosities to viewing them as integral parts of ecosystems and our natural heritage, especially as potential indicators of ecosystem health and quality.



**Cecil Bay Marsh, Lake Michigan.**

**What specific ways can students prepare themselves to increase their chances of working with such plants?**

Working with rare and endangered plants can cover a very broad area. The two major "hands on" aspects are working with the ecology and reproductive biology of the plants, and conducting various types of field surveys. From my perspective, probably the most important specific way to initially prepare for

work in this field is to become conversant with the flora by taking as many field courses as possible. There is no substitute for familiarity with the species in the wild. Once you have learned the basics, specialization can occur without taking place in a factual vacuum.

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**Deanna Glosser, Ph.D.**  
**Endangered Species Program Mgr., Illinois Dept. of Conservation**

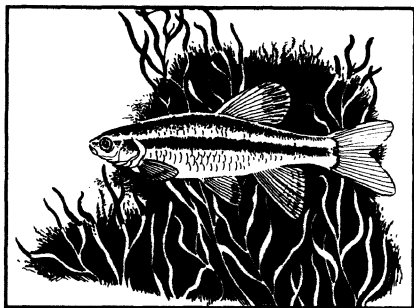
**What role did extracurricular activities in college play in advancing your career?**

As an undergraduate student, I became involved with a local environmental organization, initially because of my interest in the out-of-doors. I had no experience in being an activist, organizing a committee, or lobbying. My commitment to environmental activities deepened as I completed my undergraduate degree and began working on a master's and then doctoral degree. Surprisingly, I found myself, through these activities, beginning a training program that would prove invaluable to the development of my career.

This volunteer involvement was important in at least two ways. First, it provided an opportunity to learn and practice new skills without the pressure associated with a professional position. For example, one major project I worked on was the preparation of an appeal for a national forest management plan. This appeal ultimately led to formal negotiations, with state and local agency personnel and a wide range of citizens groups participating. Through this two-year process I learned a great deal about federal environmental laws, reviewing environmental impact statements, writing formal appeals, and conflict resolution.

Second, this volunteer effort resulted in my meeting of many people in the environmental community across the state and even the country, many of which were potential employers. Assuming responsibility for major projects and public speaking allows you to dem-

onstrate your abilities without the pressure of a formal interview.



Endangered bluehead shiner reintroduced into Illinois.

While these activities were valuable to my career development, none were taken on for this purpose. The basis of my involvement was a commitment to protecting the environment; fortunately, there were professional benefits as well.

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**Patrick R. Jodice**  
Nongame Regional Biologist,  
Florida Game & Freshwater Fish  
Commission

**What training has been most important in advancing your career?**

Two areas of experience stand out in my mind as being particularly valuable to my career advancement. The first was having a variety of field technician jobs during and immediately following my undergraduate program. These positions allowed me to see how data were properly (and sometimes improperly) gathered in order to answer specific questions. All of the field jobs I had required a great deal of independent work, and this was key in preparing me for independent decision making later in my career. The skills learned on the job were always more important than the knowledge gained regarding any particular species.

Perhaps the most important skill I learned was how to collect quality data, making sure the employers get the information they want. Even volunteer positions can be valuable in improving data collection skills. It is not as easy as one

might think to find conscientious data recorders. These field experiences were of great use when designing, carrying out, and analyzing my masters and current research.

Teaching has been an equally important aspect to my career advancement. It is imperative that scientists be able to communicate effectively to a wide variety of audiences. You may never realize how little or how much you know about a subject until you have to teach it to others. Teaching has helped me to be a better speaker and listener. Additionally, the skills I learned through teaching help me to deal effectively with the people I encounter in natural resource management issues.

In summary, I would suggest spending as much time as possible in the field collecting data. Analyzing data and writing up results are skills that take time to develop and are constantly being improved. Effective research starts with identifying the question to be asked and properly collecting the data needed to answer that question.

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**Lynn Greenwalt**  
V.P. for Int'l. Affairs, Nat'l. Wildlife  
Federation



Giant panda, international symbol of conservation.

**Are there special qualifications necessary for international conservation work?**

I don't look for many specific qualifications, but I do look for commitment: commitment to learn the issues; commitment to be patient because things always move slowly; and a commitment

to doing things well, even the things one doesn't like to do. Of course, I look for an ability to write and speak well. I don't seek ideology; I don't look for any required academic training or special experience. But I do look for interest, conviction, good humor, and an ability not to take oneself very seriously.

**How does a student get started professionally and move ahead in this field?**

Getting started is the hard part. Pick the organization you would most like to work for and find a job there--any job that's not utterly intolerable. Once you're inside the biggest hurdle has been overcome. Work hard at that job, show that you have what it takes to do more important work, and express interest in the international effort. This may take time, but not as much as you might spend lurking on the outside, waiting for the right job to turn up. Finally, never refuse an assignment that's even remotely acceptable to you. You'll get experience, you'll demonstrate your ability to do the work, and one day you'll get THE job you're after--or an even better one. This sounds like all the cliches you've ever heard, but it works--I've seen it work for others, and it worked for me.

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**Susan R. Wallace**  
Curator of Endangered Plants at  
Bok Tower Gardens, Lake Wales,  
Florida

**What advice do you have for students interested in plant conservation?**

Plant conservation is such a new field--both as a science and as a public imperative--that all of us need to be very broadly educated in a number of disciplines. Students majoring in the traditional fields like botany or horticulture need to know some of each subject as well as taxonomy, ecology, forestry, land use planning, land management, good writing, public speaking, and political advocacy.

Many conservation issues are played

out in a public arena and the scientists who know something about the facts need to be articulate and persuasive advocates. I urge students to attend public hearings on controversial development proposals or new government regulations and get a feel for how the adversarial process works and how to structure common-sense compromises that will protect our natural areas.

Internships are another invaluable way to get first-hand information on plant conservation and to meet the people who are working in the field. Botanical gardens, private conservation organizations like The Nature Conservancy, and public conservation agencies like the U.S. Fish & Wildlife Service and state natural heritage programs offer excellent (if low paying!) learning opportunities. Students should also attend as many professional conferences as possible—most offer reduced registration fees for students and welcome students as the next generation of conservationists.



Botanical gardens offer excellent learning opportunities.

#### What improvements are necessary for university training in plant conservation?

Traditional science education, which leads to very narrowly focused research degrees, doesn't serve a multidisciplinary subject like plant conservation very well. Departments of biological science, forestry, horticulture and architecture (land planning) are often on opposite sides of the campus with faculty members who never speak to each other.

The ideal plant conservation curriculum would include a broad range of course work in both theoretical and practical knowledge. Perhaps it shouldn't be

called *plant* conservation but simply *conservation* since those of us working to preserve plants are ultimately working toward the same goals as animal conservationists. Our training and techniques may differ somewhat but in the end we both need to preserve intact natural systems.

I'd also like to see a course in the history of conservation including the writings of great naturalists and a discussion of how our ideas of conservation (and humankind's relationship to the rest of the earth) have changed over time. We need to be well-grounded in the subject philosophically as well as scientifically.

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#### Douglas C. Daly, Ph.D. Curator of Amazonian Botany, New York Botanical Garden

#### What career opportunities exist for students interested in tropical botany and conservation?

Career opportunities do exist, but the number of traditional niches—university professorships, museum curatorial positions and the like—is dwindling as big-grant science continues its eclipse of organismal biology. This means that the persons with training in tropical botany and conservation who do not go the traditional route will need to write their own tickets, that is, they will have to find or create niches for which their knowledge will have great value. Government environmental agencies, government aid agencies, international lending agencies, and foundations are all in desperate need of persons with solid science backgrounds in tropical biology, ecology, and conservation, although in many instances they need to be convinced of this!

#### What qualifications are most important for these opportunities?

A good background in organismal biology is essential to pursuing careers in tropical botany and conservation, but this is getting harder and harder to find.



Tropical deforestation threatens innumerable plant species.

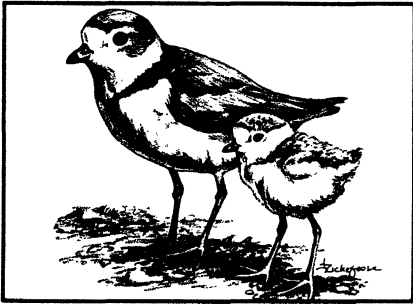
Many universities are cranking out graduate students who know plenty about molecular biology but who can't tell a maple leaf from a blade of grass or a mammal from a mollusk. Worse still, most biology graduates can barely write a complete sentence. Whether you want to write good grant proposals or guide public policy, effective writing is possibly the most important tool of all. Beyond that, a good background in zoology, botany, and community ecology means that you will know your evolutionary theory, your biometry, and your systematics. Since "you can't eat conservation" is an increasingly prevalent viewpoint, some economics courses can be very useful. Finally, some universities have graduate programs in natural resources management that can be valuable as long as they are regarded as enhancements rather than substitutes for a good science background.

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#### Karen Terwilliger Nongame and Endangered Species Program Supervisor in Virginia Dept. of Game & Inland Fisheries

#### What specific advice do you have for students interested in working with endangered wildlife?

Be persistent. Research the different federal and state agency programs and goals as well as the local and private markets. Volunteer or apply to the ones that most closely meet your career goals. Make appointments, make contact with those people performing in the job you would like. Get experience. Go into the



**Piping plover recovery is one of many of Virginia's programs.**

field and office with them. Attend professional meetings and make more contacts. If you give up, you will end up like the 90 percent or more not working in their chosen field. Persist and you will be identified as someone who has gone the extra step. That is what it will take and it is worth it.

**What qualifications would you look for in an applicant?**

A good people-person, one of vision and thought. Someone whose enthusiasm carries the message beyond the conventional norm. A self starter who is confident in his or her abilities but always eager to learn. Knowing the science is one thing, but being able to communicate and sell it is crucial. I would look for someone who consistently demonstrates commitment and integrity.

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**William Reffalt**  
**Former Program Director for Wildlife Refuge System Issues at The Wilderness Society**

**What are the advantages and disadvantages of working for a government agency, like the Fish and Wildlife Service, versus a private organization, such as The Wilderness Society?**

In the conservation field, if one is interested in working directly with the resources (such as endangered species) then a government job is the best place to be. The experience gained at the field

level and with the resources provides an excellent foundation for managerial and policy level work later in a career.

On the other hand, if one seeks immediate association with policy development and implementation then the private sector best leads to early satisfaction. Organizations such as The Wilderness Society sometimes utilize the energy, skills and knowledge of promising college graduates (often teamed with seasoned resource specialists) to help achieve success. These jobs are not numerous and may entail more career uncertainty than the government positions, but they tend to be more exciting and personally rewarding.

In considering preferred career paths, the soon-to-graduate should evaluate their long-term goals as well as the immediate ones. The experiences to be gained by working at the field level of a government agency may prove vital to preparing for the "ultimate" job. Private environmental groups recently have been increasing the number of regional positions which can offer alternatives to the more traditional government employment. However, the state and federal governments still offer excellent training grounds for basic land and people management and public service skills. For many people these tasks offer great rewards and often become the "ultimate" job of choice.

Whatever the choice, I recommend a diligent pursuit in spite of obstacles or doubts of success at the outset. An enjoyable and rewarding lifetime career is worth the effort.



**Elk have been reintroduced into many wilderness areas and refuges.**

**Photo and Drawing Credits**

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Lisa S. Yee is a graduate of the School of Natural Resources and Environment at the University of Michigan. She is interested in biodiversity policy issues.

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*Thanks to our authors for all their useful advice.*

*--Ed.*



continued from UPDATE page 7

achieve this goal. Invariably, most species will have to benefit from efforts directed at a few. By necessity then, we need to shift towards focusing on multiple species, and ultimately, towards an ecosystem approach.

Management of Idaho's nongame wildlife involves a multi-faceted effort, extending beyond just research or habitat manipulation. Emphasizing wildlife viewing and photography, backyard birdfeeding, and other nonconsumptive activities helps to instill a greater appreciation for all wildlife. Collectively, these efforts will insure that fish and wildlife will continue to be a viable component of Idaho's natural resources.

The task of managing nongame wildlife in Idaho is made more difficult by the lack of basic distributional information for most of the state's nongame species. As a result, many of our past efforts have been directed at improving our knowledge of their status and distribution. This information is then used to assess our monitoring and research needs.

### Idaho's Wildlife

The exact number of vertebrate species occurring in Idaho will never be known due to uncertainties in taxonomy, questions on historical records for some species, and the accidental occurrence of many bird species to the state. Our best estimate of the current number of vertebrate species in Idaho is 589. This total includes 83 fishes, 15 amphibians, 23 reptiles, 360 birds, and 108 mammals. Nongame wildlife are those species not classified under *Idaho Code* as big game animals, upland game animals, furbearing animals, upland game birds, migratory game birds, game fish, or predatory wildlife. By this definition, 470 of Idaho's 589 vertebrate species or 80% are classified as nongame.

### Threatened and Endangered Species

Throughout the world, an estimated 1,000 species of wildlife are going extinct each year. Scientists predict that by

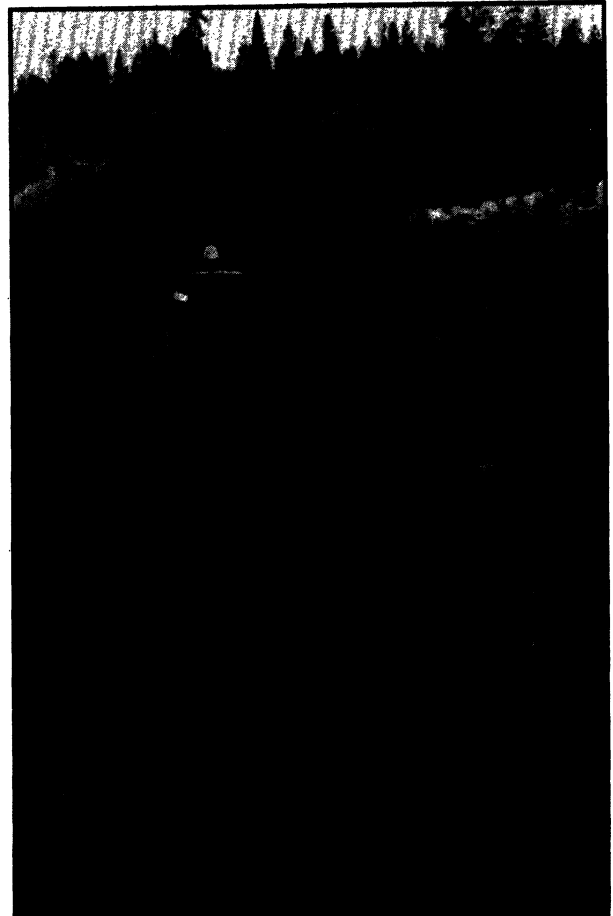
the early 21st century, we may witness several hundred extinctions each day. In Idaho, the U.S. Fish and Wildlife Service (USFWS) has listed 12 species of animals and one plant as endangered and 2 species of animals as threatened under the Federal Endangered Species Act (ESA) of 1973, as amended. The Department's list of "threatened or endangered wildlife" includes 16 endangered and 3 threatened species (all animals). Although there is no state endangered species legislation, under *Idaho Code*, no person shall take or possess those species classified as threatened or endangered at any time or in any manner.

Under Section 6 of the ESA, the Secretary of the Interior is authorized to negotiate cooperative agreements to provide financial assistance to states such as Idaho that have established and maintain acceptable and active programs for the conservation of endangered and threatened species. In November 1979, an Endangered Species Cooperative Agreement between the Department and the USFWS was signed into effect. This agreement has provided the Department with crucial financial assistance totalling as much as \$294,000 annually to implement the State's endangered species program. A similar cooperative agreement exists between the USFWS and Idaho Department of Parks and Recreation for plants.

Some examples of threatened and endangered species projects include the following:

Surveys have been conducted for gray wolves (*Canis lupus*) throughout Idaho and a database maintained on reliable sightings. Biologists estimate that no more than 15 wolves reside in Idaho, with no known pack formation.

Department biologists, working



Hack boxes like this one have been used for the release of peregrine falcons as part of the conservation effort for this raptor throughout the state. Photo by Wayne Melquist.

with other state, federal and Canadian agencies, moved 60 woodland caribou (*Rangifer tarandus*) from Canada to northern Idaho to boost the native population of this endangered species. A survey technique has been developed.

Since 1982, the Department has cooperated with other agencies and The Peregrine Fund in the successful release of 203 peregrine falcons (*Falco peregrinus anatum*) at 16 release sites throughout the state. The result has been a dramatic increase in nesting pairs from 1 in 1985 to 10 in 1992. Idaho has a recovery goal of 17 nesting pairs.

Department staff continue to conduct annual bald eagle (*Haliaeetus leucocephalus*) nesting surveys, even though no federal funds have been available for several years. Nesting pairs have increased from 12 in 1982 to 63 in 1992, far exceeding Idaho's recovery goal of 30. However, the security of many of these nesting territories remain questionable. The Department supports downlisting bald eagles from endangered to threatened.

Parts of 4 different grizzly bear (*Ursus arctos*) recovery areas are located in Idaho. Since 1983, Department biologists have conducted telemetry studies on the ecology of grizzlies in the Selkirk Mountains of northern Idaho and to identify limiting factors. Because illegal shooting is the primary mortality factor, we have also emphasized education and enforcement programs. Grizzly bear surveys have also been conducted in the Cabinet-Yaak, Bitterroot, and Yellowstone grizzly bear ecosystems.

Because caribou, grizzly bears and a variety of other rare animals are found in the Selkirk Mountains, we are attempting to shift our focus on the ecosystem and how these species inter-relate.

In 1992 and early 1993, 6 mollusks and the sockeye and chinook salmon were federally listed as either threatened or endangered in Idaho, with additional listings on the horizon. The implications of listing these species are enormous in terms of time, money, and land-use practices.

### Species of Special Concern

Species of special concern are defined as native species which are either low in numbers, limited in distribution, or have suffered significant habitat losses. The list includes three categories of species: 1) Priority species, species that meet one or more of the criteria above *and* for which Idaho presently contains or formerly constituted a significant portion of their range; 2) Peripheral species, species which meet one or more of the criteria above *but* whose populations in Idaho are on the edge of a breeding range that falls largely outside the state; and 3) Undetermined status species, species that may be rare in the state but for which there is little information on their population status, distribution, and/or habitat requirements. The current list includes 24 priority species, 16 peripheral species, and 16 undetermined status species.

Species of special concern are often the same species listed as "sensitive" by the USDA Forest Service (USFS) and Bureau of Land Management (BLM)



A female wolverine (with radio collar) at the entrance to one of the live traps used to capture the large weasel during the research project initiated Winter 1991-92. Photo by Idaho Department of Fish and Game.

and "candidate" by the USFWS. This classification allows the Department to focus on those species in need of attention in an effort to avoid possible future listing as threatened or endangered. Department biologists and cooperators have focused their efforts on a variety of species including the Coeur d'Alene salamander, flammulated owl, boreal owl, great gray owl, saw-whet owl, harlequin duck, trumpeter swan, white-headed woodpecker, amphibians, several diurnal raptors, northern shrikes, the Idaho ground squirrel, and several others. Partial funding for some of these projects came from our Nongame Small Grants Program and Student Nongame Wildlife Fellowship Program. Both of these programs have been temporarily suspended due to lack of nongame funds.

A major research project on wolverine (*Gulo gulo*) was launched during the 1991-92 winter. Three wolverine were captured and instrumented with collars and/or intraperitoneal implant transmitters to help biologists understand their movements, habitat preferences, and factors affecting distribution and survival. As of March 1993, 7 wolverine are being monitored, all with

implant transmitters.

### Conservation Data Center

In 1984, the Department and The Nature Conservancy cooperatively initiated the Idaho Natural Heritage Program. The purpose of this program was to develop a centralized data management system to collect, store, and disseminate information on the status and distribution of rare plants and animals and examples of high-quality native plant communities throughout Idaho. At the time of its implementation, Idaho's was the 32nd such natural heritage program in the country. Today, it is one of 50 state programs, and is an integral part of a network of the most complete national and international database on biological diversity. The database now contains over 6,000 records on over 100 of Idaho's rare animal species, 300 plant species, and 500 plant communities. Resident fish were recently added to the database.

In 1987, the Heritage program was merged into the Department's Nongame Program with the nongame biologist and plant ecologist moving from being

Nature Conservancy employees to staff biologists in the Wildlife Bureau. Confusion about the function and staffing of the Idaho Natural Heritage Program prompted the Department to change the name of the heritage program to the Idaho Conservation Data Center (CDC). We feel that this new name more accurately reflects the primary function of the program.

Over the last few years, the CDC nongame biologist and plant ecologist have spent the bulk of their time conducting inventory, monitoring, and research projects on rare animals and plants. Data which they collect in the field are mapped and computerized at the CDC office in Boise. Reports are written for the cooperating agency, and printouts on all species tracked in the database are provided annually to database cooperators such as the U. S. Forest Service. Department staff collect information on rare species from as many sources as possible throughout the state.

### **Ecosystem Management**

In recent years, many biologists have realized the shortcomings of the single species approach to conservation (i.e., attempting to save each endangered species). In spite of a strong Endangered Species Act (ESA), the tremendous cost

of saving an ever-increasing list of endangered species makes it clear that we cannot possibly save them all. One suggested solution to this dilemma is to shift the emphasis from a single species approach to an ecosystem approach.

In 1986, the Department became a partner in a cooperative ecosystem conservation project initiated by Dr. J.M. Scott of the Cooperative Fish and Wildlife Research Unit, University of Idaho, and his colleagues. This pilot project, termed "gap analysis," essentially involves mapping a state's biological resources with a geographical information system (GIS) to determine "gaps" in conservation. By analyzing land ownership patterns, existing preserves in relation to vegetation types, and areas of high vertebrate species richness, gaps in the existing preserve network can be identified. An atlas of range maps of all Idaho vertebrates is being published as one product of the gap analysis project. With several other states completing gap analysis projects, it has become a national effort.

The Department continues to work closely with cooperators to develop an integrated conservation strategy for the conservation of biological diversity. Although we cannot abandon our efforts to recover individual threatened and endangered species and to prevent sen-

sitive species and species of special concern from becoming more rare, we must place more emphasis on ecosystem level conservation efforts in the future.

### **Neotropical Migratory Birds**

Interest has grown, both nationally and locally, regarding the welfare of Neotropical migratory birds—those birds that nest in temperate zones such as Idaho and migrate to the tropics (Mexico, Central and part of South America). Nongame staff participate in working groups to evaluate and implement the needed projects to monitor these species. The Department cooperated with other agencies and organizations in writing and producing Nongame Wildlife Leaflet #10—Idaho's Migratory Landbirds—in an effort to help people understand the program and needs of these species. It was one of the first semi-popular publications dealing specifically with Neotropical migrants.

### **Regional Activities**

The Nongame Program has been involved in a variety of projects throughout the State. Some of these projects are administered directly from the headquarters office in Boise, while others have been handled by the Region. There are no regional nongame biologists to deal with nongame-related issues as there are regional wildlife biologists and managers to handle game-related issues. Instead, the Nongame Program has relied on existing regional staff and regional nongame coordinators (generally the regional conservation educator) working with Citizen Nongame Wildlife Committees to handle nongame activities. Because nongame responsibilities are an added task to an already demanding schedule for these regional staff, little time is spent on nongame.

With added revenue, the Department's goal is to establish regional nongame positions. Responsibilities of the regional nongame biologists would be as follows:

Coordinate with local agency personnel in conducting surveys on Sensitive Species and state Species of Special Concern.



**A goshawk being released at Sterling Wildlife Management Area. Sick or injured raptors are treated at rehabilitation centers as part of regional activities throughout the state. Photo by Idaho Department of Fish and Game.**

Participate on committees and working groups involving regional nongame and endangered species issues.

Coordinate workshops on building birdfeeders and birdhouses.

Administer the Nursing Home Birdfeeder Program.

Promote the Backyard Habitat Awards Program.

Handle the Nongame Poster Contest.

Promote wildlife viewing opportunities in the region.

Coordinate signing of wildlife viewing sites identified in the Idaho Wildlife Viewing Guide.

Collect nesting data on such species as bald eagles, peregrine falcons, ospreys, trumpeter swans, colonial waterbirds and other nongame species based on their status and distribution in the region.

Conduct surveys for new nests in monitoring the recovery of peregrine falcons and bald eagles.

Review proposed projects that might impact nongame and other wildlife.

Work with the regional Citizen Nongame Committee on nongame-related activities.

Conduct breeding bird surveys and establish permanent transects for monitoring selected nongame species such as Neotropical migratory birds.

Work with regional staff to develop interpretive material and wildlife viewing opportunities on Wildlife Management Areas.

Assist in the development and operation of Regional Office Nature Centers.

Promote the nongame income tax check-off and wildlife license plate, and the sale of items including the Idaho Wildlife Viewing Guide.

Supervise a Watchable Wildlife Specialist or technicians and work with the Regional Conservation Educator in developing and conducting environmental education/public involvement projects and programs for watchable wildlife at local schools and community groups.

Work with regional staff in developing nongame and watchable wildlife-related pamphlets, brochures, and other materials.

Work towards broadening support for the Department's overall programs.

## Watchable Wildlife

The goal of the watchable wildlife program is to build an informed, supportive, broad-based, public constituency for wildlife conservation through education, information and recreational opportunities. Public support is crucial to the success of programs to preserve and manage habitat for nongame wildlife.

In 1991, several state and federal agencies and conservation groups joined to produce the Idaho Wildlife Viewing Guide. Since then, Department staff have worked with other agency personnel to identify interpretive needs and begin installing signs at some of the 94 viewing sites in the Guide. Adequately interpreting and signing all sites will be an ongoing process.

Along with the task of signing and interpreting viewing sites, there is a clear mandate to inform and educate our publics. In conjunction with our I & E effort, the watchable wildlife program is the vehicle we use to 1) provide opportunities for a broad spectrum of people to experience and appreciate all wildlife, 2) promote environmental education, and 3) develop public support for the conservation of our natural resources.

In September 1991, the Department, USFS and BLM established a cooperative "Watchable Wildlife Specialist" position in north Idaho. Activities of the Watchable Wildlife Specialist include the following: enhance wildlife viewing opportunities at designated sites; develop site prescriptions at viewing sites; develop viewing blinds at selected sites; edit guides to birdwatching and birding routes; host an eagle-watch day; conduct workshops on "going wild in your backyard," and building birdfeeders and birdhouses; promote the nongame income tax check-off; conduct school programs on a variety of topics that instill a greater appreciation for the fish and wildlife resources of the State.

Also in 1991-92, the Department cooperated with the USFS and University of Idaho to develop a master wildlife interpretive plan for the Lochsa and

Selway River corridors. Additional cooperative watchable wildlife positions are being negotiated for other regions of Idaho.

## Information and Education

The primary focus of our I & E effort has been production of the Nongame Wildlife Leaflet Series and other brochures. These colorful and informative publications are used by Project WILD school teachers and are popular among a wide variety of users ranging from college professors and researchers to the casual wildlife advocate. Ten leaflets have been produced in the series thus far, including the following: 1. Idaho's Endangered Wildlife (12pp); 2. Idaho's Waterbirds: The Colony Nesters (12pp); 3. Backyards for the Birds: A guide for attracting wild birds to your yard in Idaho (12pp); 4. Idaho Birds of Prey, Part 1: Eagles, Falcons, Hawks, Osprey, Vulture (12pp); 5. Idaho Birds of Prey, Part 2: Owls (16pp); 6. Idaho's Nongame Species of Special Concern (12pp); 7. Amphibians and Reptiles of Idaho (12pp); 8. The Selkirk Grizzly Bears (6pp); 9. Between Land & Water: The Wetlands of Idaho (12pp); 10. Idaho's Migratory Landbirds: Description, Habitats & Conservation (16pp).

The following additional documents have been produced: 1. Building Homes for Idaho's Bluebirds (4pp); 2. Building a Kestrel House (1p); 3. Rare, Threatened and Endangered Plants and Animals of Idaho (38pp).

In summary, future implementation of the Nongame Program must be broad enough to address important needs in the areas of research and surveys, management, promotion, watchable wildlife, and information and education, yet focused enough to adequately address the needs of the resource, the citizens of Idaho, and visitors to the State. If effectively done, it will result in a broader Department constituency and greater support for *all* wildlife.

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Wayne Melquist is the State Nongame Manager for the Nongame and Endangered Wildlife Program of the Idaho Department of Fish and Game in Boise, ID.

# Book Reviews

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## Protected Landscapes: A Guide for Policy-makers and Planners

By P.H.C. Lucas. 1992.

Chapman & Hall. London. \$75.00. 282 pp.

Many countries have areas that exhibit natural qualities that characterize, to some degree, a harmonious interaction between resident human populations and the land. Known as "protected landscapes", such areas are gaining recognition for the role they can and have played in conserving biological diversity, along with traditional protected areas, like national parks.

In *Protected Landscapes: A guide for policy-makers and planners*, Lucas provides guidance on criteria for the selection of protected landscapes, implementation, management and appropriate legal measures. The main text is accompanied by 11 case studies from

around the world showing applications of the concept, plus a list of agencies currently involved in protected area management.

The book presents a useful synthesis of current thinking and experiences in protected landscapes, and serves as a good introduction for those unfamiliar with the concept. But are most policy-makers and planners in protected area management likely to be in this category? One hopes not. Some readers may, therefore, find the treatment of the subject matter inadequate and too general, desiring more information on issues such as monitoring and evaluation. Perhaps the long list of agencies was

included as a way of obtaining detailed information from those with experience, but how long before this list becomes out of date?

As an attempt to make protected landscapes better known, the guide is a welcome addition to the bookshelf. One hopes that the book will now encourage more in-depth treatments of this concept.

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Nandita Jain is a Ph.D. student at the School of Natural Resources and Environment at the University of Michigan. Her dissertation focuses on linkages between economic development, in the form of tourism, and natural resource conservation in the Annapurna Conservation Area, Nepal.

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## Wildlife-Habitat Relationships: Concepts and Applications

By Michael L. Morrison, Bruce G. Marcot, and R. William Mannan. 1992. University of Wisconsin Press. Madison. \$26.95. 362 pp.

Models and techniques used to analyze wildlife-habitat relationships have undergone rapid development in recent years. While changes have been numerous and reciprocal between theory and application, researchers have tended to specialize in one of these two areas. In an effort to clarify the interaction between theory and application, the authors review the field of wildlife-habitat assessment as practiced today.

The authors begin with an historical perspective of why humans study habitat, discussing our curiosity about natural history and ecology, our interest in wildlife for food and sport, and our ethical concern for both individuals and species. They then summarize the evolutionary perspective which forms the underlying conceptual framework for investigating the relationship between

wildlife and habitat.

A large portion of the book deals with habitat fragmentation and with measuring habitat. Landscape scale phenomena, such as patch size and geometry, corridors and connectivity, and human-induced fragmentation, are related to population dynamics of wildlife. The nuts and bolts of measuring habitat, including the importance of guilds and indicator species, sample sizes, spatial scale of sample, and observer bias are also addressed.

Another section deals with foraging behavior and its relation to food distribution and availability. Optimal foraging theory, resource use and methods of measuring behavior are discussed relative to habitat choice.

Finally, the development of predictive models and multivariate assessment

Reviewed by Terry Tompkins

of wildlife habitat are addressed. Uncertainty in data and in model structure, model validation, and multivariate techniques in habitat analysis—such as principle components analysis, multiple regression and discriminant analysis—are among the numerous concepts reviewed.

The authors have done a commendable job of presenting examples, albeit mostly vertebrate ones, of studies using the concepts presented. In addition, for each chapter, they provide a list of references which allows readers to pursue further reading in their areas of personal interest.

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Terry Tompkins is a Master's student in Conservation Biology at the School of Natural Resources and Environment at the University of Michigan. His research project investigates the effect of land use on hydrology, water quality, and biodiversity in the Tittabawassee River watershed.

# New Tallies of Federally Listed Species

(from "Endangered and Threatened Species in the 50 States, the District of Columbia,

These official tallies from the USFWS supercede estimates derived from historic range occurrences

STATE	MAMMALS	BIRDS	REPTILES	AMPHIBIANS	FISH	INVERTEBRATES	TOTAL ANIMAL	PLANTS	TOTAL
ALABAMA	4	6	9	1	11	23	54	16	70
ALASKA	1	4	0	0	0	0	5	1	6
ARIZONA	6	5	1	0	17	1	30	15	45
ARKANSAS	3	5	0	0	3	7	18	2	20
CALIFORNIA	12	15	8	2	15	15	67	43	110
COLORADO	1	6	0	0	5	2	14	12	26
CONNECTICUT	0	5	3	0	1	2	11	2	13
DELAWARE	1	4	3	0	1	0	9	3	12
FLORIDA	14	12	10	0	3	3	42	41	83
GEORGIA	3	6	6	0	7	0	22	19	41
HAWAII	2	30	5	0	0	1	38	88	126
IDAHO	3	4	0	0	1	0	8	1	9
ILLINOIS	2	5	0	0	1	8	16	7	23
INDIANA	2	5	0	0	0	7	14	3	17
IOWA	1	5	0	0	1	3	10	5	15
KANSAS	2	8	0	0	2	0	12	3	15
KENTUCKY	3	6	0	0	2	16	27	7	34
LOUISIANA	2	7	7	0	2	2	20	1	21
MAINE	0	5	0	0	1	0	6	3	9
MARYLAND	2	4	3	0	2	3	14	7	21
MASSACHUSETTS	0	5	4	0	1	4	14	3	17
MICHIGAN	2	5	0	0	0	1	8	8	16
MINNESOTA	1	4	0	0	0	2	7	4	11
MISSISSIPPI	3	8	9	0	3	6	29	2	31
MISSOURI	3	5	0	0	4	4	16	6	22

# (for the 50 States and Puerto Rico)

and U.S. Insular Areas, U.S. Fish and Wildlife Service, December 1992")

as published in Swimmer et al., *Endangered Species UPDATE* December 1992, Vol. 10 No. 2.

STATE	MAMMALS	BIRDS	REPTILES	AMPHIBIANS	FISH	INVERTEBRATES	TOTAL ANIMAL	PLANTS	TOTAL
MONTANA	3	6	0	0	1	0	10	0	10
NEBRASKA	0	7	0	0	1	2	10	2	12
NEVADA	0	3	1	0	21	1	26	8	34
NEW HAMPSHIRE	0	3	0	0	0	2	5	3	8
NEW JERSEY	1	4	3	0	1	1	10	5	15
NEW MEXICO	2	5	1	0	10	3	21	13	34
NEW YORK	1	5	3	0	1	3	13	7	20
NORTH CAROLINA	6	5	5	0	4	4	24	23	47
NORTH DAKOTA	1	6	0	0	1	0	8	1	9
OHIO	1	4	0	0	1	3	9	4	13
OKLAHOMA	3	9	0	0	3	2	17	1	18
OREGON	2	6	3	0	8	1	20	3	23
PENNSYLVANIA	1	4	0	0	0	3	8	3	11
PUERTO RICO	1	9	9	2	0	0	21	26	47
RHODE ISLAND	0	5	3	0	1	2	11	2	13
SOUTH CAROLINA	2	6	6	0	1	0	15	17	32
SOUTH DAKOTA	1	7	0	0	1	0	9	1	10
TENNESSEE	3	5	0	0	11	26	45	15	60
TEXAS	5	13	6	3	7	5	39	25	64
UTAH	2	4	1	0	8	1	16	19	35
VERMONT	1	3	0	0	0	2	6	4	10
VIRGINIA	6	5	5	1	5	19	41	9	50
WASHINGTON	5	6	3	0	1	1	16	0	16
WEST VIRGINIA	3	3	0	1	0	6	13	5	18
WISCONSIN	2	5	0	0	0	2	9	5	14
WYOMING	3	4	0	1	3	0	11	0	11

# Bulletin Board

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## Gorilla Conservation Curricula

The Dian Fossey Fund offers a 30-day middle school curriculum, covering conservation issues and using mountain gorillas as an example of an endangered species. The materials come with a 50-minute videotape and snares collected from the Rwandan rain forest. The cost is \$55 postage-paid. A second curriculum, for high school students, is a 7-day unit focussing on balancing populations, economy and conservation. This curriculum costs \$20, including shipping, and comes with a scientist's videotape of gorilla research near Karisoke. Proceeds from both curricula benefit the Dian Fossey Gorilla Fund. For details, contact the Dian Fossey Gorilla Fund at 45 Inverness Drive East, Suite B, Englewood, CO 80122-5480. Tel: (303) 790-2349.

## Society for Ecological Restoration Conference

The fifth annual Society for Ecological Restoration Conference will be held in Irvine, CA from June 14-20. Major themes will include: restoration of islands, arid and semi-arid lands, ani-

mal reintroductions, ethics and mitigation, and urban planning. For more information, contact: Society for Ecological Restoration, 1207 Seminole Highway, Madison, WI 53711. Tel: (608) 262-9547.

## Natural Areas Conference

The 20th Annual Natural Areas Conference, "Conservation in Working Landscapes", will be held at the University of Maine, Orono, from June 22-25. The conference will focus on: biological diversity in working landscapes, conservation in marine ecosystems, inventory and monitoring natural areas, and conserving endangered species and natural communities. For more information, contact: Hank Tyler, Maine State Planning Office, Station 38, Augusta, ME 04333. Tel: (207) 624-6041.

## Educational Materials on Rain Forests

The Vermont Natural Resources Council has produced a special curriculum to educate middle school students about how they can help save tropical rain forests. Titled "Tropical Rain For-

ests: The Vermont Connection", the 100-page guide explains why rain forests are important and how habits and lifestyles in Vermont can affect tropical forests. For more information, write: Vermont Natural Resources Council, 9 Bailey Ave., Montpelier, VT 05602.

## USFWS Endangered Species Technical Bulletin

The latest Technical Bulletin was published in the March 1993 issue of the *Endangered Species UPDATE*. Once the USFWS produces the next Technical Bulletin, it will be featured in the *UPDATE*.

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

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# Endangered Species UPDATE

Non-Profit  
Organization  
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